Policy Research

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World Development Report

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Background paper for World Development Report 1992

Coping with the Disappointing Rates of Return on Development Projects That Affect the Environment

William Ascher

The fundamental political economy of early commitment to grandiose projects of uncertain environmental consequence has not been overturned. Projects with environmental impacts often have unacceptably low rates of return; governments and international agencies frequently fail to reject projects of this type. More realistic evaluations will help. It is important to hold those responsible for appraising a project accountable for their appraisals.

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This paper — a product of the Office of the Vice President, Development Economics — is one in a series of background papers prepared for the *World Development Report 1992*. The *Report*, on development and the environment, discusses the possible effects of the expected dramatic growth in the world's population, industrial output, use of energy, and demand for food. Copies of this and other *World Development Report* background papers are available free from the World Bank, 1818 H Street, NW, Washington, DC 20433. Please contact the *World Development Report* office, room T7-101, extension 31393 (August 1992, 23 pages).

Lending institutions' initial appraisals often ignore the true costs of environmental impacts, and many development projects are launched despite returns that are often below the cost of capital and all too often actually negative.

Most environmental impacts are negative, so approving a project with a low true rate of return is not only a financial waste but a gratuitous stress on the ecosystem. Ecosystems typically have a low tolerance for such impacts, so low-yielding projects entail serious ecosystem opportunity costs.

Ascher explores why projects with environmental impacts so often have lower-than-anticipated rates of return, and what can be done to remedy the situation.

Many observers are optimistic because there is more environmental awareness than there was in the 1970s and early 1980s and environmental screening is more a part of project evaluation. But, says Ascher, attention to environmental risk has not yet provoked the structural changes in government institutions that would allow for the development of incentives that give proper weight to environmental risks. The fundamental political economy of early commitment to grandiose projects of uncertain environmental consequences has not been overturned.

It is also important to develop better appraisal methodologies and to hold those preparing initial project appraisals accountable for their appraisals. If post-project evaluations do not capture the most significant environmental costs, analysts conducting appraisals early in the project's life are unlikely to worry about being caught out by their unfounded optimism or their disregard for environmental consequences.

The good news is that in policy reform and structural adjustment the movement is toward eliminating blatant risk-seeking and making government institutions accountable for the results of their own actions. Although the conditionalities imposed by international funding institutions can be helpful, the primary responsibility for designing and selecting appropriate projects that have an environmental impact still lies with the governments of the developing world.

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Coping with the Disappointing Rates of Return of Development Projects with Environmental Impacts

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the World Development Report 1992

The World Development Report 1992, "Development and the Environment," discusses the possible effects of the expected dramatic growth in the world's population, industrial output, use of energy, and demand for food. Under current practices, the result could be appalling environmental conditions in both urban and rural areas. The World Development Report presents an alternative, albeit more difficult, path - one that, if taken, would allow future generations to witness improved environmental conditions accompanied by rapid economic development and the virtual eradication of widespread poverty. Choosing this path will require that both industrial and developing countries seize the current moment of opportunity to reform policies, institutions, and aid programs. A two-fold strategy is required.

• First, take advantage of the positive links between economic efficiency, income growth, and protection of the environment. This calls for accelerating programs for reducing poverty, removing distortions that encourage the economically inefficient and environmentally damaging use of natural resources, clarifying property rights, expanding programs for education (especially for girls), family planning services, sanitation and clean water, and agricultural extension, credit and research.

• Second, break the negative links between economic activity and the environment. Certain targeted measures, described in the Report, can bring dramatic improvements in environmental quality at modest cost in investment and economic efficiency. To implement them will require overcoming the power of vested interests, building strong institutions, improving knowledge, encouraging participatory decisionmaking, and building a partnership of cooperation between industrial and developing countries.

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Dennis Anderson, "Economic Growth and the Environment"

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Other (unpublished) papers in the series are available direct from the World Development Report Office, room T7-101, extension 31393. For a complete list of titles, consult pages 182-3 of the World Development Report. The World Development Report was prepared by a team led by Andrew Steer; the background papers were edited by Will Wade-Gery.

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A. Introduction

Development projects with significant environmental impacts pose special challenges for developing countries and the international institutions that help finance their development. Whether these projects directly exploit the natural resource base (e.g., timber exploitation) or have an incidental impact (e.g., a highway through a wilderness area), they are often accompanied by distinctive problems that threaten their own overall viability. Even worse, the ex ante evaluations of these "environmental impact" projects[1] often ignore the costs, delays and reduced benefits that result from these impacts. Thus, many such projects are launched despite the fact that their returns to the overall economy are often below the cost of capital and - in all too many cases - actually negative. Since, as will be argued, most environmental impacts are negative, the approval of a project with a low true rate of return is not only a waste of financial resources, but also a gratuitous eco-system stress. Since eco-systems typically have a limited tolerance for such impacts, low-yielding projects entail serious "eco-system opportunity costs".

This paper explores why environmental-impact projects so often have lower than anticipated rates of return, and what can be done to remedy the problem. Disappointing rates of return reflect two intertwined problems. One is that many project designs do not address the negative impacts of projects that affect the environment, and therefore actual rates of return will be low once the costs of environmental damage, and additional efforts to mitigate this damage, are taken into account. The related policy challenges are either to design projects that minimize negative environmental impacts, or to change development strategies to avoid projects that pose excessive environmental risks. The second problem is that the ex ante appraisals of projects with environmental impacts are typically too optimistic because they ignore the costs of these impacts -- though not with such consistency from one project to another that a simple standard adjustment to the calculated ex ante rate of return could give a reliable estimate of the true rate of return. Here, the challenge is to develop a better analytic and policymaking framework that can avoid misidentifying problematic projects as good projects.

Consequently, the following is a two-part analysis: a general exploration of the factors that diminish the rates of return of environmental-impact projects; and an exploration of why the appraisal process often misses or under-estimates the importance of these factors. It is important to clarify why these are different issues: project design and project appraisal are not equivalent. Theoretically, project design could be viewed as the selection of the highest-yielding project alternatives generated by an exhaustive appraisal of possible project designs. However, the set of possible project and design variants is infinite, and designing a project is a time- and staff-consuming task. In practice, out of the infinity of conceivable options, only a very limited number can be selected for development into concrete project proposals. There is, therefore,

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[1] Throughout this paper I will use the somewhat awkward term "environmental impact project" to denote development projects that have an effect on eco-systems. The use of this term is to avoid confusion between "environmental projects", which by common usage are projects designed to mitigate environmental damage, and projects that impinge upon the environment.

no practical possibility of designing projects by deciding whether to adopt or discard each of the total set of conceivable options. Instead, project design must proceed through the application of principles of design; for example, balancing centralized and decentralized authority, minimizing penetration into unknown physical systems, relying on incentives to induce compliance to the regulations contained within project operations, and so on. Appraisal, in contrast, entails forecasting the impacts of a given project design once it has been specified in detail. Good appraisal, while essential for deciding whether to go ahead with any particular project, cannot by itself generate a list of optimal projects. Since design and appraisal are different, the methods, institutions and politics of each differ as well. Improving project design and project appraisal must be analyzed as distinct challenges.

Preview of Findings and Conclusions.

On the basis of case studies of project selection, reviews of specific projects with environmental impacts, and a review of several statistical studies of returns on World Bank projects, this paper develops the following diagnoses:

1. Projects with environmental impacts often have unacceptable rates of return because unintended eco-system impacts are more likely to have deleterious than beneficial effects, through:

- disruptions of positive eco-system chains;
- delays for environmental mitigation;
- delays due to political or environmental opposition;
- higher costs required by unknown physical conditions;
- unanticipated reactions by the eco-system to the project's impacts;
- deviations from the optimal match between project scope and the natural resource base.

2. Governments and international funders often fail to reject unacceptable projects because:

- institutional pressures give problematic projects the benefit of the doubt, as the institutions that formulate, fund or implement development projects often benefit from proceeding with the project, regardless of its costs and merit;
- some components of environmental risk are still excluded from project appraisal, including uncertainty about consequences likely to be negative and low-probability risks of very large costs;
- rate-of-return predictions are typically not true forecasts, since they presume project adoption as proposed;
- governments often form premature commitments to problematic project designs;
- "bold" projects, often entailing greater risk of overrun, delay and environmental damage, are politically and professionally popular;
- governments often dismiss environmental critiques as unreasonable or even political attacks.

On the basis of these diagnoses, the analysis suggests that better project design and selection can be addressed by governments and international funders if they:

1. Alter project design in order to:

   - favor maintenance over frontier projects;
   - emphasize program over project commitments;
   - permit adaptive management by sequencing problematic engineering and environmental mitigation early in project development;
   - reduce the "rent" component of development projects.

2. Alter institutions and processes in order to:

   - internalize institutional costs of environmental risks;
   - enhance the impact of independent evaluation;
   - expand the knowledge base;
   - institutionalize environmental caution by incorporating presumptive environmental costs for project types that are likely to have a priori unknowable environmental impacts.

B. Why Environmental Impact Projects Are Prone to Low Rates of Return

It is important to recognize that development projects in general are subject to several problems leading to low rates of return. Projects with environmental impacts share these problems, and even where ecosystem effects are not the sole cause of disappointing returns, the environment suffers from whatever stress economically gratuitous projects put on it. While several studies purport to show that the most recent set of World Bank projects subject to appraisal[2] have ex post rates of return -- estimated at the beginning of project operations -- averaging around 15-16% (World Bank Operations Evaluation Department 1989; 1990a; Pohl and Mihaljek 1989), they are referring not to the actual rates of return calculated after the impact of project operations have been established, but rather to the re-estimations of future operations from the time that project construction has been completed. These so-called ex post rates of return do reflect knowledge of actual project development costs, the impact of start-up delays, and more updated estimates of the benefit and cost flows. Yet they do not capture the empirical results of the true outcomes of project operations, nor do they measure the impacts of unanticipated environmental costs except in so far as project expenditures have been made to address the latter. Thus, despite the fact that these evaluations seem to have an average rate of return above the cut-off point for acceptable projects, the estimation of returns well after project start-up barely surpasses the cost of capital. Daniel Kaufmann (1990: 5-6) found that the rates

[2] Some categories of projects, such as social service or institutional upgrading projects, are excluded because their returns are difficult to define and estimate.

of return of World Bank projects (excluding social-service projects), recalculated 5-8 years after the beginning of operation, average only 11 per cent. For many projects the rate of return is below the cost of capital or even negative. This finding is all the more striking given that World Bank projects have been subjected to relatively rigorous screening, and that the World Bank can often "skim" the most attractive from the entire range of projects available in the country.

Kaufmann (and others) show that macro-policy distortions, such as overvalued exchange rates, trade restrictions, and poor fiscal policies, partially account for the disappointing rates of return. Since environmental-impact projects are generally subject to the same macro-policy regimes, they are likely to face these same problems. Indeed, a large proportion of Kaufmann's sample comprises environmental-impact projects, since many were agricultural and major public works projects.

Yet Kaufmann finds that macro-policy distortions can account for only 15% of the variance in ex post rates of return. If policy distortions could have been measured more completely and accurately, perhaps their explanatory power would be higher. Yet it seems clear that for development projects in general, including projects with environmental impacts, additional impediments must also be present. This leaves open the possibility that other factors beyond the policy regime, including characteristics of the projects themselves and the processes by which they are initiated and implemented, share responsibility for the low rates of return.

The Distinctive Problems of Environmental Impact Projects

Although these calculated ex post rates of return are evidently problematic, even they do not capture all the negative consequences of environmental change. This is because the standard appraisal methodology does not add environmental damage to the project costs unless explicit environmental mitigation is included as a project component. Ironically, unaddressed environmental damage is typically ignored in ex post appraisal, while addressed environmental threats or damage are included, via the added project costs of design changes to avoid the damage or environmental mitigation to correct it. Thus, as long as unaddressed environmental impacts tend to be more negative than positive, actual ex post rates of return will be even worse than calculated.

To explore the fate of environmental-impact projects specifically, this analysis has reviewed the sixteen most recent projects evaluated by the World Bank's Operations Evaluation Department in the forestry, highway, hydroelectric/irrigation, and mining sectors. The projects and summary information on their outcomes are listed in the Appendix.

It is important to keep in mind that the recalculated rates of return of these projects were estimated at the start-up of operations, and do not therefore reflect empirical measures of project benefits, nor the impact of unforeseen problems. Moreover, as mentioned above, even identified environmental costs are not necessarily taken into account in the cost-benefit calculation. For example, Brazil's Carajas Iron Ore Project is acknowledged to have created environmental damage beyond the project's own operations, including deforestation and watershed degradation, but the calculated ex post rate of return does not incorporate these costs.

Consequently it is especially disappointing that very few projects, aside from road maintenance projects, have reported "actual" rates of return clearly above the hurdle rate of ten

to twelve percent[3]. But the set of projects is too small to establish whether projects that impinge upon the environment have systematically lower estimated ex post and actual rates of return. In order to examine a larger set, we can turn to the Operations Evaluation Department's latest annual review of post-construction appraisals. Taking the sectoral categories as rough distinctions between projects with and without significant environmental impacts, it is possible to invoke at least indirect evidence that such impacts are associated with lower rates of return. The evaluation of 1989 projects, focusing on the 116 projects for which the economic rate of return is an appropriate indicator, reports a weighted average economic rate of return of 15 percent. (World Bank Operations Evaluation Department 1990a: 2-17) Yet,

> As in previous year's cohorts, re-estimated ERRs were in general relatively high in infrastructure and urban operations...Re-estimated ERRs in agriculture were mostly in the 6-10 percent range; those in electric power ranged from 10-15 percent; and those in irrigation and drainage, from 5-10 percent. Those in highways tended to be higher than 20 percent, and those in telecommunications ranged from 10-15 percent. In other sectors no pattern was discernible. (World Bank Operations Evaluation Department 1990a: 2-18)

If we bear in mind that by 1989 most of the highway projects reaching completion were partly or largely highway maintenance or improvement projects, the pattern seems to confirm that projects with potential to have the greatest environmental impacts, namely in agriculture and irrigation, have the most problematic re-estimated rates of return, even without taking environmental impacts fully into account. These patterns are consistent with the historical record of unsuccessful projects, which shows that for projects evaluated over the entire 1974-88 period, one-third of agricultural and rural development projects were deemed failures, compared to only one-eighth for industrial projects. In Africa and Latin America, the two ecological frontier regions, agricultural projects have poorer records (49% and 76% respectively) than in Asia, North Africa and the Middle East. Similarly, the irrigation projects in Africa and Latin America have a far worse success record (38% and 33% respectively) than irrigation projects in Asia, North Africa and the Middle East (93% and 85% respectively). (World Bank Operations Evaluation Department 1989: 13)[4]

Returning to our small sample, we can examine what components of the cost-benefit analysis have gone awry. Twelve of the sixteen projects had lower benefits than estimated at the time of project appraisal. One frequently encountered reason for disappointing benefits is

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[3] This is typically set at 10% for World Bank projects, and 12% for International Development Association projects reserved for the poorest countries. The rationale for higher minimum acceptable rates of return is the greater scarcity of capital; since IDA funds are essentially grants rather than loans, the funds are accordingly scarcer.

[4] While in the case of Africa these records are in keeping with the region's overall record of project failures, other Latin American projects have had a reasonable record of success.

decline (or lack of projected increase) in the price of the project's outputs; this frequently occurs if the appraisal's price forecasts do not take the price impact of the project itself into account, or if the government fails to impose adequate user fees for irrigation or electricity-generation projects. Benefits that disappoint as a result of environmental or ecosystem reactions per se, are found largely in the hydro-power and irrigation sectors (where siltation, waterlogging and salinization are common outcomes) and in social forestry (where planting often does not have the expected yields, because of uncertainties of the survival of the species planted, climatic or soil conditions, and the vigilance of those who plant and care for the trees).

Some environmental costs probably go unreported for all the projects in the sample, with the possible exception of the road improvement projects. Even so, thirteen of the sixteen projects showed explicit cost underestimates in the post-construction appraisal. Projects that encountered unanticipated physical obstacles or environmental problems requiring attention during the construction phase showed higher explicit costs. For example, in Nepal's Kulekhani Hydroelectric Project, the cost of civil works had to be raised 12% after an extensive site examination made it clear that significant design modifications were required. Costa Rica's Fourth Highway Project also encountered higher costs when terain and geological details became known.

Project completion delays were the most consistent cause of cost overruns. Only four of the sixteen projects did not have significant delays in project completion and start-up. Two of these were Indian "social forestry" projects, in Uttar Pradesh and Gujarat; neither required "construction", nor faced the risk of requiring environmental mitigation, before the start of operations. Forestry projects involving replanting on degraded land or community woodlots do not have to confront the removal of natural vegetation or the construction of complex plantation infrastructure; there is therefore little danger of unknown physical or environmental conditions leading to delays in the project. Of course, while the project may proceed on schedule, yields may be far under expectations. Indeed, in both of these cases, lower-than-anticipated rates of return were due to disappointing yields in addition to unforeseen declines in the price of wood.

The third "on-time" package was the Central African Republic's Third and Fourth Roads Projects; these were largely road rehabilitation efforts that did not penetrate new areas (the Third Central African Republic Roads Project paved a segment of the pre-existing international route to Cameroon; the Fourth Roads Project was for road rehabilitation and institutional upgrading). While even road rehabilitation projects sometimes fall behind schedule because of difficulties with contractors, as in the case with equipment procurement for Rwanda's Fourth Highway Project, highway improvement projects seem to be less vulnerable to delays. This is because they tend not to encounter physical and environmental uncertainties as much as other projects.

The only "on-time" project that did involve major construction and ecosystem penetration was Brazil's Carajas Iron Ore Project. This may seem puzzling, since the $3 billion Carajas Project, one of the largest natural resource projects in the developing world, required the development of open pit mines, mining towns, port facilities, and roads, and might therefore have been expected to run into very complex, unforeseeable physical and environmental problems. That it did not do so was the result of the Brazilian government's strong commitment to the project's implementation, and the project's inclusion of explicit and elaborate components to deal with the environmental impacts produced directly in areas of the project's control. To be sure, the project's construction triggered environmental damage beyond its own area of

control, as the roads and other facilities attracted migrants and put greater stress on the surrounding forests and watersheds. Moreover, for reasons beyond the control of the Carajas managers, the calculated rates of return of the project were very disappointing (due to low world iron and steel prices). Taking overall environmental damage into account would lower the true rate of return further still. Yet from a project manager's point of view, the advance planning of environmental mitigation measures was very successful in neutralizing potential environmental risks and environmentalist opposition that could have halted or delayed the project.

The Negative Tilt of Environmental Impacts

Uncertain or unaddressed environmental impacts are more likely to be negative than positive. It is important to clarify the parameters of this assertion in two respects. First, there is no reason to expect that unanticipated occurrences affecting natural resource use are more likely to be negative than positive. Thus a new road might attract population settlements that preclude hydroelectric or irrigation development requiring economically or politically costly population displacements, but it might also expedite the discovery and exploitation of valuable ore deposits. In short, there is no general principle that would tilt unanticipated impacts on resource use toward the positive or negative. Second, there are, of course, some projects that are specifically designed to better environmental conditions (e.g., reforestation projects; dams designed to reduce flooding), but these benefits tend to be recognized in project appraisal since they comprise all or part of the rationale for the project.

When we consider the impacts of unknown, unanticipated, or only partially understood occurrences on the eco-system, there are three principles that lead to the expectation of a negative tilt. The first derives from the prevailing societal preference that, aside from direct project objectives, the existing ecosystem ought to be changed as little as possible; i.e., plant and animal species ought to be preserved, as should existing forests or marshes that are not to be transformed as a direct objective of the project; similarly, the living patterns and cultural practices of local residents ought to be disturbed as little as possible. It is unlikely that the ecosystem will restore its original equilibrium following the implementation of a permanent change in production, physical structure, or both. The ecosystem may indeed reach a new equilibrium, but if pre-existing ecosystem patterns are favored over change, then unanticipated changes are more likely to entail higher costs than benefits.

Second, human beings and other living creatures have to some degree adapted to the existing ecosystem. Food chains, species reproduction chains (often involving complicated plant-animal interactions), and geophysical balances underlie the sustainability of agriculture, environmental services, biodiversity, and more. Consequently, ecosystem changes run the risk of jeopardizing the survival of plant and animal species as well as the sustainability of existing resources useful to people. While it is conceivable that an eco-system change could disrupt the life cycle of noxious agents (as swamp drainage has eradicated malaria-bearing mosquitos), significant eco-system change is almost guaranteed to affect flora and fauna involved in positive chains, with no parallel guarantee of effects on negative chains. Furthermore, the replacement of species is virtually precluded within meaningful time frames.

Third, whereas the disruptions of negative cycles are often anticipated, since such problems are typically subject to much study, knowing what it takes to avoid disturbing positive

interactions is far more difficult than anticipating possible positive effects. Discovering the one link that can be disrupted in a negative ecosystem chain -- if such a link exists -- is an easier intellectual challenge than knowing all of the links necessary for maintaining a positive chain. Again, malaria eradication is an example; knowing that malaria-carrying mosquitos require swampy conditions for their reproductive cycle is sufficient. The "causes" of the sustainability of positive aspects of an ecosystem are contrastingly unbounded.

For example, in the latest available OED survey of project performance, 21 irrigation projects subjected to "impact evaluation" five to twelve years after their completion were found to have consistently worse environmental impacts than anticipated at the time of appraisal. The ex ante appraisals of nearly half of the projects had been upgraded on the promise of environmental improvements: flooding prevention, control of water-borne diseases, and village infrastructure improvement. As it turned out, however, the majority of projects had unanticipated negative environmental impacts, including waterlogging (eleven projects), salinization (four projects), and soil erosion and sedimentation (five projects). In two projects (Turkey's Seyhan Project and Sudan's Roseires Project), the indiscriminate use of agricultural insecticides actually triggered a resurgence of malaria by building up the tolerance of malarial mosquitos to the insecticide. (World Bank Operations Evaluation Department 1990a: Ch. 4)

Environmental impact projects are especially vulnerable to the following problems that push up costs or reduce benefits with a greater likelihood than the reverse:

1. Disruptions of positive interaction chains; as noted above, these are more likely to occur, than disruptions of negative interaction chains.

2. Delays required to mitigate unforeseen environmental damage. Delays reduce the rate of return by: (a) postponing project benefits while capital is tied up in project development; (b) exposing the project development to emerging conditions that may hamper its execution (such as a new government with less commitment to the project, unplanned-for macroeconomic conditions, etc); and (c) exposing the project to inflation, which often disrupts the government's funding of a project, leading to further delays and sometimes the cancellation of important project components.

3. Delays in project initiation and completion due to political/environmental opposition. A major, largely uncontrollable cause of project delay is environmentalist opposition to government projects that impinge upon natural systems or entail social disruption. Of course, environmental opposition can often be salutary if it leads to improved projects or the abandonment of bad ones. Yet in some countries, such as India, environmentalist opposition is highly polarized because of distrust between non-governmental organizations and the government. In such cases, governments frequently dismiss the predictions of environmental catastrophe because they assume that such opposition is politically motivated, and that it would arise no matter how reasonable the project in question. A common result is that projects are delayed by the opposition, but are eventually undertaken.

4. Unknown biological and physical conditions that require more intensive effort to achieve the project's objectives. In addition to the aforementioned unanticipated environmental threats, often the physical conditions facing project construction are simply more challenging than expected. The rock that must be excavated for roads is harder than predicted; natural vegetation removal to create plantations is more difficult than anticipated; difficult terrain requires unexpectedly complex engineering solutions. One reason why unknown biological and physical conditions tend to be more rather than less challenging is that project designers, ignorant of the variability of local conditions, make "most likely" - but actually incorrect - assumptions of geophysical homogeneity.

5. Complex biological, physical, and social reactions that reduce project benefits. Typically, the engineering of a large-scale project begins with the premise that the existing physical and biological structure can be modified in bounded, intentional ways, just as a sculptor typically presumes that a piece of stone or wood can be cut as planned. The rest of the physical and biological system is presumed to remain intact, not to change in ways that undermine the pursuit of project objectives. The behavior of people affected by the project is presumed to be governed by the incentives and opportunities generated by the project. In some cases, new social mechanisms, such as specific water-allocation systems introduced along with irrigation works, are introduced and applied in accordance with this same premise. Yet given the inter-connectedness and equilibria of natural and social systems, systems often change in ways that are unrelated to project intentions and that make the project's positive impact self-limiting. Large-scale dam projects, for example, are frequently plagued with silting that results from the soil erosion produced by the project's own development; likewise, highways in mountainous areas draw in settlers who cultivate steep slopes, often resulting in land-slides and road blockages.

6. Unknown biological and physical conditions leading to deviations from the most efficient match of project scope and the natural resource base. Since efficiency depends on matching project scope with the natural resource base, uncertainty can yield inefficiencies in either over-estimating or under-estimating the natural resource base. In a comparison of irrigation projects on the Pampanga River in the Philippines and in Northeast Thailand, World Bank evaluators noted that poor estimations of water inflow caused inefficiencies regardless of whether the estimates were too high or too low. The Philippine irrigation was "overdesigned relative to water availability and water shortages have been a major and increasing problem since project completion." (World Bank Operations Evaluation Department 1990b: 5). The benefits of the project were, of course, correspondingly lower than anticipated. The Thai irrigation system, for which estimates were based on only four years of hydrological records, had river inflows 40% higher than anticipated. Moreover, water needs were overestimated, because normal rainfall turned out to be greater than the previous four years'

average. In normal years, therefore, there is now a surplus of water in the reservoir. Thus, in this respect as well, ignorance is likely to lead to reductions rather than increases in the rates of return.

C. Why Ex Ante Appraisals Are Exaggerated

While the major thrust of project design ought to focus on overcoming the problems outlined in the section above, another crucial task is to ensure that projects will be screened out if they do not have adequate rates of return, whether due to environmental impacts or other problems. It is clear that consideration of such problems is inadequately incorporated even into the World Bank's relatively elaborate evaluation procedure. While the World Bank projects mentioned above have on average at best borderline rates of return, Kaufmann has found that ex ante appraisals for projects of the World Bank and its affiliates were calculated at 22%, excluding social sector projects. Recalculated rates of return, determined after project construction, were only around 15%; and the sample of projects for which additional evaluation had been done five to eight years later showed that true rates of return were on average 10 to 11 percentage points lower than ex ante estimates.(Kaufmann 1991: 5-6) What is not known -- and what cannot be known from empirical examination -- is whether changes in project evaluation at the World Bank and other institutions have improved this record.

Both the over-optimism of project appraisal and the reluctance to abandon or modify problematic projects result from analytic limitations and the promotional (or political) efforts of individuals and institutions eager for projects to proceed. These effects are abetted by the "evaluation environment" (i.e., the incentives available to the various participants in the project identification and appraisal process) and, perhaps less obviously, by the structure of the process itself.

1. The bias to proceed and the bias against rigorous analysis. Institution staff and leaders want projects to proceed. This motive is pervasive, both at the highest levels of government and within specific governmental and state agencies. With respect to the highest political leadership, the question is why a government sometimes undertakes projects with rates of return lower than those that would be generated if the capital involved were saved or invested differently. Obviously, the political support generated by providing benefits is a crucial driving force. With respect to particular agencies, the bias is clearer still; after all, the main business of agencies that formulate and undertake development projects is to undertake these projects. A government agency that does not utilize the funds available for development projects often loses power and future funds, even where the reason is laudable concern over environmental risk. Moreover, government agencies that oversee development projects are often under great pressure to bring in the foreign currency that external funding provides. Sri Lanka's Mahaweli Dam Scheme is a prominent case in point (Levy 1989; Ascher & Healy 1990).

Other parties, particularly consultants who participate in pre-approval project evaluation and the contractors who carry out project construction, also have incentives to underestimate both costs and time requirements during the pre-approval phase; this is especially so in cases where the consultants are the contractors. Consultants often want project preparation to proceed

as long as possible, so that they can continue to work on the project's analysis. An early indication that a project is not feasible might cut off further opportunities to work on that project, or antagonize government officials bent on pursuing the project.

Contractors, who are often asked to submit preliminary indications of possible project costs, have an obvious interest in getting projects approved even if costs are underestimated, so long as the government will pay more once actual costs are known. Contractors are willing to underestimate costs because the government typically bears the risk for cost overruns, whether occasioned by the need to redesign the project, to mitigate environmental damage, or to complete the core of the project once geophysical conditions are more fully known. Ironically, the receipt of international funding may exacerbate this problem; if a government has made its support for a project known to international funding agencies, then it becomes harder for it to cancel or cut back on a project that proves to have higher-than-anticipated costs. In the case of Nepal's Kulekhani Hydroelectric Project, the pre-approval estimate of the civil works construction costs was US$27 million. Once the project was approved and competitive bidding was opened, the lowest bid tendered was US$64.8 million. Essential design modifications accounted for US$7.4 million of the additional construction costs.

By the same token, the main business of development funding institutions, whether they are the World Bank, the Inter-American Development Bank, USAID or other international or bilateral agencies, is to grant or lend money for development. A funding agency that cannot expend its grant or loan allocation is widely regarded as failing in its job. This does not mean that project evaluators knowingly and cynically approve bad projects simply to fulfill lending targets. But it does mean that the urgency to identify fundable projects colors the evaluator's predisposition to give project proposals the benefit of the doubt. Moreover, the evaluative effort itself is a burden to the typical development agency and to its personnel responsible for formulating, evaluating or undertaking the project. Effective project analysis requires time and manpower; elaborate analysis thus detracts from the capacity to engage in expansive activities (such as further project identification) and/or the capacity to undertake the same level of effort more cost-effectively.

The liabilities of undertaking rigorous analysis extend down to the sub-institutional and individual levels. Project-formulation units and their personnel typically stand to gain more in funds, bureaucratic power, job security and personal advancement when they are associated with ambitious development programs. The top management of governmental and international development agencies are often aware of this bias, and in some cases may share it. When it tries to impose analytic rigor, top management has little hope of success. Simple declarations of the requirement of analytic rigor as institutional policy are unlikely to have a significant effect. Little and Mirrlees, who document the World Bank's failure to get its own staff to adopt moderately rigorous cost-benefit analysis for its projects, argue that:

> [G]ood project appraisal is done by people with their own incentives, within organizations that wittingly or not set these incentives. Both environments of project appraisal, the intellectual and the political-organizational, are keys to the quality of selection overall. This needs to be most seriously considered by those who manage and create these environments." (Little and Mirrlees 1991: 377)

Lyn Squire, the author of the World Bank's most ambitious appraisal methodology, agrees:

> To be successful this approach to implementation [of rigorous cost-benefit analysis applied voluntarily by World Bank staff] requires two ingredients: enough well-qualified analysts to conduct the appraisals and an environment that encourages such effort. The World Bank had the first but not the second. (Squire 1991: 383)

It is important to understand why mere insistence on rigorous environmental analysis is unenforceable. Lacking parallel evaluations, managers are not in a position to know whether environmental appraisals are genuinely careful or not. The same number of words can be put to paper, with the same apparent level of detail and seriousness. Supervisors' relative lack of information about project specifics makes it extremely difficult for them to second-guess analysts who have more first-hand information.

2. Limits to analysis of environmental impacts. The use of ostensibly neutral technical analysis to promote favored outcomes beyond simply endorsing technical findings, is made possible by authentic limits to analytic capacity. Everyone involved in project appraisal can point to cases of evaluators knowingly inflating rates of return. Yet it is the range of uncertainty, itself the result of real limits to analytic capacity, that allows promotionally-biased estimates to maintain their plausibility. Thus, while it might seem at first glance that the governmental motive to have projects approved so that funding with be forthcoming constitutes a sufficient explanation of distortions in reported rates of return, there are other necessary conditions. For one thing, when costs and benefits are accurately known, inflated appraisals risk the loss of professional and career standing. Moreover, in order to mislead funding institutions, governments must be able to make a plausible case for higher rates of return -- or funding agencies must have a similar compulsion to fund projects regardless of their true rate of return.

Environmental damage and natural-resource constraints are under-appreciated because of intrinsic analytic difficulties and the lack of effort typically devoted to analysis. Intrinsic limitations arise from the complexity and inevitable uncertainty surrounding environmental impact projects, which (by definition) involve the interaction of physical and social systems. Moreover, the physical and biological interactions within typical eco-systems are only minimally understood. Virtually all the discussion above of the net negative implications of uncertainty could be repeated to explain how analytic limitations, particularly for environmental-impact projects, are associated with lower-than-expected rates of return.

The level of analytic effort that has gone into project formulation and evaluation has traditionally underemphasized environmental analysis. This is not only because of the late development of environmental consciousness and the methodologies of environmental analysis, but also because of the peripheral status of environmental concerns in the very earliest, but often definitive, stages of defining project objectives. Except for the handful of projects explicitly designed for environmental improvement, the environmental impacts of development projects

are by-products, not their raison d'etre. Most attention is devoted to designing a project so as to achieve its central objectives, not to whether it will generate other consequences.

The treatment of low-probability catastrophes suffers from similar inadequacies. Often there are many low-probability occurrences, any one of which could result in very large overruns and delays. Yet because the projected probability of such occurrences is small, their implications are not typically analyzed, nor are the probabilities of all such possible occurrences aggregated in order to calculate the probability that "something major" will go wrong. Contingency funds may be established to address the possibility of unanticipated problems. Yet the typical fund, set at some moderate percentage of either total costs or specific components, reflects a presumption that the occurrence of an unanticipated condition or event will have only a moderate impact, rather than the often more common outcome of a serious impact that could result from any number of (individually) unlikely occurrences.

Moreover, the treatment of uncertainty, even in more rigorous approaches to project appraisal, does not take into account the imbalance of negative and positive uncertainties. Even the Little and Mirrlees approach assumes that unidentified consequences are equally likely to be positive or negative. They suggest that rates of return be downgraded in the face of uncertainty, but only because of, and to the degree that, risk aversion makes a negative departure from the expected outcome more costly than a positive departure of the same magnitude is beneficial in its consequences. (Little and Mirrlees 1990: 356-7; 379-80)

3. Presuming implementation. A project document developed by a government is a proposal, not only to the funding institution, but also to other actors within the country. This does not necessarily mean that it is deliberately biased to emphasize the positive, but it does mean that it is a declaration of what that government proposes to be done, not what would emerge if it were blocked or significantly resisted. Forecasted rates of return are therefore implicitly conditional on governmental plans proceeding forward more-or-less as planned. Forecasting disruptions to planned schedules is so daunting that it is rarely attempted; the timing of with which possible political conflicts generated by projects are resolved is particularly difficult to forecast. This does not excuse governments from taking into account the effects of technical and political delays, such as slippages in drawing up detailed engineering specifications, adapting to unanticipated site conditions, and actually executing the work. Yet the overruns and delays that result from opposition within the country, or from requirements to modify plans so to achieve acceptance by internal constituencies or the external funding institution, are generally not included in the characterization of the initiative that constitutes the government's proposal. Often the proposal is more of a negotiating proposition than a prediction of a negotiated outcome.

One of the most subtle but damaging implications of presuming that projects will proceed "according to plan" is the exaggeration of the potential for implementation. When projects have institution-strengthening as well as operational components, it is usually and unjustifiably assumed that the operations will be undertaken by the upgraded, and thus more competent, administration. For example, in Liberia the World Bank supported a combined forestry plantation and institutional upgrading project of the Forest Development Authority. The project appraisal report noted the weakness of the existing administrative structure; indeed, without recognizing this weakness, there would have been no rationale for the institutional strengthening

component. Yet analysis of the plantation component paid little attention to the consequences of weak institutional capacity. The results of the plantation component of the project were disastrous. To a significant degree, the managerial and institutional weaknesses of the FDA and the project management account for this failure. Initial indications that the quantities of bio-mass that would have to be removed in order to make way for pine planting had been underestimated, generated only an extremely slow response. They should have triggered a rethinking of the requirements for weeding, and indeed of whether the transformation to pine cultivation would result in greater yields than natural forest management.

For projects requiring international funding, the question is whether appraisers from domestic governments and from external funding institutions have the same orientation to project proposals that project formulators have. Even project appraisers from the World Bank, tend to adopt this kind of outlook to some degree. World Bank evaluators, to the degree that their own recommendations are reflected in project design, are themselves making a conditional proposal -- "If the project is allowed to proceed in such and such a way, and implemented as planned, then the following outcomes can be expected."

Moreover, in many cases, the distinctions between project formulator/designer and project evaluator are very blurred; indeed it is often efficient for evaluators to provide feedback with which project designers can improve designs. In effect, this transforms evaluators into project formulators. The problem then is that this kind of blurring reduces evaluators' psychological and political detachment from projects.

4. The bias to project commitment. Premature commitment to specific project designs makes it harder to adapt projects to avoid environmental damage. Typically, project identification proceeds by articulating objectives -- i.e., potential benefits -- and then establishing effective means to those ends. Means, of course, entail costs. Thus the examination of project costs -- in terms of direct cost and the indirect damage cost of its impact -- generally comes well after the project has been defined. If a government makes an early commitment to a project, that decision is usually driven by the project benefits and rarely by its costs, which tend to emerge gradually as the project's details are fleshed out. For example, early on in the design process, it is often impossible to say what specific environmental impact a dam will have, because the specific location of the dam (and thus the location of the reservoir) is established only after further engineering studies.

While there is much evidence that a government's commitment to a given project is very important for its success, it is also true that this commitment makes it more difficult for the government to tolerate delays, reductions in scope, or any changes other than those making the project more grand and impressive. Little and Mirrlees (1991: 370) point out that "[i]t has been repeated ad nauseam that economic appraisal at a late stage very rarely stops a project. It must be applied early on to stop work on the project or to effect improvements in the design of a project that will finally go ahead." When announced projects are dropped or significantly changed, those who believed that they would otherwise have stood to gain frequently feel betrayed. To back projects -- and receive credit for them -- governments typically make public commitments (often with much fanfare) to specific project designs and timetables. A government's credibility is enhanced if projects start promptly and are implemented fully; it may also obtain more hard currency, as well as greater scope for public-works employment.

Conversely, it is very difficult to convey the rationale for slow project formulation and postponement of construction; and where there is domestic opposition to a project, governments may be concerned that a cautionary approach will be viewed as a sign of governmental weakness.

5. "Heroic" projects. "Heroic" projects often provide greater rewards for the governments and analysts associated with them. One reason for some of the most disappointing rates of return is that projects are sometimes formulated as bold, short-cut approaches to solving problems. These bold formulations are often forecast to have lower costs than less bold alternatives. Yet project boldness, if defined as adopting untried approaches, will result more in unanticipated overruns and delaying conditions than in surprising discoveries of ways to reduce project costs and completion time, for all the same reasons that uncertainty tends in general to increase costs over benefits.

For example, in Costa Rica the mid-1970s highway expansion linking the Caribbean coast to San Jose could have paralleled the existing roads, at high cost due to the circuitousness of the existing route, or it could have cut through the Zurqui Pass. This mountain pass route had never before been tried; the geological conditions were to a significant degree unknown. yet its ex ante calculated rate of return of 18% was higher than the 14% estimated for the more conventional route. As it turned out, the road construction took nearly eleven years, rather than the expected four and a half. Construction costs were only modestly above the predicted costs, but delays led to a rate of return of at best 8-10% -- even before environmental problems are factored into the calculation.

However, this kind of boldness, although foolhardy from the perspective of the nation as a whole, can have a political rationale for governments and a professional rationale for analysts. "Heroic" transformations of natural systems imply that if such a project succeeds, the government in question may have impressive, highly visible benefits to dispense. Bold efforts similarly promise a more professional challenge and greater recognition for project designers. The Costa Rican road designers, for instance, were firmly committed to attempting the more challenging engineering feat.

The heroic impulse and the desire to exercise engineering virtuosity also colors responses to potential problems. When environmental difficulties are foreseen, they are often taken as problems to address rather than as fatal impediments to a project's progression; it is widely assumed that their resolution must be feasible. For example, the mid-1970s Fifth Development Program of the Companhia Hidro Eletrica do Dao Francisco (CHESF) in Brazil's Northeast entailed a displacement of 70,000 people and the flooding of previously cultivated farmland. Farmland was to be protected through project additions and resettlement was to be carried out through the project, with resettlement costs considered as normal project expenses. In fact, resettlement was considerably more expensive than had been anticipated.

6. Reactions to environmental criticism. The low credibility of many environmental groups may deter governments from taking environmental warnings seriously. The same estrangement between governments and non-governmental environmental organizations that causes project delays, often inures governments to constructive criticism of project design and can lead them to ignore the reality of genuine environmental risks. On occasion, the leaders of

a governmental agency that is committed to a particular project will develop a similarly adversarial relationship towards environmentally-concerned government officials and/or international funders. Environmental warnings may go unheeded; in more extreme cases, there may be deliberate efforts to suppress information about environmental risks.

D. Remedies

Project Design

The twin problems of poor projects and poor appraisals can be attacked by altering standard approaches to project design and the project-selection process. We first consider how to improve policy designs in order to accomplish two objectives: the reduction of environmental-impact risk and the reduction of incentives to proceed with problematic projects.

1. Favoring maintenance and rehabilitation over "frontier" projects. If many of the projects with highly disappointing rates of return are "bold" efforts to initiate penetration into natural systems rather than to improve or augment existing penetrations, then an institutionalized bias in favor of maintenance and rehabilitation projects over "frontier" projects may be in order. It has long been recognized that rehabilitation projects, such as road maintenance or correcting the flaws of irrigation and hydroelectric systems, often have handsome rates of return. They also have lower potential for environmental damage. The example of Rwanda's Fourth Highway Project, cited above, typifies the low "downside environmental risk" of rehabilitation projects.

2. Program over project approaches. One approach to addressing the fact that governments form nearly irrevocable commitments to highly visible projects is to de-emphasize specific projects in favor of broader commitments to programs. If governments find that commitments to programs can also generate political support, then they may have more flexibility in altering specific components of the program without risking the appearance of reneging on promises. If, for example, we compare Sri Lanka's Mahaweli Dam Scheme, which involved a large and changing program of dams and irrigation networks, with the Aswan High Dam, we find that the former initiative had the potential for myriad mid-course corrections (although unfortunately the Sri Lankan governments did not sufficiently avail themselves of this opportunity), whereas the Aswan High Dam initiative had little room for adjustment as more was learned about the project's likely consequences.

3. Project designs that permit adaptive management. Several design dimensions can address the potential to make mid-course corrections:

(a) If the sequencing of project work begins with the most problematic and uncertain components of projects, project designs can be changed, or projects aborted, before enormous costs are incurred.

(b) In so far as environmental mitigation actions necessitate project delays if they begin during the middle or late stages of project construction -- which is typically the case -- it is preferable to address environmental mitigation needs as much as

possible in the early phases of a project, so as to avoid tying up other project capital.

4. Reducing the "rent" component of development projects. The basic dynamic that leads governments to push for projects despite low actual rates of return can be undermined by severing, or at least weakening, the existing "political economy" of project benefits, in which the latter are allotted to recipients from whom governments then expect gratitude and political support. Ernesto Fontaine (1991: 390-1) notes that

> projects that do not charge users for the goods and services produced -- or that do not charge beneficiaries for the projects' investment costs...may be of great relevance for understanding the "political economy" of government investment. It is clear that making the beneficiaries pay for the project will help to avoid political pressures to build irrigation dams, roads, or ports, when and where the national interest is not best served...

It may seem quixotic to try to undermine the fundamental connection between government benefits and government support -- a connection that some theorists have declared as the essence of political systems (Easton 1960). Yet that is precisely what user charges are all about, and they have had some -- albeit limited -- effect.

Institutions and Processes

Approaches that pertain to the project-selection process address institutional structure as well as the project formulation and approval process per se.

1. Internalizing the institutional costs of environmental risks. The core issue is not so much whether institutions are prone to the analytical, procedural and political impediments outlined above, but rather whether institutions act to minimize these obstacles. An underlying problem, then, is that the individuals and institutions subject to these problems typically have little incentive to avoid them. Frequently incentives are lacking because the costs of poor projects do not accrue to individuals and institutions involved in evaluation; indeed, they may benefit from involvement in project development, and yet be immune from the repercussions of ultimate project failure. The key challenge, then, is to have individuals and institutions internalize some of the costs of undertaking poor projects.

Internalizing the costs of undertaking poor projects requires that the same individuals or institutions be concerned with project development and project management. This is far more feasible than expecting to hold evaluators responsible for errors that only emerge years later. It is, however, difficult to ensure the continuity or transfer of individuals from project development to project management. Therefore the most promising avenue is institutional restructuring that requires the agencies involved in project development to face the consequences of poor projects; these include the financial drain of administering low-return projects or of efforts to ameliorate environmental consequences, the embarrassment of association with failure and environmental damage.

There are three avenues for internalizing these costs. The most obvious and direct way is to establish geographically-based development authorities responsible for planning, executing, and administering development projects. It makes sense for these authorities to cover entire eco-systems, so that environmental impacts within the eco-system will not be externalized. As long as such an authority depends on sustainable development for its long-term survival and stability, low-return projects will be avoided. This is one rationale for institutions such as river basin or watershed authorities. For example, in Morocco the Oum er R'bia river authority, ORMVAD, responsible for implementing the large-scale irrigation system and providing agricultural services, has been given the major credit for the success of the Doukkala I and II projects. The World Bank's impact evaluation six years after the start-up of Doukkala I operations credited ORMVAD for its "strong and effective management performance." (World Bank Operations Evaluation Department 1989: i) In India, the Damodar Valley Corporation had much promise as an institution for developing and administering the series of dams and irrigation systems in that river valley; unfortunately the rivalry between state authorities and the central government resulted in the weakening of the Corporation when it proved to be successful. (Ascher and Healy 1990: 113-115)

Second, where agencies integrating project formulation and management can be established, they should be allowed to establish reserve funds. The near financial autonomy of Morocco's ORMVAD, for example, not only provides it with discretion and accountability, but also an institutional interest in being involved only in viable projects. More typically, agencies have little to risk from poor projects and accompanying environmental damages. If a project requires efforts to mitigate environmental damage, the managing agency usually receives funding from the central government or subnational government, and thus avoids the financial consequences of environmental problems. However, if funding has to come from the managing agency's reserve fund -- which could be used for other purposes -- then that agency faces a tangible cost in launching an environmentally risky project. It is important that the reserve fund be available for other purposes as well, so that agency managers do not conclude that the only way they can avail themselves of the fund is to create the need for environmental mitigation.

Third, if an integrated formulation and management agency cannot be established, then those agencies that evaluate, implement, and operate development projects can at least be placed within the same ministry. While each of these functions units may be different, and potentially at odds, the highest level ministerial authorities will have to confront the costs of pursuing poor projects.

2. Enhancing the impact of independent evaluation. If project-formulating institutions cannot be fully disciplined through the internalization of the costs of project-selection errors, then the voices of other institutions, those without a stake in proceeding with the project, ought to be strengthened. This can be done in four ways.

First, evaluating agencies can be institutionally separated and insulated from implementing agencies that have an incentive to undertake projects even if they have low rates of return. If evaluative agencies are staffed by individuals with strong professional incentives to apply rigorous analysis, then the rationale for caution in the face of environmental risk may be more powerful than the alternative.

Some progress in this direction has been made by the World Bank since its reorganization in 1987. A large proportion of the World Bank's environmental specialists are now on the staffs of the technical departments for each region, rather than reporting to the country program departments. They are therefore less susceptible to pressures from project division chiefs or country department directors to overlook or minimize environmental risks. It is true that both departments report to the regional vice president, who is surely concerned with the need to fulfill the lending quota planned for that region, but at the regional level the loss of any particular project only marginally detracts from the objective of meeting the overall lending targets.

Second, the discussion of project evaluations as proposals rather than predictions implies a strong need for completely independent evaluation. If an evaluating unit cannot itself be insulated, it can be overseen or evaluated by other appraisal experts. Little and Mirrlees (1991: 358) offer as possibilities the independent appraisal of randomly selected projects shortly after the original appraisal, and grading of appraisal quality by independent inspectors. These schemes would adjust rates of return for projects examined, and would reinforce the incentives for good appraisal and the risks of poor appraisal. A promising development along these lines was the expert Board of Review established in 1981 by Colombian authorities along with the World Bank loan for the Guavio Hydroelectric Project. The Colombian authorities had earlier disregarded the World Bank's recommendation to establish such a Board for the Las Mesitas Hydroelectric Project, which suffered from gross underestimation of project costs and delays.

Third, other agencies, free of the bias to proceed with problematic projects, can be given enough power to veto, or at least to delay, the projects until both project design and appraisal are more acceptable. An encouraging case is India's Indira Reservoir, which was successfully redesigned after opposition from the Indian government's Finance Ministry, Department of the Environment, and Wildlife Department demonstrated their potential to kill the project altogether. (Ascher and Healy 1990: 120-130)

Fourth, responsible participation by non-governmental organizations can strongly reinforce the discipline imposed by watch-dog governmental agencies. For NGO participation to be responsible, it must avoid the common tendencies to attack all environmental impact projects and employ environmental criticism as a vehicle for political purposes. As the case of India's Narmada Valley clearly indicates, when environmentalist groups are seen to be automatically confrontational, the credibility of their inputs suffers drastically. (Ascher and Healy 1990: 115-120)

3. Expanding the knowledge base. It is important to keep in mind the lesson that partisan analysis is strongly abetted by analytic limitations. Ignorance and uncertainty provide the latitude for analysts and policymakers to select adequately credible technical judgments that coincide with their promotional objectives. Where uncertainty is minimal, and the costs and benefits of particular initiatives and project designs are widely known and accepted, it is of course more difficult to slant technical analysis with any plausibility.

With respect to specific projects already identified, more analysis of possible environmental consequences is clearly called for. Environmental impact statements must be obligatory. The question is how to ensure that formulating and evaluating agents, who have incentives to avoid raising environmental red flags, will pursue environmental analyses in good faith. The method now employed by the World Bank, namely to designate projects with the

potential to have significant environmental impacts as requiring full environmental impact assessments, has considerable promise. It may still be that environmental specialists may be too overworked to carry out a sufficiently thorough assessment, and that project staff interested in having a project proceed will participate perfunctorily in its assessment. Yet the more subtle consequence of this arrangement is that project staff end up with less interest in pursuing projects with environmental consequences in the first place, because they recognize the additional work of undertaking environmental assessments and the risk that assessments may uncover problems that would either scuttle a project or require even more effort. The potential liability of this system is that the additional man-hours and risk entailed in developing projects with environmental impacts may create a bias against identifying rural development projects -- where much of the most abject poverty is still located. It may be argued that it is environmental risks per se, not this approach to assessing them, that makes rural development more problematic than previously appreciated. Yet it is possible to identify a large pool of rural projects, and on the basis of thorough study weed out those with unacceptably large environmental risks and modify or adopt the others.

With reference to future projects, it should be noted that natural-resource-base knowledge has much more value than currently implied by the haphazard pursuit of geological surveys, meteorological surveys, hydrological surveys, and soil analyses, in most developing countries. The obvious retort is that development often cannot wait for the painstaking accumulation of knowledge. But the essential point is that greater resources should be devoted to efforts to map out physical and biological conditions in general, not so much because today's project should be postponed, but so that such information will be available for the next decade's projects. If an important diagnosis of why resources are squandered is that ignorance prevents policymakers from realizing what is lost when development projects liquidate existing resources, then resource inventories are an obvious corrective: e.g., volume of biomass that would have to be removed for the plantation to proceed; knowledge of biodiversity; assessments of the value of non-timber extractive resources.

4. Institutionalizing environmental caution. The simplest deterrent to unwarranted optimism is deliberate pessimism. It is not feasible to make simple adjustments to ex ante calculations, because estimated returns are not uniformly exaggerated -- there is no standard "deflator". Nonetheless, appraisal reviewers can certainly be more conscious of the general pattern of uncertain or unknown impacts being more negative than positive.

In cost-benefit analysis, the known consequences of environmental impacts should, of course, be represented as costs or benefits. Yet the treatment of the risk of unidentifiable environmental consequences has to be handled carefully. If the environmental costs of a project are easily known, there is no special problem. The challenge comes when even the nature of the costs cannot be anticipated; for example, if a hitherto-unknown pest proliferates after its predator's habitat has been eliminated. One approach is to regard each development project within a particular, narrow class (e.g., monoculture plantation forestry with an exotic species) as having a presumptive cost, set at the average environmental cost of previously evaluated projects of that type. For example, it would be reasonable to calculate the average decline in actual rates of return to North India's major irrigation projects launched in the 1980s that was due to unanticipated environmental consequences (e.g., salinization and waterlogging). If these

effects, on average, account for a two or three percentage point decline in rates of return, then this figure should be added to the specific estimate of knowable expenditures and damages to generate a full calculation of costs. The net effect, of course, is to reduce the number of projects that exceed the pre-established minimum rate of return.

E. Outlook and Conclusions

Has there been progress in designing better development projects and appraising them more accurately? Can more progress be expected? It is, of course, impossible to find empirical verification that projects now being launched are more effectively screened for environmental damage and other return-reducing problems. The only definitive empirical basis for such a conclusion would have to come after the environmental impacts, costs, and benefits of such projects are known. Today we can only evaluate the projects of a decade ago, not more recent projects that have been subjected to apparently greater environmental concern and scrutiny.

The most commonly-invoked basis for optimism is the greater prominence of the environment as an issue. There is a widespread, but empirically unverifiable, view that the kinds of environmentally problematic projects that would have been approved in the 1970s or early 1980s would now be unthinkable, and certainly ineligible for international funding. Some institutions, including the World Bank, the Inter-American Development Bank and the U.S. Agency for International Development, have intensified the environmental screening contained in the project evaluation process. It is, of course, encouraging to note that the staff appraisal reports of these institutions now include environmental assessments as a matter of course for projects with potential environmental effects (see, for example, Butcher 1990).

However, this attention to environmental risk has not yet provoked those structural changes in governmental institutions that would allow for the development of incentives that give proper weight to environmental risks. The fundamental political economy of early commitment to grandiose projects of uncertain environmental consequence has not been overturned.

The development of appraisal methodologies is also inconclusive. While more sophisticated approaches are being developed, their utilization is still surprisingly limited (Little and Mirrlees 1991). The future development of project appraisal methodologies is important not only to assist properly motivated analysts and policymakers to screen out poor projects, but also to hold them accountable for their ex ante appraisals. If ex post appraisal does not capture most significant environmental costs, analysts conducting ex ante appraisals will not tend to worry about being caught out by their exaggerations or disregard for environmental consequences.

The general context of policy reform and structural adjustment is, perhaps, the most important factor in tilting toward an optimistic prognosis. The general movement to eliminate the logic of blatant risk-seeking and to make governmental institutions accountable for the results of their own actions, has the potential to bring these reforms to the challenge of dealing with environmental-impact projects in a far more sober and realistic fashion. In this respect, although the conditionalities required by international funding institutions can play a useful supporting role, the primary responsibility of designing and selecting appropriate environmental-impact projects still lies with the governments of the developing world.

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