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THE WORLD BANK

Water Management in Agriculture

Ten Years of World Bank Assistance, 1994–2004

THE WORLD BANK GROUP

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The World Bank
Washington, D.C.

http://www.worldbank.org/ieg

1818 H Street NW
Washington DC 20433
Telephone: 202-473-1000
Internet: www.worldbank.org
E-mail: feedback@worldbank.org

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World Bank InfoShop
E-mail: pic@worldbank.org
Telephone: 202-458-5454
Facsimile: 202-522-1500

Independent Evaluation Group
Knowledge Programs and Evaluation Capacity Development (IEGKE)
E-mail: eline@worldbank.org
Telephone: 202-458-4497
Facsimile: 202-522-3125

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ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AFD	African Development Bank
AFR	Africa
ARD	Agriculture and Rural Development Department
ASAL	Agriculture sector adjustment loan
AWM	Agricultural water management
CAS	Country Assistance Strategy
CDD	Community-driven development
EAP	East Asia and Pacific
ECA	Europe and Central Asia
ERR	Economic rate of return
FAO	Food and Agricultural Organization of the United Nations
FY	Financial year of the World Bank (July 1–June 30)
GDP	Gross domestic product
HIPC	Heavily Indebted Poor Countries (Initiative)
I&D	Irrigation and drainage
IBRD	International Bank for Reconstruction and Development
ICR	Implementation Completion Report
IDA	International Development Association
IEG	Independent Evaluation Group (formerly OED)
IFPRI	International Food Policy Research Institute
LAC	Latin America and the Caribbean
M&E	Monitoring and evaluation
MNA	Middle East and North Africa
O&M	Operations and maintenance
OED	Operations Evaluation Department (changed to IEG)
PAD	Project appraisal document
PPAR	Project Performance Assessment Reports
SAR	South Asia
SSA	Sub-Saharan Africa
WUA	Water user association

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Director-General, Evaluation: *Vinod Thomas*
Director, Independent Evaluation Group–World Bank: *Ajay Chhibber*
Manager, Sector, Thematic, and Global Evaluation Division: *Alain Barbu*
Task Manager: *George T. Keith Pitman*

Foreword

The purpose of this study is to update the *Review of World Bank Experience in Irrigation* (IEG 1994) and to broaden the scope of evaluation to include all water lending for agricultural development. Since that first study, the proportion of World Bank lending for agricultural water management continued to decline, a trend that started in the late 1970s when the subsector received 11 percent of the lending, falling to less than 2 percent in 2001–03. It has since staged a strong recovery and reached over 4 percent in 2005. Commitments for agricultural water management account for a quarter of all lending for agriculture and rural development—more recently, this amount increased to one-half.

This study undertook a detailed assessment of the design and performance of the agricultural water portfolio for the period 1994–2004, and updated lending trends to include 2005. Emerging issues are thus identified and lessons are drawn from the World Bank's rich experience. This study also updates and elaborates the more general findings presented in *Bridging Troubled Waters* (IEG 2002a).

The study is primarily based on the analysis of a wide range of World Bank data and reports, including 131 project appraisal documents, 129 country assistance strategies, and 71 implementation completion reports, covering the Bank's experience in 56 countries. In addition, it draws upon the detailed findings from IEG's project performance reports, country assistance evaluations, and several special sector and thematic evaluations. The methodology used in the evaluation is described in detail in appendix A.

Vinod Thomas
Director-General, Evaluation

Executive Summary

While no country has been able to decrease poverty through agricultural development alone, at the same time, no country … has solved its problem of poverty without creating a dynamic agricultural sector (Timmer 2003).

At the turn of the millennium, irrigated land made up about a fifth of the arable area in developing countries, having doubled to about 200 million hectares since the early 1960s.

Yet, this relatively small proportion of arable land produced 40 percent of all crops and close to 60 percent of cereal crops—but it also accounted for about 80 percent of all water use in developing countries. As the world's population expands from its present 6.5 billion to a projected 8.2 billion in 2030, demand for agricultural production and, thus, water will increase.

Increased attention to efficient water management will be essential to meeting that demand. Globally, water is an increasingly scarce commodity—in the next 25 years more than a quarter of the developing world population will face severe water scarcity. The rapidly growing numbers of urban and industrial consumers will be prepared to pay more for water than the agricultural sector at present. The use of this limited resource will, therefore, require efficiency improvements and tradeoffs. Groundwater, the main source of water associated with most private sector agricultural investment in South and East Asia, the Middle East, and North Africa regions, is already overexploited. Thus, more competition for water and the degradation of existing supplies, owing to pollution and reduced investments for infrastructure maintenance, will require better regulation and management.

The World Bank has long been the largest source of assistance for agricultural and rural development. This has included a range of structural and nonstructural measures to harness, control, and manage surface and ground water to improve agricultural production. These measures have involved widely variable combinations of irrigation, drainage and flood control, water conservation and storage, on-farm water management, and more recently, institutional support to improve sustainability, user operation and management, and cost recovery. Collectively, these interventions are called *agricultural water management* (AWM).

The Bank's engagement with AWM has evolved considerably since its first comprehensive sector strategy in the 1993 *Water Resources Management: A World Bank Policy Paper*. Even so, the irrigation and drainage and the natural resource management subsectors were identified as high risk in the Bank's 1997 rural development strategy, *Vision to Action* (World Bank 1997a).

That strategy emphasized a supportive policy framework for projects, an enabling environment for private sector development, and a participatory, decentralized approach to the design and implementation of projects. It shifted the objectives and the design of agricultural water projects from a narrow agricultural focus to a broader rural development approach. Subsequently, the Bank's 2001 *Water Resources Sector Strategy* highlighted that provision of water infrastructure was an important component of growth. However, the details of water development strategy and business plans for efficient and sustainable service provision and management were delegated to the main water-using sectors, which for agriculture is the Bank's Agriculture and Rural Development Department (ARD). Subsequently, ARD issued an updated rural development strategy in 2003, *Reaching the Rural Poor* (World Bank 2003a), which sought to focus the Bank's rural lending—including that for water—on extending Bank endeavors to reach the rural poor.

Despite these strategies and the increasing demand for food and water, the proportion of total Bank lending to agriculture fell from 31 percent in the late 1970s to less than 10 percent in the early 2000s. Similarly, the share of Bank lending for agricultural water management, after peaking at 11 percent of all Bank commitments in the 1970s, fell to less than 2 percent by 2000. Recently, following a strong drive from ARD it has grown to 4 percent.

The total amount of Bank lending between 1994 and 2004, for the 161 projects that included quantifiable agricultural water management components, was $13.2 billion, which went to 56 countries. Within this total commitment less than half—42 percent or $5.6 billion—was specifically for agricultural water management components. Almost two-thirds went to South and East Asia, and half to China, India, Indonesia, and Pakistan. Mexico, with only two operations, is the third largest borrower. This regional distribution follows the pattern of Bank lending established for agricultural management since the 1970s.

Since 1994 the average loan amount per AWM project has fallen from $59 million to a low of $15 million in 2001. This was because of the increasing share of projects in the Europe and Central Asia Region; a move away from freestanding irrigation and drainage projects to more general rural development or social fund-type projects, in which AWM was a minor component; and a marked reduction in new construction in favor of rehabilitation of existing infrastructure.

During the period 1994–2004 agricultural water projects directly benefited up to 12 million households and more than 60 million people. The average project served slightly less than 115,000 farm households, mostly defined as small family farms, and covered an area of 134,000 hectares. The investments were economically sound and averaged an economic return of 22 percent. However, more recently, returns have declined to about 17 percent because of lower commodity prices, smaller incremental benefits, and overly optimistic appraisal of institutional constraints.

A recent impact evaluation by IEG in India's Andrah Pradesh area has reaffirmed irrigation's role in reducing rural poverty (IEG 2006a). Irrigation increased net farm income by just over 60 percent, about half of which came from increased cropping intensity and most of the remainder from higher yields, with only a small part attributable to changes in the crop mix. However, irrigation had a very modest impact on income distribution. The top quartile benefited the most in absolute terms, and the second quartile benefited the most in relative terms, experiencing income growth of 30 percent. The poorest quartile experienced a low benefit, but their already low income meant that they also experienced income growth of 20 percent, compared with 19 percent for the top two quartiles. Dynamic effects also had an impact on income distribution. Households subject to repeated negative shocks became heavily indebted and depleted their assets, constraining their ability to undertake productive investments. Reducing the negative impact

of bad years by irrigation thus aided asset accumulation and helped households grow out of poverty.

Irrigation investments in Andrah Pradesh increased the demand for labor, particularly for women. This increase in the demand for labor led to an increase in average wages of 5 percent for men and 10 percent for women because of the high demand for female labor for weeding and harvesting paddies. In an IEG survey, women accounted for 63 percent of agricultural employment in 2005 and 64 percent in 2006. There is a considerable body of evidence that women's incomes have a larger impact on child welfare (health and education) than do men's incomes.

Given the relative importance of AWM and the fact that the last comprehensive independent evaluation of this subsector was in 1994, this study set out to answer three questions:

- Why has Bank investment in agricultural water management declined so precipitously?
- Are agricultural water projects relevant to the Bank's renewed focus on poverty alleviation and institutional and policy reform?
- What should be done to improve performance and relevance?

Reasons for Reduced AWM Lending in the 1990s

Following its 1990 *World Development Report on Poverty*, the Bank adopted a strategy that targeted efficient, labor-intensive growth and greater attention to social concerns, including education and health care. With the stronger focus on reducing poverty, lending to the social sectors increased while lending for infrastructure, agriculture, and the environment fell after 1993. International Development Association (IDA) replenishment agreements (IDA10–12) also required increases in the share of investment lending in the social sectors, and the Heavily Indebted Poor Countries (HIPC) initiative required beneficiary countries to allocate funds freed up from debt service to public expenditure on the social sectors. Lending to education, health, and other social services peaked at 31 percent ($5.8 billion) of total lending in 2003 (compared with 12 percent in 1990), before falling back to 18 percent in 2005.

Also contributing to the reduction in agricultural lending during the 1990s was the secular decline in agricultural prices (owing to the success of the Green Revolution) and reductions in government involvement in agriculture (such as input and credit subsidies). Dissatisfied with previous public sector–led approaches to agricultural development, the Bank began to experiment with a more diversified menu of subsector strategies, depending on the characteristics of each subsector and the level of each country's development. Central and state governments continue to fund research, extension, and livestock services (because of the strong public-goods elements), while private sector investment tends to be associated with land markets, agricultural marketing, and rural finance. Local governments are a key to improving rural infrastructure, and local communities to improving the management of renewable natural resources, such as pastures, forests, and fisheries, provided that incentives are in place such as harvest or property rights.

Finally, internal Bank factors also played a role. Overall Bank budget constraints may also have contributed to reduced lending for agriculture and AWM, because the Bank's administrative budget for lending preparation declined from $150 million in 1993 to $122 million in 2000; and economic and sector work declined from 13 percent to 7 percent of the Bank's budget during the same period. (In real terms, the Bank budget for lending preparation declined by 44 percent between 1993 and 2001.) While the administrative budget for lending preparation has recovered since 2001, it was still only three-quarters of its 1993 value in 2005. In this context of increased competition for scarce Bank budget resources, the rural sector, and the AWM subsector in particular, were at a disadvantage because of the relatively high costs of preparation and supervision, fiduciary, and safeguard concerns. (Agricultural projects were a quarter more

expensive to prepare than the average Bank project, and AWM projects that required additional preparation costs to meet the Bank's safeguard policies were almost twice as expensive.) A reduction in the number of technical staff may also have contributed to reduced sector lending. The introduction of new lines of business under the 1997 *Strategic Compact* (World Bank 1997b) brought about a change in the skills mix of Bank staff—all of the targeted sectors, except rural and private sector development, increased their staff. Within the rural sector there was a reduction in the number of agricultural and irrigation specialists. (By 2002 there were only 16 irrigation and drainage specialists left in the ARD sector.)

AWM Remains Relevant

No country has successfully tackled rural poverty without developing a dynamic agriculture sector. In most of the Bank's client countries this is dependent on efficient water management, good drainage, and flood protection. Sound water management increases agricultural productivity and this has substantial positive impacts on rural employment and the rural nonfarm economy. Although agriculture's contribution to growth and employment continues to shrink as economies make the transition from agriculture and subsistence production to more reliance on industry, processing, and services, IDA borrowers have consistently placed the highest priority on infrastructure and agricultural development in the Bank's client surveys. In a recent IEG assessment in Madagascar, for example, farmers reported that they were able to send their children to primary school only after irrigation and road access to markets had improved their incomes—the uptake of investments in education was strongly conditioned on the impact of infrastructure investment.

Many borrowers are seeking external support to improve the productivity of agriculture through private sector growth, agribusiness, better communications, marketing and trade, and improved input efficiency, particularly for water. In some countries, managing agricultural water shortages is an increasing concern—particularly in China, India, Pakistan, Yemen, much of the Middle East, and in a number of Central Asian countries.

Irrigation boosts growth and reduces poverty directly and indirectly, benefiting the poor in several ways. Poor farmers directly benefit from increases in their production, which enables them to increase their own consumption or provide a surplus of marketed products, thereby increasing their farm income. Small farmers and landless laborers benefit from agricultural employment opportunities and higher wages, and a wide range of rural and urban poor benefit from related growth in the rural and urban nonfarm economy. Larger crop harvests from irrigated areas lead to strengthened staple and nonstaple food output, which lowers prices and benefits all consumers, particularly the poor. Even so, it is the "package" that matters for effective poverty alleviation and not just the supply of irrigation water. Investments in agricultural water management may not reduce poverty directly in any significant way unless accompanied by other complementary interventions.

The Importance of Agricultural Development and Sound Water Management Is Increasingly Recognized in CASs

Evaluation of the Country Assistance Strategies (CASs) and projects approved during the period 1994–2004 shows a change toward a more comprehensive approach to rural development, with a growing emphasis on building social capital. Project objectives encompassing community support and participation, income and employment, and support for capacity building and institutional development increased. Conversely, objectives that are central to the new policies—addressing poverty reduction, agricultural development and production, and environment and natural resources management—declined in importance. One reason for these changes is that development objectives have become more practical and achievable by focusing on measurable outcomes

rather than global targets. For example, increased attention to income and employment almost offsets the decrease in poverty-reduction objectives.

Attention to the technical and social issues of agricultural water management has become more polarized. The more general projects, in which water-related activities are in the minority, are building water infrastructure with less attention to issues of technical efficiency and sustainability. This may not be an issue where agricultural water management projects are part of a broader package of rural development that deals with social, human, and economic development. But these findings indicate the importance of integrating agricultural water management projects within country rural strategies and ensuring that they are adequately supported either by parallel operations that address critical omissions, or by improving the skills mix of appraisal teams preparing agricultural water management components of nonwater projects.

While most CASs discussed the importance of agriculture policy, less than half discussed it in the context of economic growth; greater prominence was given in the CASs to community-driven development, general rural development, and reform of agricultural institutions. In part this is the result of economic evaluation that neglects the analysis of growth impacts and poverty-alleviation effects of investment in AWM.

Projects Are Smaller and Cheaper but Broader Policy Issues Have Been Neglected

Low-cost approaches are increasingly important. The average Bank commitment to agricultural water management projects declined for two reasons: a change in the type of infrastructure financed and the greater emphasis on nonstructural and capacity-building components. Freestanding projects dedicated to water management now comprise only about 40 percent of the agricultural water management portfolio. There is a marked difference in the type of infrastructure components financed by dedicated and nondedicated projects even though most contain a mix of physical interventions ranging from some new construction, redesign and upgrading, to repair of damage caused by deferred maintenance, referred to as rehabilitation. Among the dedicated projects, rehabilitation or improvement of large irrigation systems now account for more than 80 percent of Bank commitments. Nondedicated projects, after an initial focus on rehabilitation in the mid-1990s, now support the construction of new systems that are small scale, community owned, and integrated in social development programs. Because rehabilitation projects averaged $2,900 per hectare, while new construction projects averaged $6,600 per hectare, there was a substantial fall in the cost of projects. As a result, the average loan amount per project fell from $59 million in 1994 to a low of $15 million in 2001.

Dedicated irrigation and drainage projects with policy content—large or small—only give broader policy issues modest attention. For about 20 percent of the cases reviewed, policy was not addressed at all, either because it was no longer relevant or because it was being addressed outside the project. Many of the appraisal documents implicitly assume either that policy reform is largely complete, or that it is beyond the project's scope—particularly in cases where irrigation and drainage was only one of many components, or where the size of the investment was small in relation to the norm for earlier periods. Yet, in many cases, important policy issues remain. For example, in Brazil, the Bank's analysis shows that there is a need to increase the security and enforceability of water rights, to introduce water charges that reflect the economic value of water, and to clarify the roles and responsibilities of institutions. These recommendations are valid for many of the Bank's clients, particularly in countries such as India, Jordan, and Mexico. This clearly indicates that a comprehensive approach—as opposed to an irrigation-led one—is required for agricultural development in developing countries.

Better Private Sector Participation Is Needed

While the principle of user participation to improve management of public sector irrigation projects remains valid and is still widely supported, farmers often lack the skills needed to manage the larger irrigation systems, and the need for continuing government support has been underestimated. Projects have tended to give more emphasis to strengthening water user associations than to strengthening the broader authorization and institutional framework in which they must function. Cost-recovery targets have been wildly ambitious and unrealistic because of inadequate social assessment. And frequently, essential credit, inputs, extension, and marketing linkages have been neglected. Projects also have not planned for the gradual phasing out of support as the user groups mature.

Simultaneous attention to community operation and management, and physical modernization of water distribution networks has not been very common, reducing the efficacy of both interventions. Where this has been done, the results can be outstanding, as shown in China's Tarim Basin and in Armenia. Where the potential synergy has not been captured, the outcomes have been disappointing.

The complementarity among irrigation investments and extension, marketing, and credit services can be improved, particularly for dedicated projects. While there was a big increase in the share of irrigation projects that addressed credit and marketing constraints after 1998, most of this increase derives from nondedicated projects.

Monitoring and Evaluation Was Poor but Is Improving Slowly

Throughout the study period there was systematic improvement in the overall quality of monitoring and evaluation systems. The overall annual average rating increased from slightly above modest in 1994 to substantial 10 years later—the primary reason for the improvement in the design of monitoring and evaluation was the introduction of logical frameworks in the late 1990s and their mandatory use in project appraisal documents. While the overall quality of indicators improved, only a fifth of sampled projects had good poverty output indicators.

Only 11 percent of projects were designed to have the tools that would allow rigorous impact assessment: this includes well-defined output and outcome indicators, good baselines, and independent control groups unaffected by project interventions that would allow the counterfactual to be determined. Another 41 percent would allow determination of what happened before and after project implementation, but not a robust attribution of observed changes. Slightly fewer than half the projects did not have any means of verifying project impacts—no surveys or baselines—even though more than two-thirds of them included outcome or impact indicators.

Key Indicators Are Infrequently Reported

Outcomes from 71 projects in the portfolio that have been completed reveal that while all of them provide qualitative accounts of policy or institutional outcomes, less than half can define quantifiable outcomes and impacts. There are three reasons for this. First, almost a third of the projects (20) could either define benefits only very generally (for example, the community-driven development projects) or very narrowly, such as the six output-oriented emergency-disaster recovery projects. Second, planning and setting up of monitoring and evaluation is poor. And third, very often there is a lack of relevant indicators because the results chain linking inputs to outputs and impacts is either weakly developed or missing.

In comparison with the rest of the Bank, the rural sector is more assiduous in carrying out economic evaluations, and more projects—about half—are reevaluated at completion. In the agricultural water subsector, there is a partic-

ular need for more attention to broaden projects' economic analysis to demonstrate growth and poverty impacts, thereby increasing project relevance to Bank country directors and ministers of finance. And in most projects, the impacts of capacity building and institutional reform are not factored into the benefit stream. This is particularly important because the economic efficiency of rural projects (based on more easily measured impacts such as incremental crop production) has been less than most other sectors in the Bank, and it has been declining.

Reports on how many people benefit, their social status, and what benefit they realize are not very common. Slightly under half of the projects report how many farmers benefit, but less than a fifth report how many people this affects or the social distribution of benefits.

There Is Potential for Increasing Relevance and Performance

Demonstrate growth impact though better economic analysis. The relevance of agricultural water management operations to borrowers and to Bank country directors could be increased through better analysis of links to economic growth and more attention to demonstrating social impact and poverty reduction. More explicit and thorough results chains are needed in project design. Current project economic analysis is typically limited to input and production impacts with almost no attention to modeling employment, poverty alleviation, growth, environmental, and institution-building impacts because it is often regarded as impractical to quantify their benefits. Consequently, these potential benefits are omitted.

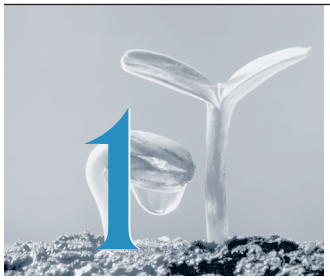
Currently, the value of water saved through more efficient agricultural use is neglected if that water is not used to expand agricultural production. Yet, increased urban demand puts a much higher value on water. This is clearly a benefit derived from more efficient agricultural water use and should be added to the benefit stream. Capturing these effects is clearly very difficult but options for some assessment could be developed from the analysis of earlier experiences and the literature. Better economic analysis would also help the selection of the most relevant project objectives and components, and help simplify project design, thus avoiding projects overloaded with too many objectives.

Give more attention to enhancing water use efficiency. Agriculture uses 70 percent or more of all water resources in the Bank's client countries. Increasing water use efficiency will become increasingly important as inter-sectoral competition for scarce water increases. More attention to irrigation system modernization is needed to ensure that systems designed for top-down supply management are redesigned with the provision of appropriate volumetric measurement for demand management by water users. Simultaneously, more care should be given to developing supporting institutions and incentive structures for water user groups. Greater social assessment and financial capacity-building is generally required.

Match sector staffing to needs. There is ambivalence about technical staffing in the agricultural sector, and for irrigation and drainage, brought about by the Bank's preference for less technically demanding operations and more fungible generalists. If better economic analysis leads to increased demand for AWM projects, then attention will have to be given to recruiting staff that can deliver technically sound and relevant projects—a pressing issue because about half of the senior technical staff in AWM will retire in the next two to five years.

Provide sufficient resources. Increasing the contribution of agricultural water investments to economic growth and poverty reduction may require additional Bank resources for front-line development. If it is demonstrated that inadequate or inefficient agricultural infrastructure hinders economic growth and slows

poverty reduction, then the Bank may have to consider increasing resources for project preparation and economic, sector, and advisory work. The Bank should not continue to allow economically justified lending to agriculture to languish just because projects are expensive to prepare. The distorted incentive structure that this creates when budgets are tight should be recognized and rectified. This is particularly important because the agricultural sector provides most of the employment for the rural poor.



Introduction

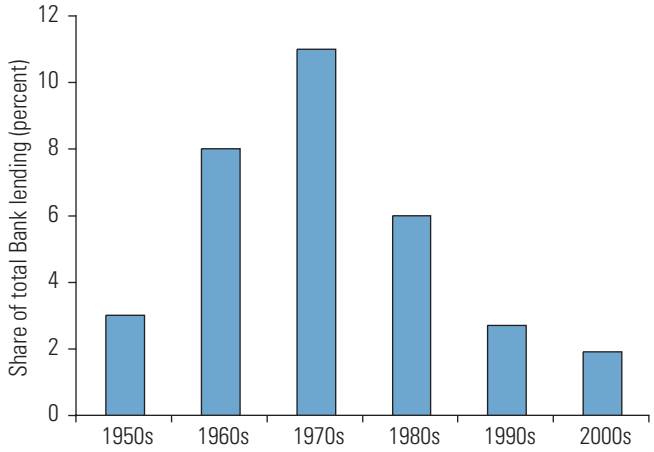
Since its inception the World Bank has been the world's largest source of assistance for agricultural and rural development. This has included a whole range of structural and nonstructural measures to harness, control, and manage surface and ground water to improve agricultural production.

Typically these measures include widely variable combinations of irrigation, drainage and flood control, water conservation and storage, on-farm water management, and more recently, institutional support to improve sustainability, user operation and management, and cost-recovery. Collectively, these interventions are termed *agricultural water management* (AWM). Bank lending for AWM peaked in the 1970s (figure 1.1).

Effective irrigation and drainage contribute to food production, generate rural employment, and raise the incomes of farmers. Successful agricultural water management minimizes production risks (drought, poor drainage, and flooding), boosts output, and provides incentives for farmers to invest in other inputs and agronomic improvements. In high-risk environments, farmers tend to rely on robust but low-yielding varieties of crops and are generally unwilling to invest in fertilizer and other inputs because of the risk of failure and loss. Conversely, good agricultural management makes it economically and financially attractive to grow high-yield seed varieties and to apply adequate plant nutrition as well as pest control and other inputs, thus increasing yields. In successful irrigation projects, for example, conversion from rain-fed to irrigated crops typically increases crop yields twofold or more; and, using either reservoir or groundwater storage, it may be possible to extend the normal growing season and produce two or more irrigated crops each year in warm climates.

In 1998, irrigated land made up about one-fifth of the total arable area in developing countries, having doubled in size since the early 1960s to reach about 200 million hectares. Despite the relatively small proportion of total arable land irrigated, this produces 40 percent of all crops and close to 60 percent of cereals—it also accounts for about 80 percent of all water use in developing countries.[1] The Food and Agricultural Organization of the United Nations (FAO 2003) estimates that since the early 1960s more than 70 percent of agricultural production increases in developing countries have been the result of yield increases, much of it associated

Figure 1.1. Bank Lending for AWM



Source: World Bank data.

with irrigation and improved on-farm water management. In the Philippines, for example, yields of irrigated rice are twice those of rain-fed varieties.

Poor drainage is as much an impediment to crop production as insufficient water and about half the world's irrigated land suffers from drainage problems.[2] Twenty-five million hectares of prime agricultural land have become unproductive due to irrigation-induced waterlogging and salinity.[3] Two hundred and fifty million hectares of rain-fed cropland need improved drainage. Improved drainage can also produce substantial benefits to health, reduction of damage to roads and buildings, and flood control. In Egypt, subsurface drainage increased the annual net income of the traditional farm up to $375 per hectare.[4] In the Mardan project area of Pakistan, crop yields increased between 27 percent and 150 percent. In Mexico, economic rates of return of the drainage subprojects, based only on the changes in agricultural yields, ranged from 15 percent to 22 percent.

Investment in agricultural water management requires substantive support from the government and the private sector in order to attain its full efficiency. Large- and medium-scale surface water irrigation from canals and tanks and drainage projects have been built primarily through public investment. Groundwater abstraction, initially developed through public expenditure on large well fields, is now financed mainly through private investment because of its small scale and manageability (Barker and Molle 2004). Because an integrated approach to water resources development is needed to minimize harmful externalities and resource degradation, government has a major regulatory and planning role.

Expansion of private investment has also increased the pool of resources available for agricultural water management. However, private sector irrigation development has been limited mainly to groundwater and, to a lesser extent, smaller commercial surface water systems growing high-value crops. Two-thirds of groundwater irrigation in India and Mexico is privately managed.[5] In India and elsewhere in South Asia, and in Latin America and the Middle East and North Africa, public investments have facilitated private irrigation investment. In South Asia, private tubewell irrigation systems have grown most rapidly in areas with reasonably good roads, research and extension systems, access to credit, and electric or diesel energy. As a result, these have been concentrated in and around the command areas of large, publicly developed surface irrigation systems.

World Bank Strategies for AWM

The first Bank water strategy, presented in "*Water Resources Management: A World Bank Policy Paper*" (1993), evolved in response to growing unease within the Bank that water operations were failing to deliver sustainable development, and growing international concern about the mismanagement of global water resources and poor service levels, particularly for the poor. When the strategy was issued, water-related projects were among the poorer performers in the Bank's portfolio. This was emphasized by the influential Wapenhans Report (World Bank 1992), which was highly critical of the quality of the Bank's water lending

based on the findings of sector reviews of water supply and sanitation, irrigation and drainage, and trends in project outcome ratings.[6, 7]

The strategy paper recognized that improving performance in meeting water needs requires borrowing countries to reform their water management institutions, policies, and planning systems. It also acknowledged that this would require changes to the Bank's internal processes, training, skills mix, and resources assigned to water and water-related operations. The main recommendation was that a new approach—recognizing that water is a scarce natural resource, subject to many inter-dependencies in conveyance and use—be adopted by the Bank and its member countries. Specifically, the aim of the strategy was to maximize the contribution of water to countries' economic, social, and environmental development while ensuring that resource and water services are managed sustainably. This was to be achieved through the establishment of comprehensive analytical frameworks to foster informed and transparent decision making, with an emphasis on demand management, promotion of decentralized implementation processes, and use of market forces to guide the appropriate mix of public and private sector provision of water services.

Integrating the Strategy with Rural Development

The Bank's 1997 rural development strategy, *Vision to Action* (World Bank 1997a), attempted to shift the Bank from a narrow agricultural focus to a broader rural development approach, integrated with country assistance strategies (CASs), with particular focus on 18 countries.[8] Four subsectors—agricultural research and extension, forestry, irrigation and drainage, and natural resource management—were identified as high risk. To address the risks the strategy emphasized a supportive policy framework for projects, an enabling environment for private sector development, and a participatory, decentralized approach to the design and implementation of projects. Independent evaluation of this strategy found that the urban bias often shown by governments, and sometimes echoed by the Bank's country directors, continued to impede selectivity and strategic mainstreaming.[9] Despite increasing support for sector investment programs, progress with sector and sector-level policy and institutional reforms remained slow, restricting rural growth in many countries. While the strategy helped to improve the design and implementation of rural projects, it was not adequately incorporated into CASs and there remained room for improvement in knowledge management, training, and monitoring.

Agricultural water management received minor attention in the *Vision to Action* strategy. Major actions proposed included improved intersectoral coordination and planning of all water-using sectors, resolution of water allocation disputes among sectors and countries, support for efforts to decentralize irrigation management based upon water user associations and greater attention to sustainability of infrastructure, including full recovery of operation and maintenance costs.

Independent evaluation of the Bank's 1993 *Water Resources Management Strategy* conducted during the period 1999–2000 did not assess the efficacy of *Vision to Action* on agricultural water management.[10] Generally, agricultural water management performed poorly on compliance with the main elements of the water strategy compared with the other water-using sectors—energy, environment, and water supply and sanitation. Even so, agricultural water projects were superior on social assessment and participation but inferior on institutional and financial issues, and their supervision was more problematic. Among the recommendations was that more attention was needed on loss of skills through net loss by retirement of experienced water sector staff; better guidelines were also needed on best practice.

Subsequently, the Bank's new *Water Resources Sector Strategy*, finalized in 2001, confined itself

to the broader policy issues and new directions for water resources management, deferring and delegating the detailed strategy and business plans for efficient and sustainable service provision and management to the main water-using sectors, in this case, agriculture.[11] The 2001 strategy identified the falling investment in hydraulic infrastructure as a critical failing of the Bank's lending in the 1990s. Thus, it proposed institutional support to facilitate development of "high risk–high reward" infrastructure, in recognition of the controversy surrounding large-scale investment to harness water resources.

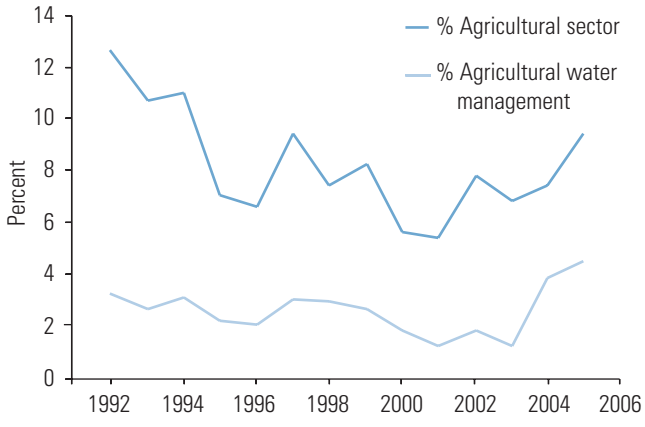
Renewing the Focus of the Rural Strategy

The renewed rural strategy, *Reaching the Rural Poor*, was launched in 2002 to realign the Bank's declining rural lending with the incidence of poverty (World Bank 2002b). While three-quarters of the world's poor reside in rural areas, the proportion of total Bank lending to agriculture fell from 31 percent in the late 1970s to less than 8 percent in the early 2000s but has since shown a strong resurgence (figure 1.2). The new strategy focused on creating an investment climate conducive to rural growth and empowering the poor to share in the benefits of growth.

Reaching the Rural Poor stressed the centrality of sound water management to agricultural development, which is the main engine for broad-based rural development. While detailing priorities for Bank assistance—including tackling the well-known systemic institutional problems of irrigation and drainage—*Reaching the Rural Poor* promotes several new initiatives. New approaches to irrigation that yield benefits disproportionately to the poor are promoted, as is greater attention to monitoring and evaluation to ensure accountability of monopoly service providers in irrigation, and linking irrigation reform to broader issues of development and political economy. Overall, the approach is to encourage coherent and integrated rural development that is more closely aligned with Poverty Reduction Strategies Papers and CASs. But *Reaching the Rural Poor*'s prescriptions for improving agricultural water management are not based on systematic review of the Bank's experience or a detailed evaluation of implementation experience.

Reaching the Rural Poor succeeded in refocusing the Bank on improving its approach to agriculture and agricultural water management and better equipping of its staff to do the job. This has not only rejuvenated lending but also produced two comprehensive internal Bank evaluations of the subsector and its performance—*Agricultural Growth for the Poor: An Agenda for Development* (2005c) and *Reengaging in Agricultural Water Management: Challenges and Options* (2006). In addition, Bank staff were supported in implementing these new directions through development of practical guidelines *Shaping the Future for Water in Agriculture: A Sourcebook for Investment in Agricultural Water Management* (2005d).

Figure 1.2. Agriculture Sector and AWM Lending in Total Bank Lending



Source: World Bank data.

Objectives of the Study

With less than three years of implementation experience, it is too early to evaluate the efficacy of the rural development strategy laid out in *Reaching the Rural Poor* or of the subsequent detailed guidance to Bank staff. However, more than a third of the Bank's rural investments between 1994 and 2004 dealt with agricultural

water management. Given the relative importance and specialized nature of the subsector, and that the last comprehensive, independent evaluation of this subsector was in 1994, it is appropriate to evaluate the performance of agricultural water management since then. The main study questions are:

- Why did Bank investment in agricultural water management decline so precipitously?
- Are agricultural water projects relevant to the Bank's renewed focus on poverty alleviation, and on institutional and policy reform?
- What should be done to improve performance and relevance?

AWM Relevance to the Bank Declined

This chapter demonstrates that the commitment to agricultural water management declined in the 1990s as the Bank's development agenda focused more on social, human development and environmental concerns, and good governance, and because it was seen in the Bank as less relevant to the needs of borrowers.

Overview

Although borrowers have become more concerned with issues of urbanization and social development, particularly as food security is no longer a concern for most countries, infrastructure and agriculture remain at the top of their developmental priorities. Within the Bank, the 1997 action plan, *Strategic Compact: Renewing the Bank's Effectiveness to Fight Poverty* (1997b), significantly reduced budgets for project preparation, a trend accelerated by a substantial shift toward development policy lending during the mid- to late 1990s. At the same time, the skills mix of Bank staff was realigned to the *Strategic Compact*, resulting in a loss of technical staff and their replacement with staff having more fungible skills. Enhanced fiduciary and safeguard provisions increased the costs of project preparation such that AWM projects became among the most expensive to prepare. Squeezed by budget pressures, high costs, muted advocacy, and new development initiatives, country directors' interest in AWM waned. Since 2002, budgets and staffing have modestly improved and, refocused by the new rural and water sector strategies, lending for rural development and AWM has resurged.

Within agricultural water management there has been a strong trend toward more general agricultural development projects that are more closely aligned to the Bank's objectives and to agricultural sector strategies, that focus more on poverty alleviation, human and social development, and capacity building. At the same time, attention to environmental issues has steadily fallen and, within the fewer and more specialized AWM projects, the approach also has become more technically focused. More general AWM projects—many of which use community-driven development—are building water infrastructure with less attention to issues of technical efficiency and sustainability. These findings indicate the importance of integrating AWM projects within country rural strategies and ensuring that they are adequately supported

either by parallel operations that address critical omissions, or by improving the skills mix of appraisal teams. It is important to realize that there is no "ideal" AWM package—country needs and preferences should drive project design, be it entirely a water project or part of a more general or sequenced approach to rural development.

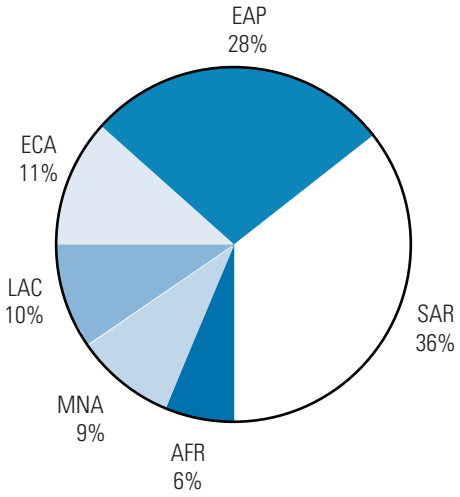
AWM Investment Shrank

The proportion of total Bank lending to agriculture fell from 31 percent in the late 1970s to less than 10 percent in the early 2000s. Similarly, the share of Bank lending for AWM, after peaking at 11 percent of all Bank commitments in the 1970s, was less than 2 percent in the early 2000s. Recently it has grown to 4 percent. The size and composition of the AWM portfolio also changed in response to borrowers' preferences and evolving Bank strategies for poverty alleviation and agriculture.

Globally, the international financial institutions are small players in agricultural water management. In the 1990s, the irrigated area in developing countries expanded at an average rate of 2.5 million hectares a year and increased the stock of irrigated land to 207 million hectares by 2000. This represents an annual investment of about $36 billion in current prices, including the costs of operations and maintenance (O&M) for past irrigation investments. In the same period, international financial institution investment averaged $1.6 billion a year, 4 percent of global investment, half of which came from the World Bank.[1] The balance of global investment came mostly from the public sector, from private investment in small-scale, mainly groundwater-based irrigation, and small contributions by bilateral development partners—there are, however, no reliable global estimates of their relative contribution.[2, 3]

The total amount lent by the World Bank between 1994 and 2004 for the 161 projects that included quantifiable AWM components was $13.2 billion. This represents almost 6 percent of the total Bank commitments during the period and it went to 56 countries. Almost two-thirds went to the South Asia and East Asia Regions (figure 2.1), with 51 percent to China, India, Indonesia, and Pakistan. After India and China, Mexico, with only two operations, is the third-largest borrower, accounting for almost 8 percent of the total amount committed. This regional distribution follows the pattern of Bank lending established for irrigation and drainage since the 1970s (IEG 1995). Within this total commitment, less than half (42 percent or $5.6 billion) was specifically for agricultural water management components.

Figure 2.1. Most Bank AWM Investment Went to Asia in 1994–2004



Source: World Bank data.

In practice, the Bank allocated more to AWM, but this is difficult to quantify. Although a textual search of the Bank's data for 1994–2004 found that 371 projects included some discussion of AWM, only 161 could be quantified—these form the portfolio used for this evaluation. For consistency, the lending for agricultural water components was estimated from the cost tables in project appraisal documents (PADs). However, the subsequent random sampling of PADs and more detailed cost allocation found that in several projects the agricultural water component was almost 20 percent more costly than those identified using only the sector code. The remaining 210 projects that mention AWM were not analyzed further for two reasons. First,

153 of the projects were either social funds or community-driven development (CDD) types of intervention that did not make an *a priori* allocation of the loan amount because it was not known what interventions the beneficiaries would choose.[4] Second, the remainder had only very small, if any, AWM components that would not be cost effective to assess.

During the period 1994–2004, the average loan amount per AWM project consistently fell from $59 million in 1994 to a low of $15 million in 2001. Since then it has recovered (figure 1.2). While there is high variability from year-to-year in the number of project approvals, averaging 15 a year, they exhibit no significant trend over time. The amount of lending declined until 2003, when it recovered as a result of two large projects in Mexico and Vietnam and several large projects in India. Five factors explain the falling lending for AWM in the portfolio: (i) realignment of lending with the Bank's strategy for assisting poverty, (ii) a shift in borrowers' priorities, (iii) a growing emphasis on integrated rural development, (iv) changing development objectives in AWM, and (v) increased use of low-cost approaches.

Aligning Overall Bank Lending with Its Poverty Strategy

Following the 1990 *World Development Report on Poverty*, the Bank adopted a two-pronged strategy that targeted efficient, labor-intensive growth and greater attention to social concerns, including education and health care. This was put into effect through the Bank's 1997 plan, *Strategic Compact: Renewing the Bank's Effectiveness to Fight Poverty*, as part of the systemic reforms introduced by President James Wolfensohn. The *Compact* focused on implementing four priority-change programs: (i) refueling current business activity to improve client services, (ii) refocusing the development agenda, (iii) retooling the knowledge base, and (iv) revamping institutional capabilities to support a more agile, creative, and client-orientated work environment. Sectors and themes highlighted for attention were environment and social, finance, human resources, public/private sector, and rural development. Subsequently, the Bank's 2000/2001 *World Development Report: Attacking Poverty*, advocated an increased focus on public sector governance and institutional reforms that would empower and foster participation of the poor in the conduct of public institutions and delivery of public services (IEG 2004a).

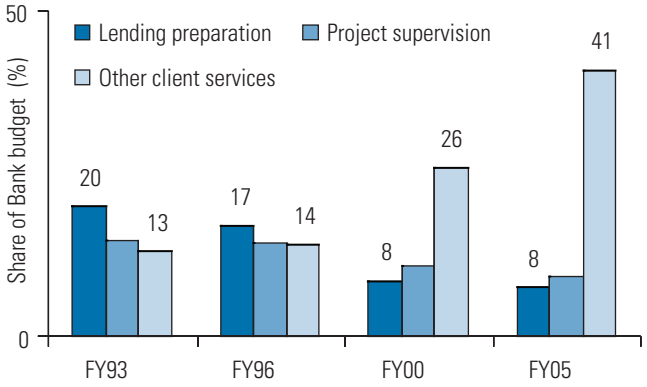
With the renewed focus on poverty, lending to the social sectors increased while that for infrastructure, agriculture, and environment fell after 1993. International Development Association (IDA) replenishment agreements (IDA10–12) required increases in the share of investment lending in the social sectors, and the Heavily Indebted Poor Countries (HIPC) Initiative required beneficiary countries to allocate funds released from debt service to public expenditure on the social sectors. Lending to education, health, and other social services peaked at 31 percent ($5.8 billion) of total lending in 2003 (compared with 12 percent in 1990), before falling back to 18 percent in 2005.

The *Compact* Had Unintended Consequences

The *Compact* had an adverse impact on overall Bank lending, and on lending for all infrastructure—the rural sector and agriculture in particular.

Infrastructure lending declined from a peak of $10.3 billion (44 percent of the Bank's lending portfolio) in 1993 to as low as $5.1 billion (26 percent) in 2002. The largest declines were in electric power and water supply. In the mid-1990s, before the Asian financial crisis, rapid growth in the volume of private sector investments was widely expected to continue unabated. Coupled with serious concern about the environmental and social impact of several large-scale projects—particularly those for water—this caused the Bank to reduce its support for public investments in civil works. With the introduction of the Infrastructure Action Plan in 2003, however, infrastructure lending is now recovering, reaching $6.9 billion (32 percent) in 2005.

Figure 2.2. Bank Resources to Prepare Projects Declined in the Late 1990s



Source: World Bank data.

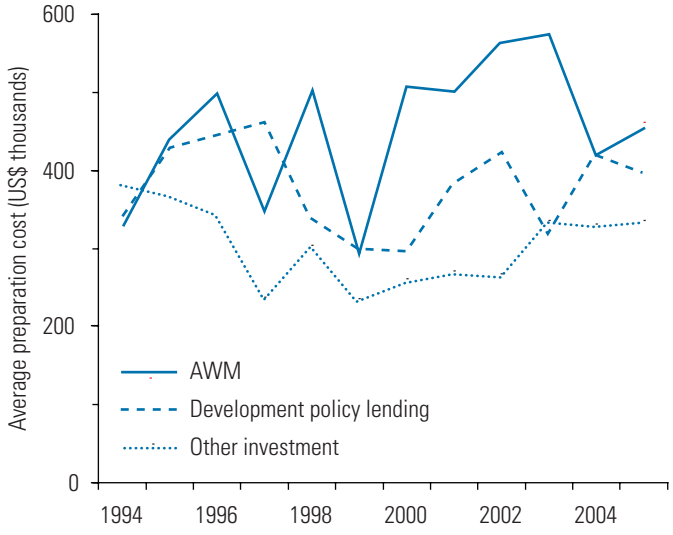
Budget Constraints Led to Reduced Lending

The additional financing to implement the *Compact*—$250 million—was agreed to on the basis that efficiency savings would enable the Bank to be more effective in 2001 but on the same overall administrative budget as 1997. While there were major achievements—the decentralization of many directors to country offices, an increase in the number of satisfactory projects, reduced processing time for Bank lending, harmonization and streamlining of information and knowledge management systems, and improved client services[5]—these were at the expense of Bank budgets for lending preparation, which declined from $150 million in 1993 to $122 million in 2000, and for economic and sector work, which fell from 13 percent to 7 percent of Bank budget in the same period. While the decline in budget for lending preparation bottomed out in 2001, in 2005 it was still below the level of 1993 (figure 2.2). In real terms the Bank's budget for lending preparation declined by 44 percent between 1993 and 2001.[6] Even so, the total number of Bank loans fell by only 13 percent in the same period as a result of efficiency improvements and a preference for smaller, less risky projects in sectors other than infrastructure and rural development.[7]

Overall budgets for lending preparation, however, remain tight. While the budget for lending preparation recovered by 2005, it was still only three-quarters of its 1993 value. And while use of trust funds supplemented project preparation costs, these have declined Bank-wide from a third of overall cost in the period 1999–2001 to 16 percent in 2005. Generally, the agriculture and rural sector has attracted more trust funds, but their contribution to overall preparation costs fell from about 40 percent to about 25 percent between 1999 and 2005.

Competition for an increasingly scarce Bank budget reduced country directors' interest in the rural sector and the AWM subsector because of the relatively high costs of preparation and supervision, fiduciary and safeguard concerns, and performance issues. In that sense the opportunity cost of continued investment in a traditional line of Bank business was high because new development initiatives promoted under the *Compact* were much cheaper to prepare, were seen as less risky, and delivered results more quickly.[8] And preparation costs of AWM projects are among the highest in the Bank—even compared with development policy lending —and in a time of tight budgets this led

Figure 2.3. AWM Projects Are among the Most Costly to Prepare



Source: World Bank data.

to reduced lending to the subsector (figure 2.3).[9] For example, in 2001 the average new lending per sector staff was $22.5 million for public sector governance, $15.5 million for finance, and $6.2 million for rural development. Only education and health had similar cost-to-lending ratios. Clearly, if only lending volume was a priority, rural, education, and health sector projects would not be selected unless they could be made much larger. While the moral imperative and international pressure to lend for education and health is strong, this is not the case for agriculture—even though most of the poor live in rural areas. Yet leaving countries prone to droughts, floods, and famines because the projects are too expensive to prepare is not a defensible option for the Bank as the lender of last resort.

The primary reason for increased preparation costs of rural, AWM, and infrastructure is because their size and spatial impact may adversely affect the environment, human settlements, and employment. Normally they include substantial contracting and procurement. Consequently, when the Bank's fiduciary and safeguard policies are invoked, preparation costs rise (table 2.1).

The *Compact's* introduction of new lines of business brought about a change in the skills mix of Bank staff (table 2.2).[10] All of the targeted sectors, except the rural and private sector, significantly increased their staff. Within the rural sector there was a reduction in the number of agricultural and irrigation staff because they did not fit the new requirements for less technically specialized and more fungible skills—in 2002 there were only 16 irrigation and drainage staff in the Agriculture and Rural Development Department (ARD).[11] The primary means of downsizing was early retirement without replacement. From 425 staff in 1985–86, numbers in the rural sector declined to 330 in 1996 and 309 in 2005. A survey of rural sector managers indicated that 330 staff was the critical threshold they needed to discharge their sectoral responsibilities.[12]

Table 2.1. Cost of Safeguard Policies Is High, 1994–2005 (US$ thousands)

Sector Board	Average Preparation Cost	Plus Safeguards	
		Partial	Full
Rural Sector	447	445	655
Water Supply and Sanitation	437	432	492
Energy and Mining	401	403	553
Urban Development	372	379	588
Environment	349	355	483
Transport	348	360	381
Private Sector Development	329	347	320

Source: World Bank data.

Investment lending was also reduced by the rise in the importance of adjustment lending during the 1990s.[13] From about a quarter of total Bank lending in 1990, adjustment lending—now called development policy lending—steadily increased to more than half of all Bank lending by 1999 and stayed around that level until 2002. Although it declined subsequently it is expected to increase with the growing preference within the international financial institutions for general budget support operations.[14]

Agriculture's Shrinking Contribution to Growth and Employment

The Bank's approach to attacking poverty laid out in its 2001 Strategic Directions paper was the rationale for strategy articulated in *Reaching the Rural Poor* (2002b). Underpinning the focus on

Table 2.2. Changes in the Bank's Skills Mix, 1997–2005 (number of professional staff)

Sector	1997	2000	2005
Human Development	342	516	542
Rural	289	314	309
Private Sector	158	164	151
Environment	139	199	207
Finance	115	186	147
Social	53	129	145

Source: World Bank, Human Resources Department data. Professional staff includes headquarters and country office staff at grade GE and above.

poverty was growing evidence that accelerating economic growth was the fastest way to raise people out of poverty—a 1 percent increase in per capita income reduces the proportion of people living on less than a dollar per day by an average of 2 percent because economic growth *per se* does not systematically affect the distribution of income (Revallion 2001, 2004, IEG 2005). While most of the poor reside in rural areas, however, sectors other than agriculture frequently offer more rapid economic growth.

Agriculture's contribution to growth and employment continues to shrink as economies make the transition from agriculture/subsistence to more reliance on industry, processing, and services. This shift of economic focus has lowered policy makers' attention to agricultural policy and water management. Between 1980 and 2000 the share of agriculture in the world's gross domestic product (GDP) fell from 7.9 to 5 percent, but the decline was much greater for the regions where most of the AWM infrastructure is located. It fell by a quarter to 25.1 percent in South Asia and halved in East Asia and Pacific to only 12.6 percent. The only region where the share of agriculture in GDP remained unchanged was Sub-Saharan Africa (17 percent), and in the Middle East and North Africa where it actually increased—from 10.3 to 14.3 percent. In comparison, among all low- and middle-income countries, agriculture's value added to growth in the 1990s shrank to about half of that added by the industry and service sectors and about a quarter of that added by exports of goods and services.[15]

Agricultural employment has become less important. In the Philippines, for example, between 1980 and 2000, agricultural employment fell from 60 to 47 percent.[16] In the same period, Egypt saw a decline from 45 to 29 percent while in Brazil it fell from 34 to 26 percent.

Borrowers Are Becoming Focused on Urban Challenges

Food security concerns that were the focus of agricultural development in the 1960s to 1980s were mostly assuaged. Declining prices of staples—particularly the irrigated rice that accounts for the majority of food grains consumed—helped by improved nonwater inputs, markets, and trade, increased the food access of the poor. Among the Bank's borrowers, food security remains an issue in a number of Sub-Saharan countries (for example, Ethiopia, Kenya, Madagascar, Malawi, Mali, Mozambique, and Zambia), in postconflict Afghanistan, and in Indonesia as a consequence of natural and economic shocks. Thus, in most developing countries agricultural production has met performance expectations. Even so, many are seeking external support to improve the productivity of agriculture through private sector growth, agribusiness, better communications, marketing, and trade.

Dramatic growth in the urban populations of developing countries is posing severe economic, political, and social challenges that have displaced the attention given earlier to rural development. Rural populations are anticipated to decline slightly from 3.3 billion in 2003 to 3.2 billion in 2030,[17] and agricultural employment will continue to contract—as discussed earlier, agriculture employment has declined in the Philippines, Egypt, and Brazil in the past two decades. Therefore, while 48 percent of the world's population lived in urban areas in 2003, this is projected to rise to 61 percent by 2030. Of the two billion new urban dwellers, almost all will be in developing countries.

Between 2005 and 2050, eight developing countries are expected to account for half of the world's projected population increase: India, Pakistan, Nigeria, the Democratic Republic of Congo, Bangladesh, Uganda, Ethiopia, and China (in order of the size of their contribution to population growth). Four of the eight (Bangladesh, China, India, and Pakistan) are among the world's leading irrigation states. Increased urbanization will require more water supplies and it is expected that this water will come from the increased efficiency of agricultural water use in conjunction with less pollution that reduces water resources.

Demand Is Still High for Assistance to Agriculture

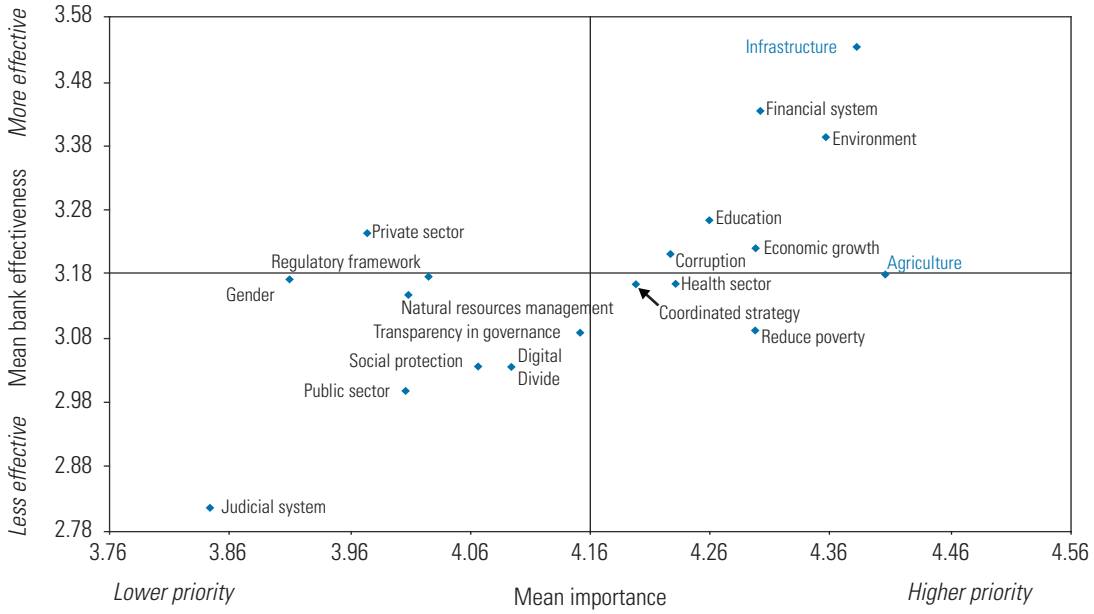
In global polls covering 55 countries during the period 2002–04 Bank clients gave the highest priority to agriculture where they perceived the Bank to be moderately effective (figure 2.4), though International Bank for Reconstruction and Development (IBRD) countries, as expected, gave this a much lower priority than did IDA countries. The next highest priority was for infrastructure, in which the Bank received the highest scores for effectiveness, followed by environment, financial systems, economic growth, and poverty reduction. One interpretation of this sequence is that IDA governments put the highest priority on public service infrastructure, agriculture, and sound financial management to enable growth. The Bank also needs to improve its effectiveness in many areas, particularly poverty reduction and assistance to improve public sector performance and good governance. The Bank's greatest weaknesses—a consistent trend seen in all the client surveys throughout the period 2002–05—is that it imposes technical solutions without regard to political realities, it is too bureaucratic, and it does not explore alternative policy options. While most of the sectors targeted by the *Strategic Compact* align with priorities identified by clients, it is clear that agricultural development is the exception in terms of investment and Bank resources allocated to this sector.

AWM Is Now Less Focused on New Investment

Escalating construction costs for dams and related irrigation infrastructure, together with concerns over environmental impacts and involuntary resettlement, reduced demand for new AWM infrastructure.[18,19] Irrigated environments also faced increased competition for water and reduced water supplies owing to system degradation and reduced infrastructure development.

Poor performance and maintenance problems of public sector irrigation induced disillusionment among governments and policy makers, thus quelling interest. Much of this was because the rapid expansion of irrigation infrastructure

Figure 2.4. Borrower Demand for Agricultural Investment Remains High



Source: World Bank Client Survey, data aggregated from more than four years, more than 10,000 decision makers, and 55 countries. The survey indicates how clients perceive the relative importance and effectiveness of the Bank's development interventions, on a scale from 1 (negligible) to 5 (high).

Table 2.3. Developing Countries: Annual Investment for Water Services

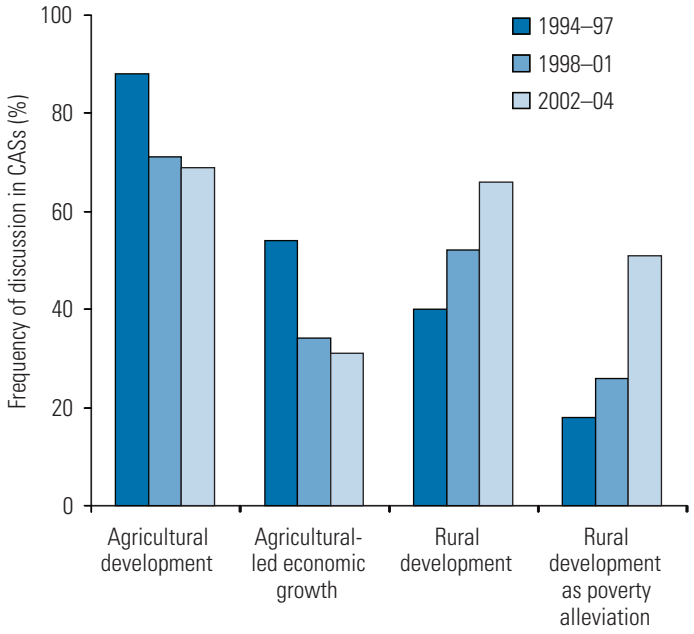
	Annual Cost of Investment (US$ billions)	
Investment sector	**2000**	**2002–25**
Municipal Wastewater Treatment	14	70
Agriculture	**32**	**40**
Industrial Effluent	7	30
Sanitation and Hygiene	1	17
Drinking Water	13	>13
Environmental Protection	7.5	10
Total	75	180

Source: Camdessus Panel 2003.

outpaced effective public management and local institutions.[20] Therefore, by the early 1990s institutional development and reform, beneficiary management, and upgrading and rehabilitating existing irrigation systems became more important than area expansion.[21]

With competition for scarce public sector financial resources, it is likely that political preference will be given to public investments in basic water supply, sanitation, and environmental needs because agriculture is regarded as primarily a private sector activity. And financially it is projected that demands for water supply and sanitation will far outweigh the investment needed for continued growth of AWM (table 2.3). Diminishing attention to agriculture among the Bank's IBRD borrowers was, therefore, consistent with increased attention to social issues, urbanization, and growth.

Figure 2.5. CASs Reflected Changes in Bank Policy



Source: IEG review of 129 CASs.

Emphasis on Comprehensive Rural Development Is Growing

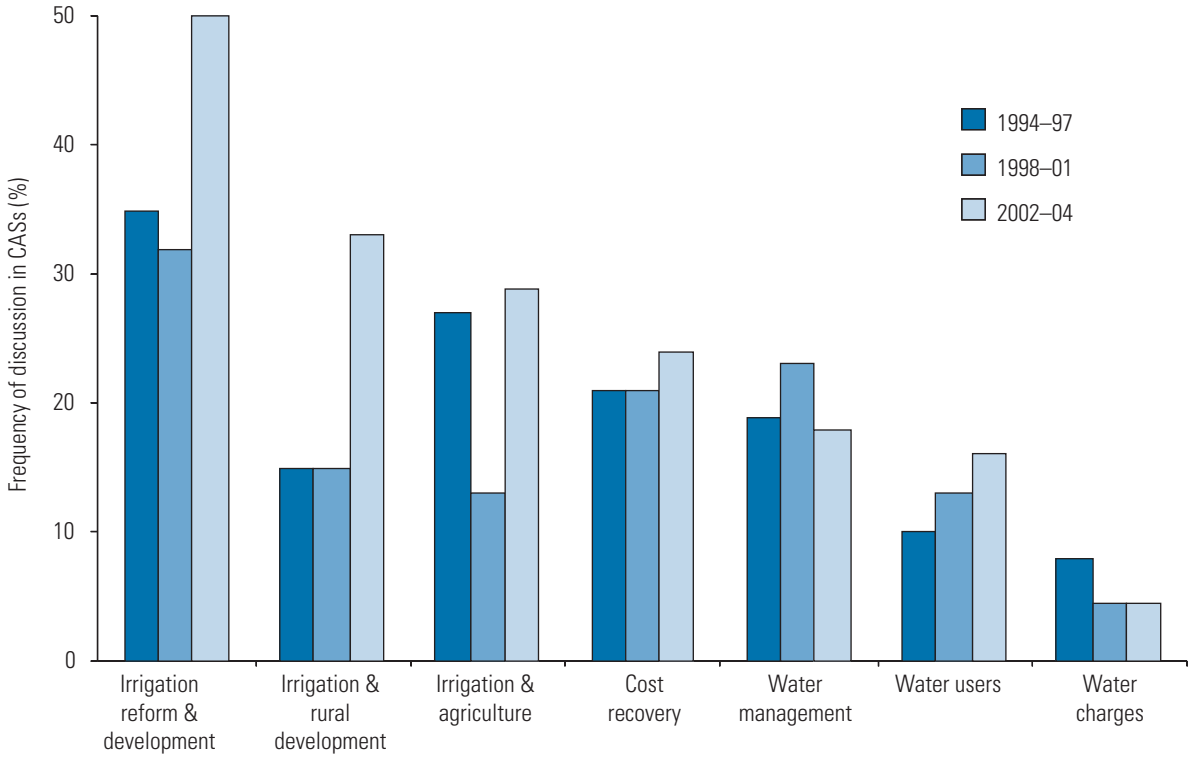
Borrowers' preferences and Bank policies and strategies are translated into country-specific, three-year rolling action plans through CASs developed in collaboration with governments and civil society. An evaluation of the CASs in the period 1994–2004 shows a change toward a more comprehensive approach to rural development, with a growing emphasis on building social capital—a result of the new rural strategy. While most CASs discussed the importance of agriculture policy, less than half discussed it in the context of economic growth, giving greater prominence to community-driven development, general rural development, and reform of agricultural institutions (figure 2.5).[22] Agricultural water issues were less frequently discussed.

Coverage of privatization, trade, and markets, also declined overall, perhaps because less attention was needed as they became self-sustaining in many countries. Indeed, a prevailing view among the Bank's country directors who were interviewed by IEG was that the Bank's major contribution was helping to get the country's policy environment right, not assisting agriculture, which is seen as primarily a private sector activity.

Policy Evolution Is Reflected in the CASs

Attention to irrigation reform to reduce subsidies and improve sector efficiency was fairly constant during the 1990s but grew after 2001, featuring in almost half the CASs (figure 2.6). Within this trend was growing recognition

Figure 2.6. Discussion of Institutions for Water Management Became More Prominent in CASs



Source: IEG review of 129 CASs.

that institutional reform will depend on greater capacity building in the water sector. Contrarily, discussion of agricultural water charges almost disappeared, being internalized in participatory irrigation management, while discussion of cost recovery modestly increased. Discussion of cross-cutting water resource management issues generally declined, except in the Middle East and North Africa (MNA) Region. Reduced interest in water tariffs is of some concern because it avoids the increasingly important issue of the opportunity cost of water in agriculture as urban and environmental competition for scarce water increases. The general softening of the approach to AWM and tariff issues is explained in part by the comparative doubling of discussions on irrigation in the context of comprehensive rural development—this is also a reflection of the changing skills mix of Bank staff caused by retirement of AWM specialists and their replacement with generalists.

Regional Differences Are Captured in the CASs

In the MNA Region water resources management concerns now top the agenda because of rapid urbanization and growth of agriculture, which now uses 90 percent of all water resources.[23] Even so, except in critically water-overdrawn countries like Yemen, discussion of agricultural development and water issues in the CAS dropped by half and irrigation to zero. In part this was caused by the very uneven progress on removing agricultural subsidies on inputs and protective tariffs on outputs. In Jordan, protective tariffs were removed via a structural reform program, yet high implicit subsidies to agricultural water use and the government's unwillingness to reform the sector distorted crop production, making it regionally noncompetitive. Consequently, the Bank is investing in sectors that are willing to reform, such as telecommunications and urban water supply,

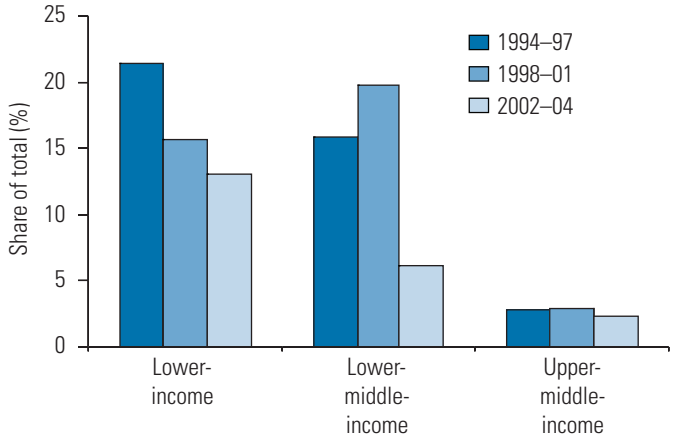
and where social needs are greatest, such as education. Morocco has a similar history except that most protective tariffs remain in place.

At the other end of the spectrum, attention to rural development in Sub-Saharan Africa CASs increased fourfold in the past 10 years, and a slight drop of interest in agricultural development has since revived in the past two years (box 2.1). Sub-Saharan Africa is the only region where population is growing faster than agricultural GDP and absolute poverty is increasing. While there are some notable agricultural successes based on irrigation (for example, in Mali and Niger), some countries also have problems. In Senegal, for example, irrigation-related bilharzia is a major public health issue. In Madagascar, the second largest irrigator in the region, irrigation has made little difference to agricultural productivity because of low skills, input use, technology, and access to markets.

Mixed AWM Responses to New Bank Policies

Bank lending for AWM was primarily to the poorest countries (figure 2.7). And except for 4 of the 11 years, more than half of all lending was to those in the lower-income group. Overall, IDA credits accounted for 55 percent of all AWM projects and 52 percent of commitments, and IBRD/IDA blends accounted for another 9 percent of projects (mostly in China, Indonesia, and Pakistan). Eight loans to China and one to Indonesia account for the increased share going to lower-middle-income countries in the period 1998–2001. Argentina, Lebanon, Mexico, and Turkey received most of the lending to upper-middle-income countries. There is some evidence of targeting the poorest countries following the 1997 *Vision to Action* strategy. As the volume of lending sharply contracted in the period after 1999, an increasingly larger portion—reaching more than 95 percent in 2002—went to the lower-income group.

Figure 2.7. Poorest Countries Received Most Bank AWM Investment, 1994–2004



Source: World Bank data.

Performance issues rather than poverty considerations were the main drivers of reduced lending among the biggest borrowers. Although China, India, Indonesia, and Pakistan remained the Bank's most consistent and prominent borrowers, the amount they borrowed for AWM fell significantly in the past 11 years (table 2.4).[24] This falloff in borrowing reflects greater Bank attention to performance, institutional issues, and governance, as well as country agreements to better use existing agricultural water infrastructure and to reform irrigation institutions. The shrinkage of lending is generally in accord with the CASs agreed with these countries.

In India during the 1990s the Bank's approach to irrigation development became far more focused on assisting states, such as Andrah Pradesh, that were willing to reform institutional shortcomings and organizational inefficiencies and better manage irrigation expenditures. In Andrah Pradesh, greater spending on O&M improved reliability of water deliveries and farmers' willingness to pay water fees (table 2.5). Even so, the subsector remains extensively subsidized. This trend away from new construction was accelerated because water resources and, by association, irrigation projects were perceived to be risky for the Bank's reputation, especially in the light of the controversies surrounding the Bank's engagement with the Sardar Sarovar Project, resettlement, and the ensuing Morse Report that cooled interest in the sector.

Box 2.1. Bank Strategy for Sub-Saharan Africa: The Importance of Agriculture

Agricultural production remains an important component of GNP in most Sub-Saharan countries and the adverse effects of periodic droughts has severe impact on economic growth, sometimes for several years, as happened in the early 1990s.[a] With a high reliance on rainfall and lack of irrigation, most farmers are unwilling or unable to risk investment to improve agricultural productivity. Instead, they have increased the area cultivated using traditional methods because land is the least constrained resource. Even so, yield increases have stagnated as soil nutrients become depleted—Sub-Saharan Africa (SSA) fertilizer use is only 5 kilograms per hectare; in East Asia it is 194 kilograms per hectare. Only 2 percent of water resources are harnessed compared with 36 percent in SAR and 53 percent in MNA.[b] The FAO projects that to meet basic human needs, irrigation in Sub-Saharan Africa will have to expand by 2 to 4 million hectares in the next three decades.

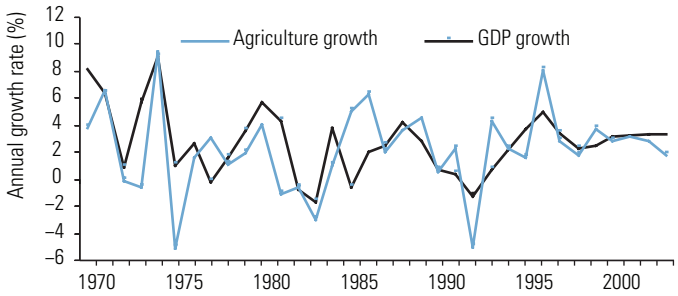
Working together with the New Partnership for Africa's Development, African agricultural ministers, the African Development Bank, the United Nations Economic Commission for Africa, FAO, and the World Bank developed the 2003 Comprehensive African Agriculture Development Program. The primary purpose of the program is to raise farm production, increase economic growth, and reduce hunger through concentration on four pillars:

- Extending land area under sustainable land management and reliable water control systems,
- Increasing food supply and reducing hunger,
- Improving rural infrastructure and capacities for market access, and
- Promoting, over the long term, agricultural research and technology dissemination.

Annual investment needed under this plan averages $17.9 billion, of which three-quarters will be for land, water, and rural infrastructure investment and their operations and maintenance. The sum is large; but is less than the amount spent on food imports.

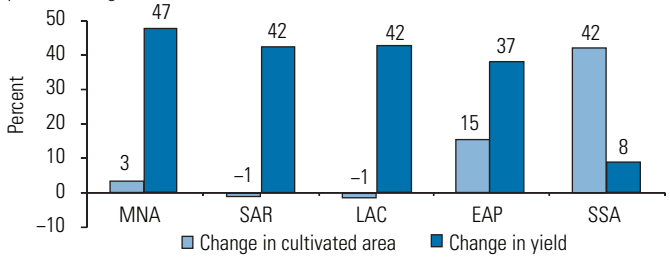
a. Regression of agricultural growth on GNP during the period 1990–2001 yields an R^2=0.5104 and a regression coefficient of +1.1898.
b. Bruinsma 2003.

Figure A. GDP Depends Much on Agriculture



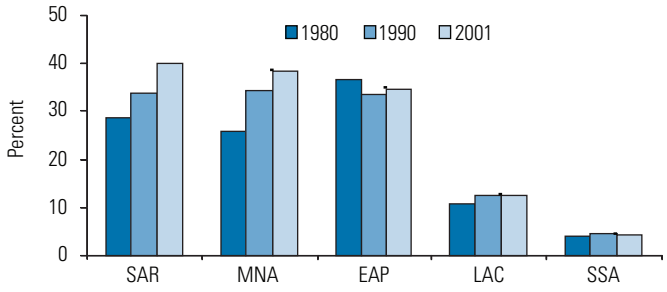
Source: FAO 2004.

Figure B. Agricultural Area Increased but Yields Have Stagnated, 1980–2003 (percent change)



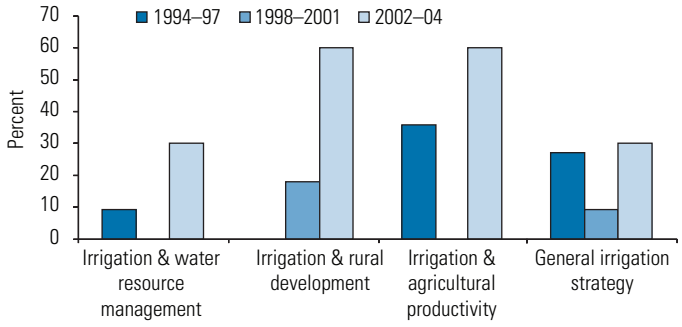
Source: FAO 2004.

Figure C. Sub-Saharan Africa Is the Least Irrigated Region, 1980–2001 (percentage of land irrigated)



Source: FAO 2004.

Figure D. More CASs Are Emphasizing Agricultural Productivity and Water Management, 1994–2004 (percentage of all Sub-Saharan Africa CASs)



Source: IEG analysis of 33 CASs.

Table 2.4. Largest Borrowers Took a Smaller Share of Investment

Borrower typology (and number of countries)	FY94–FY98			FY99–FY04		
	Investment in agriculture water only			Investment in agriculture water only		
	(US$ millions)	(Percentage)	No. of Projects	(US$ millions)	(Percentage)	No. of Projects
Consistent (4)	1,884	62	24	956	38	18
Regular (9)	336	11	15	646	26	29
Periodic (10)	255	8	13	384	15	17
Occasional (12)	444	15	13	370	15	11
One-off (21)	131	4	8	157	6	13
Total	3,050	100	73	2,512	100	88

Source: World Bank data and IEG analysis.

An earlier independent review of India's water sector (IEG 2002b) found that half of the irrigation projects completed in the 1990s had satisfactory outcomes, a third were judged to have substantial institutional development impact, and fewer than 20 percent were evaluated as having likely sustainability. A country assistance evaluation found that the selective and more relevant focus on reforming states had a larger impact on rural development institutions than the disparate and enclave projects of earlier years. There was also a need to move away from state-monopolized, monocrop irrigation to more diversified agriculture, and to give greater attention to increasing the productivity of the rain-fed agriculture sector that accounts for much of the residual rural poverty. Allied with an early 2002 Planning Commission embargo of new works and the transfer of an increased portion of the budget responsibility to the individual states, these imperatives led to a reduced level of lending for irrigation infrastructure rehabilitation and modernization.

Table 2.5. Reform in India Improved Spending on O&M and Revenue Collection

State	Proportion of O&M costs (percent)	
	Spent on establishment and staff	Realized from water charges
Reforming:		
Andrah Pradesh	38	74
Nonreforming:		
Assam	99	0.1
Gujarat	50	28
Haryana	85	27

Source: India Planning Commission 2002.

The Bank's approach in China before 1990 was to finance new and conventional irrigation projects prepared by the line agencies with little input by the Bank. During the 1990s this changed as Bank staff introduced innovative institutional and participatory management components, improved procurement practices, and increased the Bank's role in providing knowledge about modernizing water management and using water more efficiently. The Bank's decrease in lending reflected a move from its more conventional banking role to a focus on broader development goals and policy, a decrease in lending that was accelerated by the switch from concessional IDA credits to more commercial IBRD loans.[25]

Decreased lending to Pakistan for agricultural water management and infrastructure was the result of its low overall portfolio performance—in the late-1990s Pakistan was ranked among the 25 worst performers Bank-wide.[26] Consequently,

an aggressive portfolio improvement strategy, implemented in mid-FY98, closed 32 projects, reducing the portfolio to 16, and whittled the pipeline of potential projects from 30 to 12. Many large and important projects and programs—notably the Left Bank Outfall Drain, the National Drainage Program, the Chashma Right Bank Canal Project, and the Social Action Program—did not have the desired impact because of poor design, poor feasibility, poor coordination, delays in implementation, or corruption. The main risk factors in the National Drainage Project were very uneven provincial buy-ins to institutional reform and inadequate attention to reform and capacity building. And because the water sector only slowly adapted to the government's development agenda, which was based on decentralization, participation, and management transfer, investment for most agricultural water activities contracted.

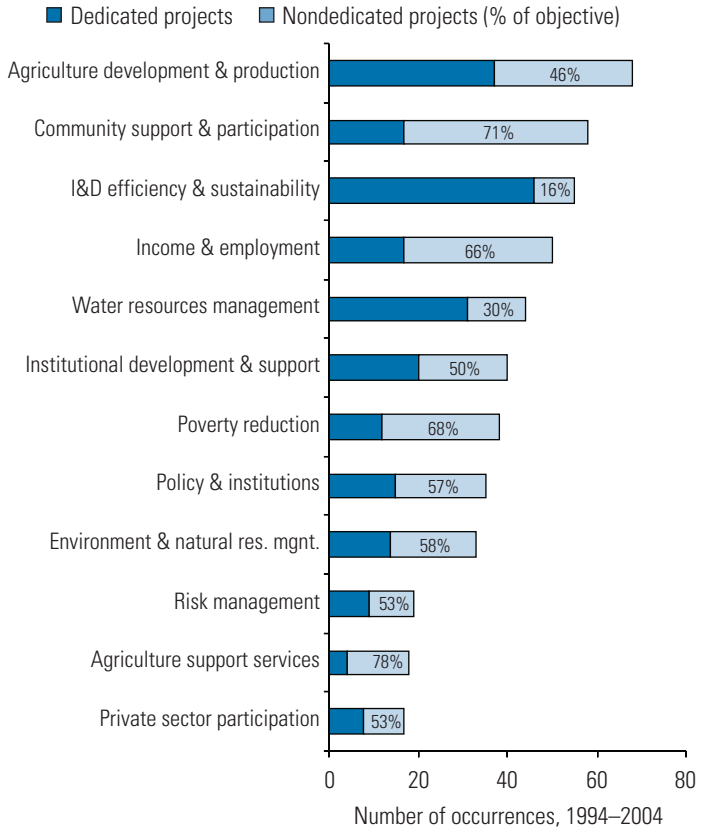
Like India and Pakistan, Indonesia's top-down public sector focused on building new infrastructure—while deferring maintenance of existing irrigation and drainage works—and became increasingly challenged during the mid-1990s. The Water Resources Sector Adjustment Loan (1999) brought institutional reform to the fore. Thereafter, the reduction in infrastructure components, along with the financial crises, decentralization, and increased requirements for provincial financing, caused lending for agricultural water management to shrink.

A new set of smaller country clients for AWM emerged as commitments to the biggest borrowers declined. Before 1999 Europe and Central Asia (ECA) accounted for only 11 percent of projects in the portfolio; afterward, with 29 loans, it accounted for a third. The relatively small size of most ECA agricultural water projects is more a reflection of the size of the economies in the region and the limited IDA envelope, than the Bank's identification of needs. The transition to market economies and loss of the former Soviet Union market for agricultural outputs has put most of the region's investments in agricultural water management in jeopardy. Yet, simultaneously, the collapse of nonagricultural employment in those countries caused many people to revert to the land for subsistence production. Therefore, the Bank's small interventions not only assisted poverty alleviation in the medium term but also provided an entry point for policy discussions aimed at rationalizing the region's aging and oversized infrastructure, which was frequently environmentally damaging and uneconomic to operate.

Development Objectives Have Changed

Considering the whole portfolio, the primary development objective of projects was agricultural production, followed by community support and participation, and measures to increase the efficiency and sustainability of irrigation and drainage (figure 2.8)—development priorities that accord with the Bank's 1993 *Water Resources Management Policy* and 1997 *Vision to Action.*

Figure 2.8. Relative Importance of Development Objectives for All AWM Projects, 1994–2004



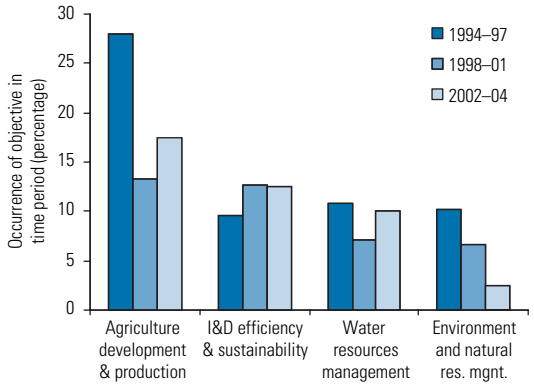
Source: IEG analysis of 161 PADs.

Because development objectives and components differ according to the relative importance of AWM in projects, the portfolio was further disaggregated into 67 dedicated projects, where more than half of the Bank's commitments were for AWM, and 94 nondedicated projects. All of the dedicated projects are managed by ARD plus one by the Environment Department. While dedicated projects tend to address risk, agricultural, and infrastructure issues, nondedicated projects focus on social concerns and agricultural support services.

While most development objectives were aligned with Bank and sector policies during the period 1994–2004 there were some notable exceptions. Objectives central to the new strategies—addressing poverty reduction, agricultural development and production, and environment and natural resources management—declined in importance (figure 2.9a). Conversely, objectives encompassing community support and participation, income and employment, and support for capacity building and institutional development increased (figure 2.9b). One reason for these changes is that development objectives have become more practical and achievable by focusing on measurable outcomes rather than global targets. For example, increased attention to income and employment almost balances the decrease in poverty-reduction objectives.

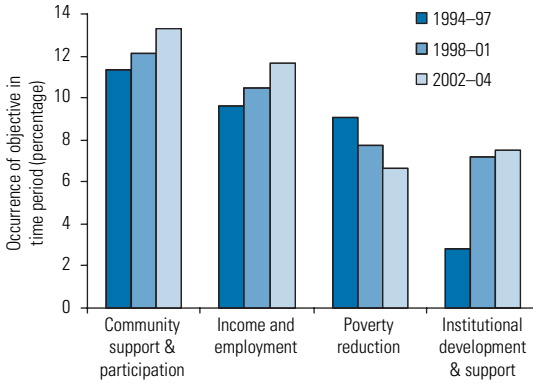
ARD's dedicated projects clearly show increasing interest in making the physical aspects of AWM work and declining interest in policy, institutions, and the environment. In contrast, nondedicated ARD projects, in which AWM professionals have a minor role, emphasize development priorities more aligned with current Bank policies. The net effect of nondedicated AWM on the development objectives of the more traditional, technically oriented approach to AWM shown by dedicated projects is evident in figure 2.10. The main lesson from these findings is that the skills mix in the teams designing AWM projects need broadening to avoid design capture by professional enclaves within the Bank. That way the quality-at-entry of

Figure 2.9a. Importance of Physical Development Objectives Either Stabilized or Declined in Importance



Source: IEG analysis of 161 PADs.

Figure 2.9b. Improved Attention to Social and Institutional Issues

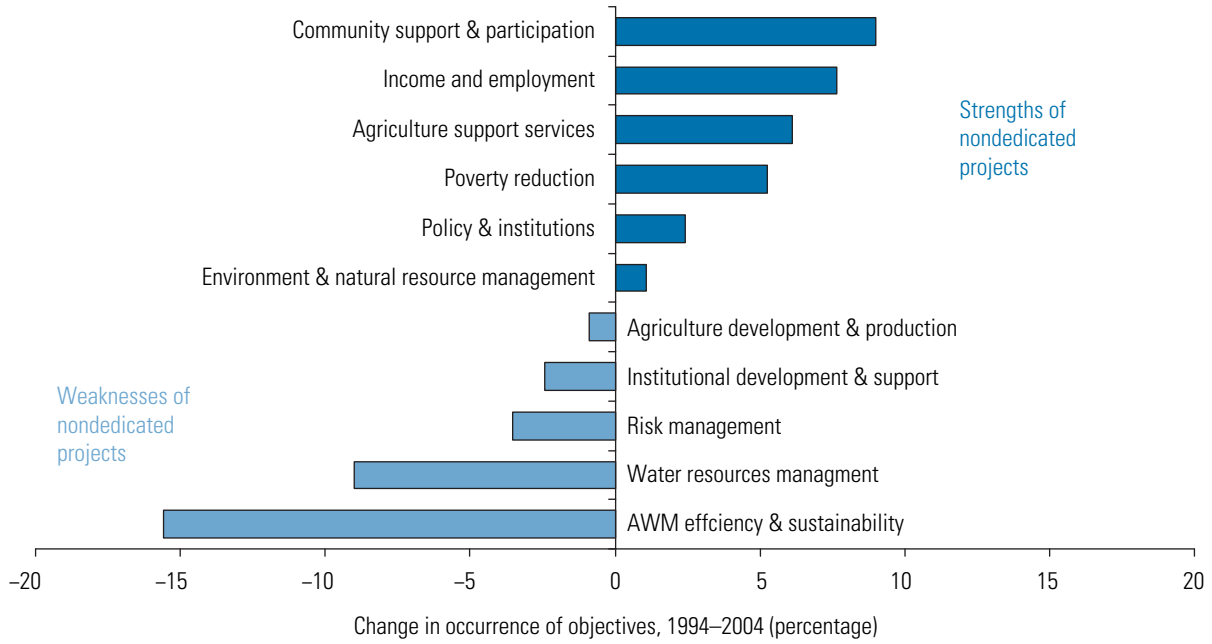


Source: IEG analysis of 161 PADs.

dedicated and nondedicated projects would improve to meet both technical and policy imperatives.

The few non–ARD projects distributed across seven departments preclude statistical analysis. However, the effect of this diversified responsibility on the outcomes and impacts of the agricultural water components outside ARD is generally difficult to discern in the Bank's implementation completion reports. This is because outcomes, if reported at all, are confined to the few key objectives that reflect the rationale for a project as articulated by the initiating Sector Board. Minor agricultural water components are, therefore, most frequently accounted for in terms of inputs and outputs

Figure 2.10. Comparison of Dedicated and Nondedicated Project Objectives Reveals Strengths and Weaknesses



Source: IEG analysis of 161 PADs. This analysis is based upon a comparison of all dedicated projects with all nondedicated projects designed in the period FY94–FY04. The occurrence of each objective in each cohort was expressed as a percentage of all objectives and the differences between the cohorts is plotted above. Thus, for example, AWM efficiency and sustainability was 4.6 percent for nondedicated projects and 20.2 percent for dedicated projects, and the difference was –16 percent.

such as the length of canal or drainage works, or number of wells installed. There is invariably no description of what these facilities achieved in terms of area irrigated or drained and the impact on crop production, rural incomes, or the environment.

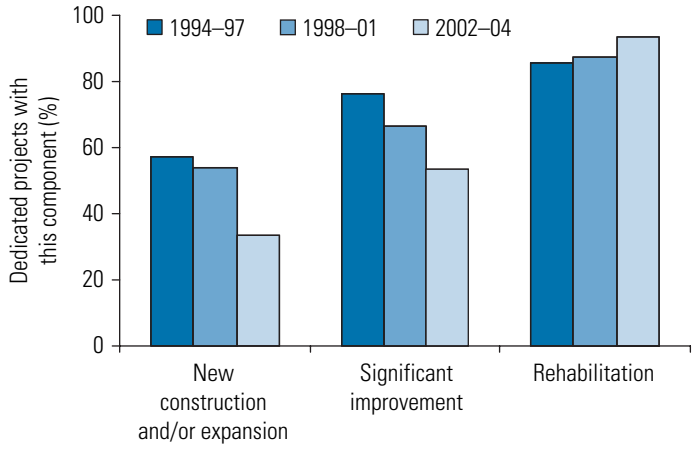
Less New Construction and Lower Costs

As overall lending for agriculture fell, the Bank's commitment to freestanding AWM projects dedicated to water management decreased. Since 1994, nondedicated projects have comprised 58 percent of the AWM portfolio.

The type of infrastructure components financed by dedicated and nondedicated projects are markedly different, even though most projects contain a mix of physical interventions ranging from some new-builds, redesign and upgrading, and repair of damage caused by deferred maintenance referred to as rehabilitation. Dedicated projects now prioritize rehabilitation of large irrigation systems or improvement of them, and by FY02–FY04 these accounted for more than 80 percent of Bank commitments in this group of projects (figure 2.11a). Examples include the 1996 Punjab Private Sector Groundwater Development Project that focused on transferring after rehabilitation some 4,200 public tubewells to farmer organizations, decreasing the leakage from all types of canals, and improving the efficiency of water distribution on communal and on-farm watercourses. In Mexico the 2002 On-Farm and Minor Irrigation Networks Improvement Project covered improvements to irrigation canals and drains, land leveling, and installation of new high-tech sprinkler, drip, and microsprinkler irrigation systems.

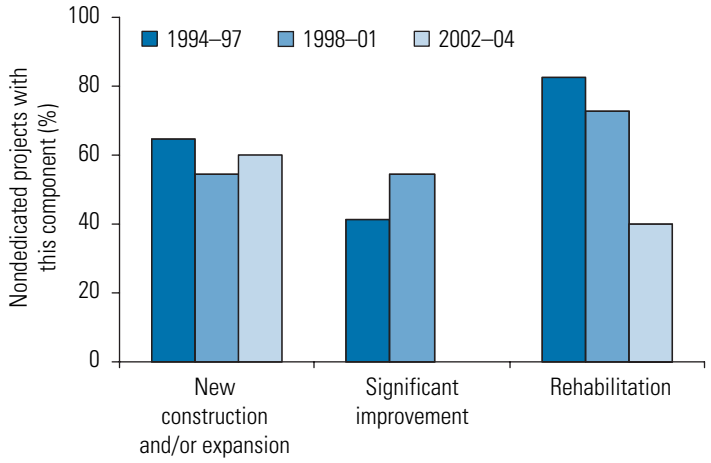
Nondedicated projects, while initially focusing on rehabilitation in the mid-1990s (figure 2.11b), now focus primarily on building new systems that are small scale and community owned. For

Figure 2.11a. Reduced New Construction and Improvement in Dedicated Projects



Source: IEG analysis of 161 PADs.

Figure 2.11b. Reduced Improvement and Rehabilitation in Nondedicated Projects



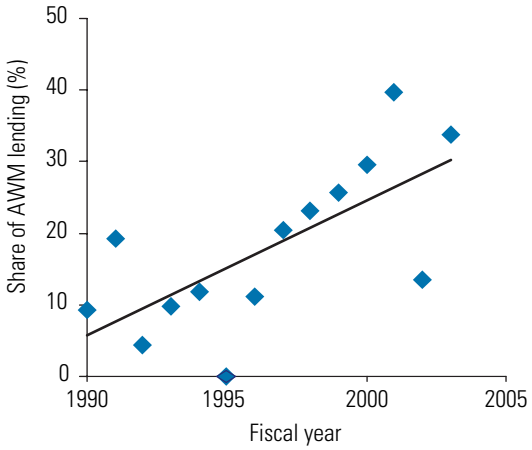
Source: IEG analysis of 161 PADs.

example, the 1995 Brazil Northeast Rural Poverty Alleviation Project—Ceara provided, via a CDD approach, $107 million for infrastructure. Of this, 77 percent was for basic infrastructure (water supply, drains, sewage disposal) and 22 percent was for "productive" investments, mainly irrigation that included, for example, irrigation kits to cover 0.8 hectare plots and sprinkler irrigation systems to irrigate 10 hectares areas of new lands. In Bolivia, the 1998 El Niño Emergency Assistance Project helped to repair 24 irrigation systems and to build a replacement system.

The average Bank commitment to AWM projects declined for two reasons: a change in the type of infrastructure financed, and the greater emphasis on nonstructural and capacity-building components discussed above. This trend reflects not only the needs of deferred O&M of infrastructure in the SAR and East Asia and Pacific (EAP) Region but also the growing importance of clients in the emerging economies of the ECA Region with similar problems. Because dedicated AWM projects became more focused on rehabilitation, the costs of these projects fell: rehabilitated projects averaged $2,900 per hectare while new construction averaged $6,600 per hectare. The increased focus on new construction in dedicated projects increased their share of commitments for AWM (figure 2.12). Even so, the overall commitment to dedicated projects fell much faster than the commitment to nondedicated projects grew and overall commitments to AWM declined (figure 2.13).

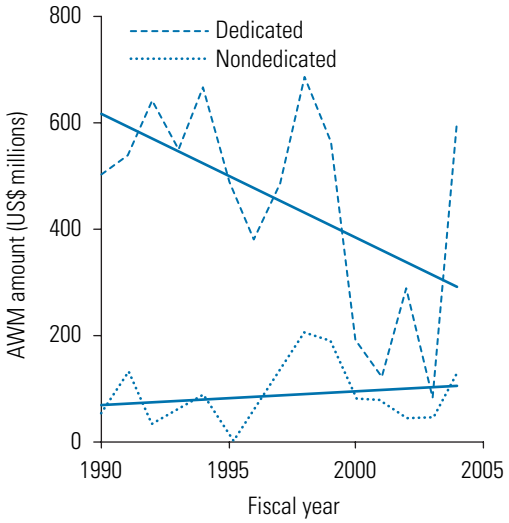
In the 1980s and early 1990s investment in AWM was also strongly supported by parallel investment in agriculture. This has now changed among the biggest borrowers (figure 2.14).

Figure 2.12. Share of Nondedicated Lending Increased



Source: IEG analysis of 161 PADs.

Figure 2.13. Overall Commitment Declined



Source: IEG analysis of 161 PADs.

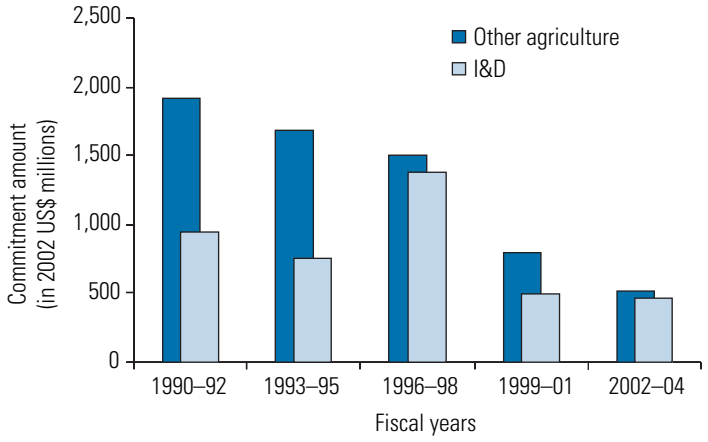
Policy Reform Has Languished

The Bank's water strategy gives considerable emphasis to the enabling environment. However, project appraisal documents make only modest proposals for policy reform and completion reports usually conclude that reform expectations at appraisal were unrealistic, particularly for cost recovery.[27] Does the lack of policy reform content reflect a lack of need, a lack of leverage, or a pragmatic decision to tackle this business outside the project, using other Bank vehicles? All three of these considerations played a role. Independent evaluations of attempts to reform agricultural policy have found that passing laws and developing regulations is easier than implementing them—and that attention to the detail of implementation is often slighted, typically because the time span of a single project is not long enough to come to grips with the toughest issues.[28]

Dedicated irrigation and drainage projects with policy content—large or small—only give it modest attention. For about 20 percent of the cases reviewed, policy was not addressed at all, either because it was no longer relevant or because it was being addressed outside the project.

Many of the appraisal documents implicitly assume either that policy reform is largely complete, or that it is beyond the project's scope—particularly where irrigation and drainage was only one of many components, or where the size of the investment was small relative to the norm for earlier periods. Yet, in many cases, important policy issues remain. For example, in Brazil the Bank's analysis shows that there is a need to increase the security and enforceability of water rights, introduce water charges that reflect the economic value of water, and clarify the roles and responsibilities of institutions.[29] These recommendations are valid for many of the Bank's clients, particularly in countries such as India, Jordan, and Mexico. In Madagascar, for example, the extremely poor performance of irrigation, despite decades of Bank support, caused a withdrawal from the sector in 2001. Yet, subsequent analysis has shown that most of the problems are the result of a distorted incentive structure for seeds and fertilizer, inadequate attention to agricultural extension and severance of its linkage to agricultural research, and inadequate transport infrastructure that precludes efficient markets (World Bank 2005a and Minten 2006). There is a danger in many countries that the Bank will scale back lending for irrigation before the policy reforms needed to get the balance right between public and private intervention are complete.

Figure 2.14. Other Agricultural Investment Declined Steeply among Large Borrowers



Source: World Bank data and IEG analysis.

Policy reforms need integration across the whole agricultural sector. The success of irrigation can adversely affect the welfare of rain-fed farms in developing countries.[30] Since the early 1960s, yield improvement was by far the largest factor, not just in the developed world but also in the developing countries, where it accounted for 70 percent of increased production. Thus, while irrigated farms increased output the most, many rain-fed and marginal farms also benefited. Unlike the irrigated farms in the developing world, however, rain-fed farms are generally not subsidized. Hence, while irrigated farms can increase (subsidized) production to maintain their incomes, rain-fed farms do not have that option but are subject to the price structure. Consequently, they have little option but to accept falling grain prices.

This paradox clearly indicates that a comprehensive approach—rather than an irrigation-led one—is required for agricultural development in developing countries. It also shows that if market-distorting subsidies for irrigation were removed, then irrigated farms would move out of competition with rain-fed farms and grow higher-value crops. Further inducements to rain-fed farms would also arise from the elimination of the high subsidies in developed countries. A good example of the analysis needed to get irrigation and subsidies right is provided by some of the Bank's recent economic and sector work for Morocco.[31]

Implications for Management

Within the more specialized AWM projects that have significant components devoted to irrigation, drainage, and flood control, the approach also has become more technically focused. This may not be an issue where AWM projects are part of a broader package of rural development projects that deal with social, human, and economic development, as is the case, for example, in Armenia (box 2.2).

However, the more general AWM projects—many of which embody CDD-type approaches—are building water infrastructure with less attention to issues of technical efficiency and sustainability. Independent evaluation of CDD approaches shows that this is a major problem—more than three-quarters of Bank task managers for these projects raised sustainability of project infrastructure as a major issue.[32] This is the classic decentralization dilemma: how to give power to local stakeholders while at the same time providing them with sufficient technical support.

These findings indicate the importance of integrating AWM projects within country rural strategies and ensuring that they are adequately

Box 2.2. Armenia: Creating Synergistic Packaging for AWM Lending

The first Irrigation Rehabilitation Project (FY95) in Armenia targeted decayed public sector infrastructure and focused on engineering and institutions. This was complemented by the FY06 Social Investment Fund that included modest support for small-scale irrigation. Subsequently, in FY99, the Dam Safety Project (and its second phase in FY04) secured bulk irrigation supplies, the Title Registration Project secured farmers' rights to land and thus collateral, while the Agricultural Reform Support Project aimed to improve rural finance, agro-processing, and agricultural institutions, including research and extension. The FY00 Judicial Reform Project aimed to improve governance and thus private commercial transactions. Two projects in FY02—the Irrigation Development Project, aimed at improving system efficiency, reducing operational costs, and enhancing the effectiveness of water user associations, and the Natural Resources Management and Poverty Reduction Project—targeted marginal farmers and those in mountain and hill areas. The FY04 Agricultural Reform Project Supplemental Credit provided critical support for commercial fruit growers. The FY06 Rural Enterprise and Small-Scale Commercial Agriculture Development Project supported the development of Armenia's small- and medium-scale rural businesses and the ability of farmers and rural entrepreneurs to access markets and by stimulating market-oriented private and public investments in rural areas.

supported by parallel operations that address critical omissions. Where the country lending window is small it is essential that projects address the most critical issues and include enabling actions that may lie outside the water or agricultural sector. Comprehensive appraisal that includes upstream and downstream linkages thus becomes vitally important, as does economic modeling and analysis. And improving the skills mix of appraisal teams preparing nondedicated AWM is also essential: irrigation engineers should be included on appraisal teams where water development or its management is part of a broader social package. Similarly, dedicated projects need social scientists, anthropologists, and rural financial specialists to address issues related to capacity building, incentives, and social sustainability.

Global Relevance Remains High

Agricultural water management to increase food production contributes toward meeting the Millennium Development Goals, provides basic food security needs for growing populations, and has important catalytic growth impacts on the rural economy. It is also vital to the conservation of increasingly stressed water resources.

Overview

This chapter summarizes the evidence and shows that AWM remains relevant to the Bank's development agenda.

Benefits of Good AWM Are Substantial

Sound AWM has the potential to boost growth and reduce poverty to benefit the poor in several ways. It is directly relevant to the Millennium Development Goals (table 3.1). Hazell and Haddad (2000) classify the direct and indirect ways that irrigation and other new water management technology can increase growth and reduce poverty:

- It can benefit poor farmers directly through an increase in their level of own-farm production. This may involve production of more food and nutrients for their own consumption, and increasing the output of marketed products for increased farm income.
- It can benefit small farmers and landless laborers through greater agricultural employment opportunities and higher wages within the adopting regions, and thereby increase migration opportunities for the poor to other agricultural regions.
- It can benefit a wide range of rural and urban poor through growth in the rural and urban nonfarm economy.
- It can lead to lower food prices for all consumers, rural or urban. Crop harvest from irrigated areas leads to strengthened staple or nonstaple food output. This abundant supply lowers the prices of staples and other food and thereby cuts the food bill of small farmers and the poor from the rural areas as well as that of the urban poor (Lipton, Litchfield, and Faures 2003). Irrigated land must, therefore, be supported in order to sustain low food prices (Carruthers, Rosegrant, and Seckler 1999).
- It can empower the poor by increasing their access to decision-making processes, increasing their capacity for collective action, and reducing their vulnerability to shocks via asset accumulation.

Table 3.1. Improving Agricultural Water Management Significantly Contributes to the Millennium Development Goals

Millennium goals		How water management contributes to achieving goals: Directly contributes	How water management contributes to achieving goals: Indirectly contributes
Poverty:	To halve by 2015 the proportion of the world's people whose income is less than $1/day	Assured water and its good management raise rural incomes Water as a factor of production in agriculture, industry, and other types of economic activity Investments in water infrastructure and services act as a catalyst for local and regional development	• Secondary employment in agro-processing and off-farm activities • Reduced vulnerability to water-related hazards reduces risks in investments and production • Reduced ecosystems degradation boosts local-level sustainable development • Improved health from better quality water increases productive capacities • Ensured ecosystems integrity to maintain water flows to food production • Reduced urban hunger by cheaper food grains from more-reliable water supplies
Hunger:	To halve by 2015 the proportion of the world's people who suffer from hunger	Improves food security by mitigating drought, flood, and drainage risks Water as direct input into irrigation, including supplementary irrigation, for expanded food production Reliable water for subsistence agriculture, home gardens, livestock, tree crops	• Improved school attendance from improved health and reduced water-carrying burdens, especially for girls • Community-based organizations for water management improve social capital of women • Reduced time and health burdens from improved water services lead to more balanced gender roles

Source: Soussan 2002.

In the remainder of this section, the evidence on irrigation impacts on production, impact, and poverty is reviewed. In undertaking the review, IEG acknowledges the contribution of previous reviews, including Bhattarai (2004) and Heyd (2004).

Irrigation Impact on Production, Income, and Poverty

Rapid agricultural and economic growth, together with direct social spending and appropriate social policies, is essential for poverty reduction in developing countries. According to De Haan and Lipton (1998) economic growth explains between one-third and one-half of poverty reduction in Asia. Their report, based on a summary of various studies on developing Asia, found that a 1 percent growth in per capita GDP is associated with a decline in the incidence of poverty of 0.82 percent. Analysis at both the macro and sectoral levels and at the microirrigation or farm levels showed that irrigation has significant impacts on crop production, farm income, and poverty. At the macro level, Fan, Hazell, and Thorat (1999); Fan and Hazell (2000); and Fan, Zhang, and Zhang (2002) found that irrigation investment has significant effects in increasing crop production and reducing poverty, but that the impact of irrigation is lower than that of rural roads and agricultural research.

Other studies have shown much stronger impacts of irrigation on crop productivity and poverty alleviation. Datt and Ravallion (1997) found that differences in the growth rate of average agricultural output per unit of crop area were important in explaining cross-state differences in rural poverty reduction between 1958 and 1994. The initial endowments of physical

infrastructure and human resources played a major role in explaining the trends in rural poverty reduction. Higher initial irrigation intensity, higher literacy rates, and lower initial infant mortality all contributed to higher long-term rates of poverty reduction in rural areas. Bhattarai (2004), in an econometric analysis using state-level data for India, 1970–94, showed that rural literacy, followed by irrigation, had higher impacts on agricultural productivity than other input factors, including fertilizer, modern crop varieties, and road density. The impact of irrigation on reducing poverty was even higher than that of rural literacy and significantly higher than roads, fertilizer, and modern varieties. The marginal impact of groundwater sources of irrigation on spatial and temporal reduction of the rural poverty level in India was, in general, higher than that of the canal irrigation.

Barker et al. (2004) investigated the different investment variables that contribute to output growth in Vietnam. Based on their results, investment in irrigation ranked the highest in explained share of total agricultural output growth, at 28 percent from 1991 to 1999, followed by research and development at 27 percent, and road improvement at 11 percent. Pardey et al. (1992) studied the socioeconomic effects of past investments in rice and soybeans in Indonesia. They argued that investment in technology alone did not affect yield and output growth, but substantial increases in fertilizer application, pesticide use, and irrigation services have contributed significantly to gains in total production. Rosegrant, Kasryno, and Perez (1998) found that irrigation investment explained 29 percent of rice production growth in 1969–90, as well as 11 percent of maize production growth, 35 percent of cassava production growth, and 7 percent of soybean production growth.

At the micro level, a number of studies have established that irrigation increases crop yield per hectare per season, land-use intensity, and cropping intensity, leading to increased land productivity (gross crop outputs per unit of land per year) that in turn helps improve farm income (Dhawan 1988, 1999; Vaidynathan et al. 1994). As revenue increases, the purchasing power of rural farmers is positively affected, enabling them to procure a wide variety of food. In effect, a balanced food diet with adequate intake of micronutrients is assured for the farmers' families (Lipton, Litchfield, and Faures 2003). In Bangladesh and India, farmers cultivate three rice varieties (boro, aman, and aus) per year in irrigated areas, in contrast to only one rice crop for rain-fed agriculture. This practice of crop diversification offers substantially higher crop productivity and helps increase returns to farmers' land and labor resources at the household level (Dahawan and Datta 1992; Hussain and Hanjra 2004a, 2004b).

Impact on Employment and Wages

Improved access to irrigation generates both direct and indirect employment in the rural economy. While direct employment is generated by the construction and maintenance of irrigation projects, more importantly, indirect employment is generated through enhanced land-use intensity, cropping intensity and productivity, as well as its multiplier effects in allied activities like livestock and rural nonfarm sectors (Patel 1981; Dhawan 1988; Saleth 1997). Patel (1981) found that the average additional employment generated per hectare per annum of farming in those 10 irrigated-system-level studies in Gujarat was 50 person-days per hectare per year. Another analysis showed that in Gujarat, while the nonirrigated farms used only 484 hours of total labor per gross cropped area, canal-irrigated farms used 729 hours, well-irrigated farms used 835 hours, and conjunctive use of groundwater- and canal-irrigated farms used 1,456 hours (Bhattarai 2004).

The most effective way to tackle poverty may be to marry irrigation with other complementary investments. A modeling exercise for Ethiopia found that the impact on poverty of combined investment in irrigation and roads was substantially greater than investment either in irrigation or in roads alone.[2] In Bangladesh and Nepal it has been found that benefits from investments in roads or in new inputs are higher when land

is irrigated (Brabben et al. 2004). Detailed surveys in Madagascar found agricultural yields and access to essential inputs to be lower and the incidence of poverty higher the farther a village is located from a good, public, all-weather road (Minten 2006). In summary, it is the "package" that matters for effective poverty alleviation and not the mere supply of irrigation water; and "investments in irrigation sectors may not reduce poverty directly in any significant way unless accompanied by other complementary [*public*] interventions" (Hassain and Hanjra 2004). There are, however, many complementary *private* investments that will be stimulated through markets after the initial irrigation and other public investments have been made. The skill of good economic and sector work feeding into project appraisal is determining what the minimal public investment should be and avoiding projects that try to deliver everything and fail.

Impact on the Nonfarm Economy

Agricultural growth—and the irrigation investments that contribute to it—has significant impacts on the rural nonfarm economy as well. Agriculture can influence nonfarm activity in at least three ways: through production, consumption, and labor market linkages. On the production side, a growing agriculture sector requires inputs (fertilizer, seeds, pesticides, pumps, sprayers, machinery repair services) that are either produced or distributed by nonfarm firms. Moreover, increased agricultural output stimulates forward production linkages by providing raw materials that require milling, processing, and distribution by nonfarm firms. Consumption linkages arise when growing farm incomes boost demand for a range of consumer goods and services. Demand increases as rising per capita incomes induce diversification of consumption into nonfood goods and services, many of which are provided by local firms (Rosegrant and Hazell 2000).

Numerous empirical studies consistently show that agricultural growth does, in fact, generate important income and employment multipliers within the surrounding nonfarm economy. The multipliers are particularly large in Asia—between 1.5 and 2.0. That is, each dollar increase in agricultural value generated by irrigation or other investments or new technology leads to an additional $0.5 to $1.0 of additional income created in the local nonfarm economy (Hazell and Ramasamy 1988; Haggblade and Hazell 1989). The multipliers are about half as large in Africa and Latin America (Haggblade and Hazell 1989; Dorosh, Haggblade, and Hazell 1998). Lower multipliers in Africa are attributable to low per capita incomes, poor infrastructure, and farming technologies that require few purchased inputs (Dorosh, Haggblade, and Hazell 1998). In a comprehensive review of growth linkages, Haggblade and Hazell (1989) found that the strength of growth linkages is higher in labor-abundant regions, and increases with regional development and per capita incomes. In particular, irrigated regions dominated by medium-sized farms and modern input-intensive farming systems generate the largest multipliers. The multipliers are smaller in rain-fed farming systems and in regions dominated by very small farms or by large estates.

Relatively few studies have estimated the multiplier effects of investment in irrigation on the nonfarm economy, but those that have done so have confirmed such multiplier effects. In a comprehensive study of the Muda Dam in Malaysia, Bell, Hazell, and Slade (1982) found that for every one dollar of value-added generated directly by the dam, another 83 cents were generated in the form of indirect or downstream effects, resulting in a multiplier of 1.83. Bhattarai, Narayanmoorthy, and Barker (2002), analyzing a panel of state-level Indian data, found that the direct and indirect income benefits of irrigation investment exceeded the direct benefits to the farming community by more than 3 to 1. An ex-post analysis (Olsen 1996) of the Grand Coulee Dam and the Columbia Basin Project showed that investments made in the basic sectors generated between 1.5 to 1.7 dollars of total income within

the local area for each dollar produced by the basic sectors.

Irrigation also has substantial indirect impacts on nonfarm employment. The employment growth multipliers are predominantly driven by increased rural household demands for consumer goods and services as farm incomes rise, many of which are supplied by small, informal, and labor-intensive rural nonfarm firms. This leads to high nonfarm employment elasticity within rural regions; each 1 percent increase in agricultural output is often associated with a 1 percent increase in rural nonfarm employment (Gibb 1974; Hazell and Haggblade 1991). Mellor (2001) indicates that the additions to employment in the rural nonfarm sector stimulated by agricultural growth can be as much as twice that for the agriculture sector. In a study of rural nonfarm employment in 114 Indian villages in different states, it was found that the nonfarm employment is determined by the extent of irrigation. Similarly, using village-level census data of Tamil Nadu, Jayaraj (1992) showed that irrigation is a major variable in explaining the magnitude of rural nonfarm employment. In a survey of canal-irrigated and rain-fed farming villages in Tamil Nadu, India, Saleth (1995) estimated that nonfarm employment is about 46 person-days per hectare higher in canal-irrigated villages than in rain-fed villages.

Impact on Food Prices and Diet Quality

Technological change, including the spread of irrigation, contributes to increases in the aggregate output of affected commodities and often to lower unit costs. This has proved to be one of the most important ways through which poor people have benefited from technological changes in agriculture (Scobie and Posada 1978; Rosegrant and Hazell 2000; Fan, Hazell, and Thorat 1999).

If the national demand for these products is downward sloping (that is, export opportunities are constrained by trade policy or by high transport costs), then the output price will fall. The price decline will be greater the more elastic the supply is, relative to demand (Alston, Norton, and Pardey 1995). Lower food prices are of benefit to rural and urban poor alike, and because food typically accounts for a very large share of their total expenditure, the poor gain proportionally more than the nonpoor from a decline in food prices (Pinstrup-Andersen and Hazell 1985). These price effects may be muted in open economies with low transport costs, and more countries now fall into this category than before because of recent rounds of market liberalization policies. But many poor countries still face high transport costs because of poor infrastructure, remoteness from world markets, or inefficient marketing institutions, and may still face considerable domestic price determination even after market liberalization. In many landlocked African countries, for example, domestic prices still fall sharply when domestic food production increases suddenly. Many traditional food crops are also not traded in world markets, and hence their prices also continue to be determined within the countries that grow them.

Technological changes that smooth seasonal food supplies (such as irrigation and short-season rice varieties) can also help smooth seasonal price variations and this can be of considerable benefit to the poor. The rural poor may also obtain enhanced food security from increased production within their region if it displaces food purchases from outside the region that previously had to be priced to cover high transport costs.

Impact on Empowerment of the Poor

Hazell and Haddad (2000) have pointed out that "the assets which individuals, households, and communities control are critical for the capacity to cope with vulnerability and to establish secure livelihoods. In many developing countries, the poor are highly dependent on natural resources within their local environments; hence poverty can be exacerbated by not having access to those resources. The cycle can be perpetuated by not having access to technologies and inputs in order to be better

able to use those resources, or by not being able to participate in the design and evaluation of those technologies." Irrigation is one of the key assets that empowers farmers (see box 3.1).

Demand for Food and Better AWM

The FAO predicts that a projected world population of 8.2 billion in 2030 will drive a new round of investment in irrigation and drainage, albeit at

Box 3.1. Effects of New Irrigation in India's Andrah Pradesh Area, 2005–06

The income benefits from irrigation accrue in the form of higher net income for cultivating households and higher wage income and increased employment. The evaluation found that irrigation increased net farm income by just over 60 percent, about half of which comes from increased cropping intensity and most of the remainder from higher yields, with only a small part attributable to changes in the crop mix (figures A and B).

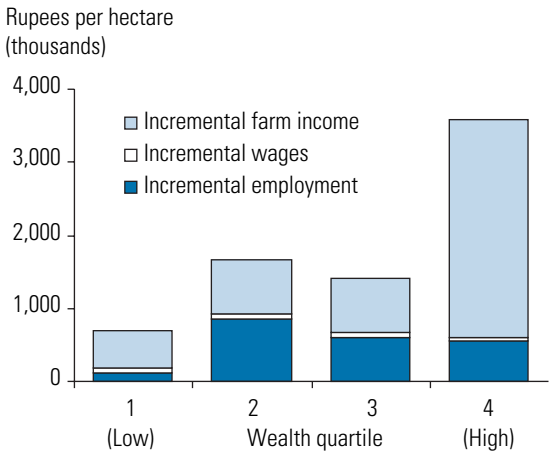
However, irrigation has a very modest positive impact on income distribution. The top quartile benefits most in absolute terms, the second quartile benefits most in relative terms, experiencing income growth of 30 percent. The poorest quartile has a low benefit, but their already low income means that they also experience income growth of 20 percent, compared with 19 percent for the top two quartiles.

Dynamic effects also have an impact in distribution. Households subject to repeated negative shocks become heavily indebted and deplete their assets, constraining their ability to undertake productive investments. Reducing the impact of bad years thus aids asset accumulation and helps households grow out of poverty. Because of prolonged drought in the Andrah Pradesh project area, many more households had zero or negative income in 2005 than in 2006 when irrigation became available. As a result, the bottom 10 percent of households in 2005 got 20 percent of the farm income in 2006. So, while the impact of irrigation in a good or normal year has a modest impact on the income distribution, in drought years there is an extreme worsening in income inequality as many farmers experience negative income. The presence of irrigation can mute this effect.

With the good rains improving agricultural performance in 2006, combined with new irrigation, there was greater labor demand, particularly for women. Each household supplied, on average, 223 days of agricultural labor in 2006 compared with 155 in 2005. The increase in demand for labor led to an increase in average wages of 5 percent for men, and 10 percent for women because of the high demand for female labor to weed and harvest paddies. In the IEG survey, women accounted for 63 percent of agricultural employment in 2005 and 64 percent in 2006. There is a considerable body of evidence that women's incomes have a larger impact on child welfare (health and education) than do men's incomes.

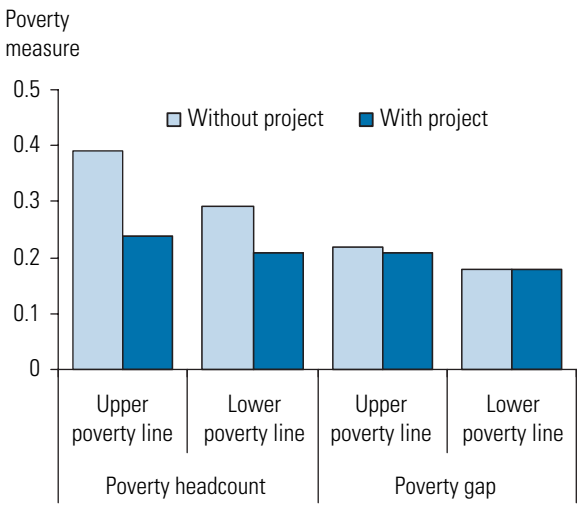
Source: IEG 2006a.

Figure A. Distribution of Incremental Irrigation Benefits Is Skewed toward the Better Off



Source: IEG data.

Figure B. Irrigation Reduces Poverty Headcount but Not the Poverty Gap



half the average rate of the preceding four decades. If the historic supply response will hold in the future as it has in the past, the FAO projects that 80 percent of future increases in food production will come from intensification through higher yields, increased multiple cropping, and shorter fallow periods—and much of this is possible in rain-fed areas without irrigation. The balance of new arable land will come from developing countries (especially those in Sub-Saharan Africa and Latin America), which have the potential to add about 120 million hectares of new arable land.

The expansion of irrigation—40 million hectares, or about 1.3 million hectares a year until 2030—is projected to be strongest in South Asia, East Asia, and the Middle East and North Africa regions, where almost all arable land potential is used. Harvested irrigated area, subject to multiple cropping, is likely to increase by a third by 2030, or 83 million hectares, provided water is available.

Better Management of Limited Water Resources

Achieving these projections for expanded irrigation will be difficult. Irrigated environments face increased competition for water but also reduced water supplies owing to system degradation and reduced investments in infrastructure development to store and distribute water. Globally, water is becoming an increasingly scarce commodity—one-quarter of the developing world's population will face severe water scarcity in the next 25 years (Seckler, Molden, and Barker 1998). The net effect will be increasing real costs of water at the farm level and declining profitability of irrigated agriculture, taking into account all maintenance and environmental costs.

Box 3.2. Yemen: Evolution of an Integrated Water Resources Management Strategy

Groundwater is Yemen's only significant year-round source of water. Until recently, despite a large water-sector lending program, the Bank paid minimal attention to water resources management in Yemen. The lacuna in recognizing the growing water crisis over some 30 years of Bank lending is linked to a virtual absence of strategic analysis and sector work in Yemen's water sector until the 2000s. Urban water supply and rural irrigation projects proceeded without linkages between them, and out of 28 water projects approved since lending to the water sector began in FY73, only one project—the Land and Water Conservation Project (FY92)—focused on water conservation. Because withdrawal is greater than replenishment from rainfall, groundwater levels continue to decline—in heavily populated areas by as much as 6 meters per year. And mining of water from the deep aquifers, where water is not renewable, is increasingly practiced. Despite this, groundwater management was neglected. Instead, supply-side infrastructure projects continued, without consideration of ways to better manage the groundwater resource. The following lessons can be drawn from the experience:

- Where groundwater is a state's major resource its sustainable management should be the highest priority.
- Technological, managerial, and institutional improvements to increase water conservation of all water-using sectors are essential.
- To manage costs and sustain supplies, urban water projects need to give water resource management a higher priority.
- Link urban and rural water use through integration of planning and management. It is inevitable that rural-urban water transfer will be needed in the future as urban populations quickly grow.
- Equitable water markets need to be developed.

Fortunately, the problems have been increasingly recognized by the Bank. A sector strategy has been prepared, and several recent projects are starting to tackle water depletion head-on, for example, the Sana'a Basin Water Management Project (FY03) and the Groundwater and Soil Conservation Project (FY04).

Source: IEG 2006b. PPARs of one rural and two urban water projects in Yemen. In less detail, the review also considered the overall water-sector program in Yemen. IEG's draft Yemen CAE has also discussed the water crisis.

In the Middle East and North Africa, for example, a large proportion of irrigation is based on groundwater resources and most of these are all fully exploited. Additional dams to provide storage for the unreliable rains is likely to be controversial and expensive, and better agricultural water demand management is clearly a solution (box 3.2).

In China there is a water crisis in the eastern third of the country: groundwater levels are declining (at half a meter a year) and surface and ground water are being allocated by both deliberative policies and unregulated appropriation—the implicit values in different uses being far removed from economic realities. The value of water for municipal and domestic use is a multiple of 10 to 40 times its value to agriculture.[3]

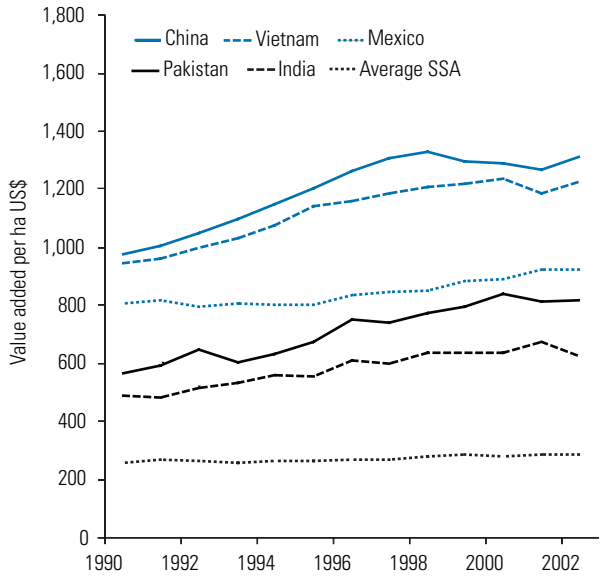
In India, almost all readily available surface water is allocated and almost three-quarters of its groundwater is fully utilized. And four of the biggest irrigation states—Haryana, Punjab, Rajasthan, and Uttar Pradesh—are mining groundwater resources, a situation encouraged by the huge subsidies for electricity supplied to agriculture. Yet, 13 million hectares within India's 388 irrigation projects do not yet receive water because of incomplete infrastructure.[4]

Uneven Policy Reform Retards Agricultural Productivity

A comparison of the growth in value added by agriculture indicates that the Bank's biggest borrowers for AWM appear to have run out of steam and that agricultural growth is slowing. In contrast, other borrowers have grown consistently and more quickly (figures 3.1a and 3.1b.). The economies where growth slowed shared several common characteristics: high levels of public intervention, highly regulated or inefficient agricultural markets, few incentives for private sector development, poorly targeted provision of public goods and subsidies, and inefficient inputs including water use.

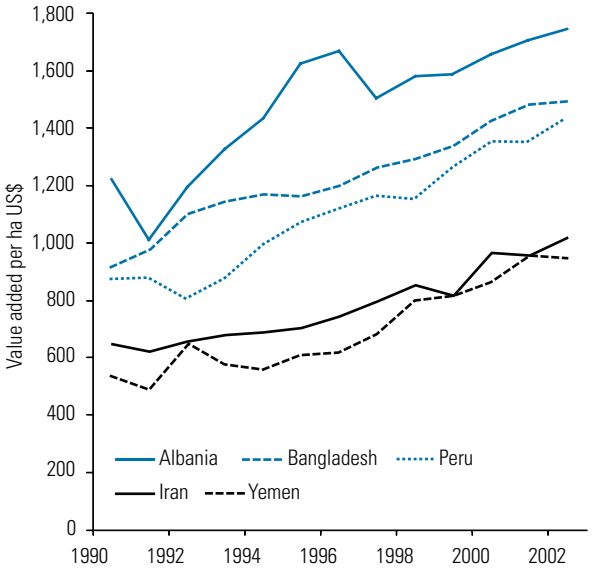
Agricultural reforms in China spurred productivity, rural incomes rose 15 percent a year between 1978 and 1984, and the share of the population

Figure 3.1a. Declining Agricultural Value Added Is Faltering in Some Countries and Regions



Source: World Bank, Statistical Information Management and Analysis data.

Figure 3.1b. But Is Growing Apace in Others



Source: World Bank, Statistical Information Management and Analysis data.

in rural poverty declined from a third to 11 percent (IFPRI 2005). This was the result of the rural nonfarm sector that developed to meet the growing demand from better-off farmers and to provide employment for surplus agricultural labor.[5] In turn, the rural nonfarm economy stimulated growth in the urban sector, which has been the main engine up to the present. Even though agricultural diversification grew substantially, the slowdown in agricultural value added since the late 1980s has been largely the result of state dominance in procurement of food grains, which remains the principal crop sector. There is still too high a reliance on collectively owned township and village enterprises, inadequate finance for the private sector and small farmers, and restrictions on farm inputs which slow farmers' response to market forces (IEG 2005). Among the key interventions identified were a move away from production-based projects toward projects that would raise returns to labor, increase resource use efficiency, and help solve market failures in rural China. Specifically, these include the provision of public goods in relation to water management, environmental sustainability, and agricultural research.

In India, minimum support prices and input subsidies for agriculture, intended to support technological innovation and growth, instead became inefficient income-support interventions (IFPRI 2005). Agribusiness and private sector initiatives are hampered by outmoded regulations on trade in essential commodities, lack of rural electricity that adversely affects agro-processing and related industry, and policies aimed at protecting rural employment. Consequently, incentives to increase crop diversification and output are weak. This, allied with inefficient water management, groundwater overextraction, and slow diffusion of research, has slowed the growth of agriculture. The Indian government has recently realized that its neglect of the agriculture sector is affecting aggregate GDP growth and has, since 2005, embarked on a new agricultural strategy that involves substantial public investment, particularly in irrigation, improved agricultural water management, and a focus on rain-fed agriculture.[6]

Similarly, despite the big push for agricultural sector reform in Mexico in the 1980s and early 1990s, sustained growth in agricultural value added seems elusive. Between 1979–81 and 2000–02, value added per worker grew by 22 percent compared with 59 percent for Latin America as a whole. A primary reason is that the rural workforce is comprised not of market-oriented producers, but of semi-subsistence producers, combining income from production for their own consumption with casual wage earnings, remittances from migrant relatives, and government transfers.[7] These problems reflect the weakness in the incentive environment and the absence of institutions needed to generate and disseminate improved farm technologies, including AWM.

The countries where agricultural growth has occurred have a number of characteristics in common. All have adopted substantial reforms that have empowered farmers and water user groups, made determined efforts to increase agricultural water use efficiency, get farmers involved in paying for agricultural inputs—particularly for O&M—and have liberalized agricultural policy, and improved markets and access to credit. At the same time, these countries continued to develop and support all other sectors of the economy—in contrast to the partial approach in the poorer performing countries. The main lesson, therefore, is that reform has to be evenly balanced across the economy—adopting a stop-start approach does not provide the right signals for farmers to perform and for the private sector to become involved. Most of the sustained growth in Bangladesh, for example, has been the result of private tubewell development and market liberalization assisted by better information, a partial result of the Grameen Bank's microcredit for village cellular phones.

There are clearly huge institutional and policy issues related to rural development, agricultural water use, and groundwater that remain unresolved. Not only do they threaten agricultural productivity but they also have profound implications for potable water supplies and for

equitable sharing of scarce water supplies between rural and urban areas and for environmental management. The Bank has a strong comparative advantage in this multifaceted arena—natural resources management, agriculture, power, and trade—and thus more support for policy, sector, and analytical work by the Bank is highly relevant.

Current Evaluation Captures Only Partial Impacts

Agricultural water management produces impacts that are highly relevant to the Bank's development objectives. Despite this, reporting of the results tends to focus primarily on the physical achievements and infrequently describes higher-level impacts on poverty, employment, welfare, and to the rural economy as a whole. The next two chapters discuss why this has occurred.

Outcomes Need Improved Reporting

The previous chapters showed that lending for water infrastructure and institutions has become more closely aligned with the Bank's rural strategy and poverty alleviation objectives. Therefore, the relevance of AWM for rural development is high.

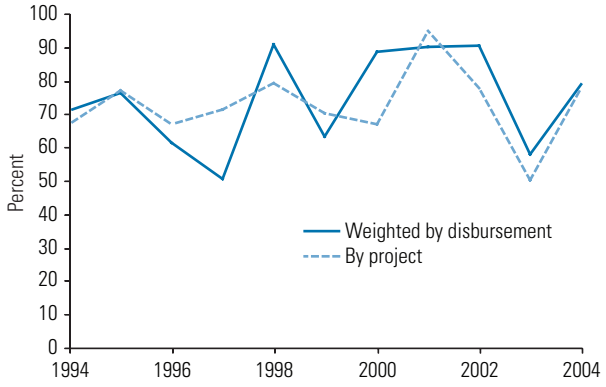
Overview

Evaluation of outcomes discussed in this chapter show that there is insufficient attention to monitoring and evaluation (M&E) of outcomes and impacts. Robust results relevant to the Bank's mission are lacking. The present level of M&E fails to provide adequate information to inform Bank management of progress toward strategic objectives—particularly poverty alleviation and the Millennium Development Goals—and needs to be overhauled. Economic appraisal needs to go beyond the project and indicate value added to the sector and economy as a whole—not only the direct impact of infrastructure improvements but also of institutional reform and capacity building. Much greater attention to indicators and evaluative frameworks is needed to unambiguously determine and attribute the development impacts of Bank lending. Better demonstration of the positive impacts on growth and poverty alleviation of rural development and AWM would also strengthen the sector's case for an increased budget for economic and sector work and lending preparation.

Outcome and Performance Ratings

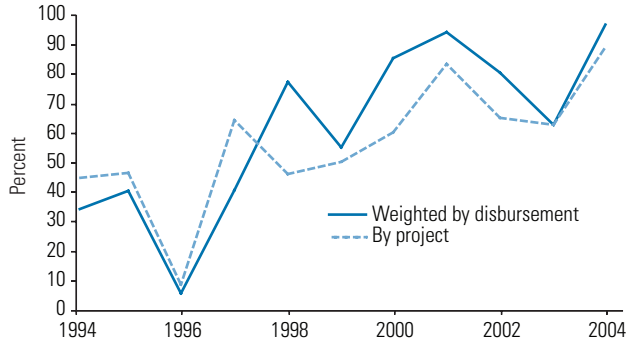
Between 1997 and 2000 annual average IEG outcome ratings for AWM projects were marginally better than the Bank as a whole but dropped by over 30 percent in 2002–03 (as lending to the subsector reached its all-time low), before recovering in 2004 (figure 4.1). Overall, 74 percent of AWM projects had satisfactory outcomes. Given that most agricultural water

Figure 4.1. Outcomes: Satisfactory Ratings



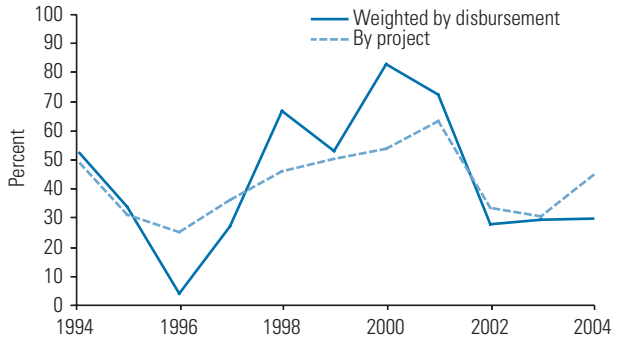
Source: IEG project database.

Figure 4.2. Sustainability: Likely and Highly Likely Ratings



Source: IEG project database.

Figure 4.3. Institutional Development: Substantial Ratings



Source: IEG database.

projects have a life of seven years, these outcomes reflect project design between 1987 and 1997 and the effect of subsequent supervision. In comparison with the Bank's *Strategic Compact* target of 75 percent, satisfactory outcomes were achieved in half of the years.

Sustainability

The overall average percentage for the period FY94–04 had 56 percent rated "likely" or better, which is still quite low with respect to the Bank average of 60 percent. However, the average hides a significant upward trend from among the lowest levels in the Bank to a level of 90 percent in FY04 (see figure 4.2). This is higher than the rural strategy target of 60 percent and better than the Bank as a whole.

Institutional Development

Although the overall AWM average of 43 percent is slightly higher than the Bank average of 41 percent, it is still lower than *Reaching the Rural Poor*'s target of 50 percent. As with sustainability, exit ratings declined dramatically after FY00 (see figure 4.3), which suggests the factors responsible for the decline in performance were sown by the lack of attention to institutional development and support in the early to mid-1990s and its narrow focus.[1] Although this project design problem was rectified after 1997, these projects have not yet been completed.

Performance by Bank Region

The ECA and Latin America and the Caribbean (LAC) Regions have performed best with respect to outcomes, sustainability, and institutional development, and the SAR and Africa (AFR) Regions have performed the worst (figure 4.4). Since 1994, MNA has had the greatest improvement in outcome ratings. ECA exhibited a strong outcome rating cohort in the FY94–FY98 exits, perhaps reflecting the spurt of political and land ownership changes that took place in the region in the early 1990s. In marked contrast, project performance in AFR has continually declined.

Less than Satisfactory Performance Ratings

The majority of projects that perform poorly primarily do so because of institutional problems. These may affect the government's ability to efficiently implement projects or establish viable mechanisms to sustain them. Most instances indicate the need for more thorough appraisal and less institutionally ambitious projects given the long time needed to change attitudes and bring about reform. A review of 75 IEG evaluation summaries since 1998 shows that the following factors accounted for most cases of modest institutional development:

- Poor coordination among implementing agencies;
- Lack of capacity within the main implementing agency;

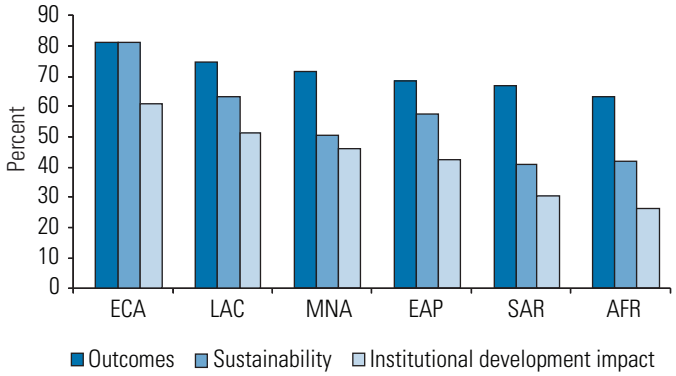
- Insufficient buy-in to sector reform and reorganization;
- Neglect of complementary agricultural services, credit, marketing, and diversification; and
- Weak commitment to cost recovery and/or user participation in system management and operation.

The Colombia Small-Scale Irrigation Project, for example, attempted to scale up the experience of an earlier project before the implementing agency's capacity was strengthened. As a result, the agency was ill equipped for agricultural and community organization and there was little extension support for crop diversification and essential marketing. Conversely, Mali's Irrigation Promotion Project failed because civil servants saw the introduction of the private sector as too risky and were unwilling to delegate the task to more knowledgeable nongovernmental organizations. In Uruguay's Natural Resource Management and Irrigation Development Project the main implementing agency could not harmonize the approach of several different government agencies primarily because the scope of the project was not matched to agency capacity. Similar problems affected Nepal's Second Mahakhali Irrigation Project and Indonesia's Provincial Irrigated Agricultural Development Project. In view of these lessons the current trend to smaller projects is highly appropriate. Box 4.1 summarizes many of the key lessons from completed projects.

What Benefits Were Expected for Bank AWM?

The 161 agricultural water projects were designed to improve national and local institutions, build capacity, and directly benefit up to 12 million households and more than 60 million people during the period 1994–2004. About 54 million people, comprising 9 million households, are expected to benefit directly from the dedicated projects and a further 7 to 18 million people in nondedicated projects. Thus, the total number of direct beneficiaries could be between 61 and 72 million.[2]

Figure 4.4. Performance Comparisons, by Region



Source: IEG project database.

Note: Percentage of regional project outcomes rated satisfactory, sustainability rated as likely, and institutional development impact rated as substantial.

The average dedicated project was designed to serve slightly more than 150,000 farm households, mostly defined as small family farms. Only a few projects also targeted medium or large family farms.[3] Projects ranged from big projects that aimed to serve over 400,000 families, such as Pakistan's Punjab Private Sector Groundwater Development Project (1997) and Egypt's Third Pumping Stations Rehabilitation Project (1999), to very small projects that aimed to serve less than 10,000 farm families, such as those in Yemen's Groundwater and Soil Conservation Project (2004) or the Dominican Republic's Irrigated Land and Watershed Project (1995). Nondedicated projects, which are generally assumed to be quite small, were each expected to benefit, on average, nearly 120,000 households—only a small proportion of which would benefit from agricultural water development or management.

The average area that was planned to be irrigated was around 400,000 hectares per project.[4] Omitting the four huge projects designed to benefit an area larger than one million hectares (such as Pakistan's National Drainage Project) drops the average to about 190,000 hectares, with quite a bit of variation across and within the time periods. Consistent with findings related to the project's financial

Box 4.1. Main Project Lessons

Project Design

- *Institutional reform and policy sequencing are important; do not overstretch weak institutions.* The 1995 Niger Pilot Private Irrigation Project could not handle the reforms for this reason, while overly optimistic assumptions about reforming deep-seated institutional problems undermined the effectiveness of the 1999 Armenia Third Sector Adjustment Credit.
- *Design poverty-targeting mechanisms* that are simple, verifiable, transparent, and minimize political interference.
- *Look for commercial opportunity*, agro-processing links, product quality, and certification. Although the 1994 Uruguay Natural Resources Management and Irrigation Project supported links to product markets, marketing in low-value products became an issue.
- *Where appropriate, adopt a basin approach* that addresses water allocation, and integrate higher-level government reform with farmer-level institutional reform. The 1994 Indonesia Java Irrigation Improvement Project showed strong performance on basin planning but still had weaknesses in overall integration.
- *Agree on a plan for supporting services such as extension, credit, and marketing*. The 1997 Nepal Irrigation Sector Project showed the risk of relying on a separate initiative to deliver improved services; while in the 1995 Vietnam Irrigation Rehabilitation Project, the support activities started too late.

Implementation

- *Public awareness programs* are important before major system changes. In several Pakistan projects, this was a case of "too little too late." In the Sri Lanka Mahaweli Project a series of awareness workshops for stakeholders contributed to the reform program.
- *Train stakeholders in new participation concepts*. There was weak understanding of what "microcatchment" management and "participatory planning" meant to stakeholders of the 1997 Peru Sierra Natural Resources Management and Poverty Alleviation Project.
- *Operational manuals should be completed* before loan approval so that all staff understand what is expected and to uncover any flaws in design. The absence of operational guidelines for the 1996 Indonesia Nusu Tenggara Agricultural Area Development project resulted in poor first-half performance.
- *Give more attention to modernization and the construction quality of irrigation and drainage works*—this was a problem in the 1996 Indonesia Village Infrastructure for Java Project.

Institutional Issues

- *Keep institutional issues high on the agenda* and do not allow them to be crowded out by investment in civil works as occurred in the Peru Sierra Natural Resources Management and Poverty Project.
- *Develop an institutional development road map* and detail steps that are important in order to define relationships and the input of stakeholder institutions (a lesson from the Indonesia Java Irrigation Project). Clearly spell out institutional responsibilities (as in the Mexico On-farm & Minor Irrigation Networks Improvement Project).
- *Get the balance between public and private focus right and, if necessary, improve both*. Improved performance of community organizations is frequently constrained by mistrust of government agencies. Government unwillingness to accept enabling private sector development frequently slows down market-driven demand—this was insufficiently addressed in Albania.
- *Make allowances in design for the managerial weakness* of community organizations (the 1997 Mali Pilot Private Irrigation Promotion Project had problems in this area). Social mobilization and "after-care" is important for sustainability of water users associations, as demonstrated in the 1997 Pakistan Punjab Private Sector Groundwater Development Project.
- *Adapt to cultural constraints and work with local leaders on gender issues.* Do not forget to give this continuous attention during supervision.
- *The rationale for water charges* needs to be transparent to farmers—clearly identify the incentives. When it is not transparent, they frequently refuse to cooperate.
- *Increase water delivery efficiency before increasing water tariffs*. This avoids passing on the costs of agency organizational inefficiency to farmers.

Technology, Knowledge, and Capacity

- *Technology supporting services* need to accompany water development. The 1997 Mali Pilot Private Irrigation Promotion Project limited dissemination of technology despite strong farmer interest.
- *Ensure information transparency*. Village notice boards were empowering in the Indonesia Village Infrastructure Project.

size, all the projects covering a very large area were designed before 1999. The change over time was substantial. After 1998 the average project area fell by two-thirds. Projects designed to cover large areas are now rare.

Benefits Produced Were Less Than Expected

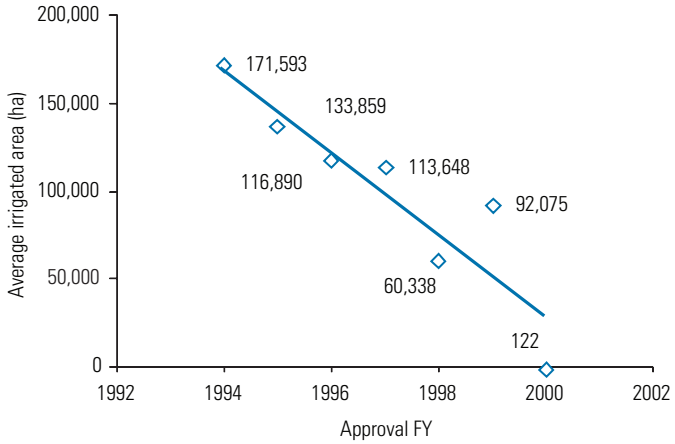
Outcomes from 71 projects in the portfolio that have been completed reveal that while all provide qualitative accounts of policy or institutional outcomes, less than half can define quantifiable outcomes and impacts. There are three reasons for this. First, almost a third of the projects (20) could either define benefits only very generally (for example, the CDD projects) or very narrowly, such as the six output-oriented emergency-disaster recovery projects.[5] Second, planning and setting up of M&E is poor. Third, very often there is a lack of relevant indicators because the results chain linking inputs to outputs and impacts is either weakly developed or missing (chapter 5).

Of the 43 projects with data, nearly all report the irrigated area, primarily because this is easily measured and closely linked to disbursement through well-defined contract arrangements. Overall, the total area that benefited was 5.45 million hectares (82 percent of expectations) and this averaged 146,000 hectares per project but with a substantial decline throughout the period (figure 4.5a). Unless drainage was a project objective, such as in the 1996 Estonia Agricultural Development Project or the 1994 China Songliao Plain Agricultural Development Project, it was generally subsumed under the irrigated area and was only reported for 14 percent of projects—even though 40 percent of projects included some drainage.

For the projects reporting area and cost (38), the overall average per project was $2,123 per hectare. When three outliers are eliminated, the average project per hectare cost reduces to $1,293.[6] There are significant diseconomies of scale as project areas get smaller and, therefore, more recent projects are proportionately more expensive (figure 4.5b).

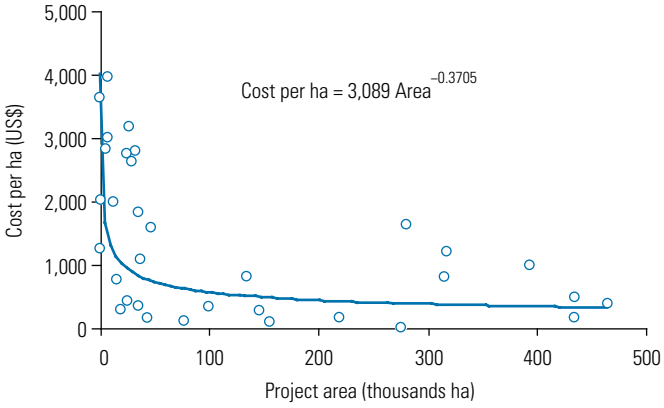
There is also high regional variation in unit area costs, average project costs per hectare in MNA and AFR being about three times more expensive than those in ECA (figure 4.6). When average project costs are weighted by area, AFR becomes the most expensive region for irrigation investment followed by MNA—and as also demonstrated by Kikuchi and Inocencio (forthcoming), irrigation investment in AFR and MNA are two to three times more expensive

Figure 4.5a. Area of Completed Projects Is Falling



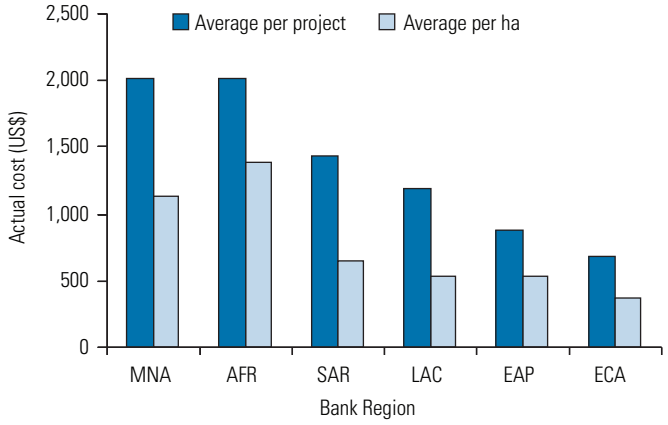
Source: IEG database.

Figure 4.5b. And Future Projects May Be More Expensive



Source: IEG analysis of 43 completion reports.

Figure 4.6. Regional Variations in Infrastructure Costs Are Large



Source: IEG analysis of 43 completion reports.

than the other three regions. Kikuki and Inocencio qualify their finding because they found that AFR projects with acceptable economic performance (economic rates of return above 10 percent) were no more expensive than those in other regions—they infer that higher unit cost were due to the relatively high proportion of unsuccessful projects compared with other regions.[7] The six completed Bank projects in Africa designed after FY93 are too few and varied to draw any such conclusion.

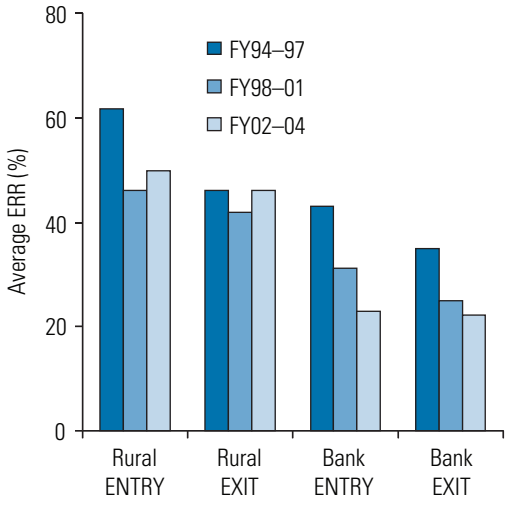
Compared with earlier investment, the current Bank portfolio of AWM projects is more cost effective. Kikuchi and Inocencio show that the average cost of AWM in the period 1967–2003 was $5,021 per hectare, ranging from $6,590 for new construction to $2,882 for rehabilitation. As the current AWM portfolio comprises about 90 percent rehabilitation projects by area, the balance being new construction, the average cost should be about $3,253 per hectare. In fact, at $2,123 per hectare it is about a third less expensive. Does this mean that AWM management projects are now more economic? The next section examines this issue.

Economic Efficiency and Competitiveness Are Declining

Economic efficiency has been generally satisfactory in those agricultural projects where an attempt was made to estimate an economic rate of return (ERR). In general, project economic analysis seems to have been allowed to slide in the past 20 years, either being avoided or being done peremptorily. In comparison with the rest of the Bank, however, the rural sector is more assiduous in carrying out economic evaluations, and more projects are reevaluated at completion (figure 4.7).[8] In the agricultural water subsector, there is a particular need for more attention to project economic analysis to demonstrate growth impact and impacts of institutional reform and efficiency improvements. This is particularly important because its economic efficiency is less than most other sectors in the Bank (figure 4.8) and is declining.

Of the 71 completed projects, slightly under half (32) had implemented AWM and estimated the ERRs at both entry and exit to the portfolio. The remaining projects had either ERRs derived from non–AWM activities or did not estimate an ERR because they were either sectorwide in scope, dispersed CDD-type projects, or emergency projects that focused primarily on short-term reconstruction.[9] The overall average ERR estimated at exit was 22 percent, similar to the overall average at appraisal and close to the rural sector average of about 20 percent. When

Figure 4.7. Economic Evaluations: Rural Sector Is Better Than Other Bank Sectors



Source: World Bank data.

weighted for project area, the overall average increased to 23 percent but there is no statistically significant increase of ERR with project size. Almost 60 percent of the ERRs estimated at appraisal were not achieved and, on average, appraisal overestimated economic efficiency by 8 percent.[10]

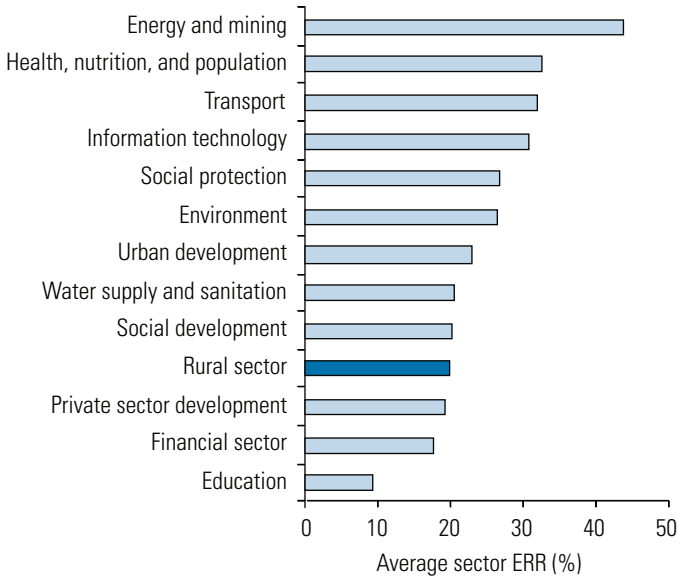
ERRs Are Declining

Even so, the average annual ERRs decrease over time, whether plotted against the date of entry to the portfolio or exit from it, falling from 25 percent in 2002 to 17 percent in 2006 (figure 4.9). Clearly the estimates of project economic efficiency provide few incentives for the Bank to invest more in AWM. IEG's review found that there was no change in ERR methodology during the period of review even though there is now general acknowledgment that many positive and negative externalities are missing from the analysis. A review of the economic analysis of projects in China, for example, reveals that most appraisals are too simplistic because they avoid econometric analysis of nonproduction impacts that would justify investment. In particular the impact of public goods and institutions was underestimated (IEG 2005.) The reasons for the downward trend in ERRs are not clear without detailed econometric analysis and case studies, but the Implementation Completion Reports (ICRs) do reveal some of the causes.

Lower Commodity Prices. Globally, commodity prices for most food grains have fallen because of the overall higher productivity of agriculture and freer trade. As a result, for Indian projects, the parity price for the dominant paddy crop in 2004 was 18 percent lower than what was projected in 1997 at appraisal. Similar changes occurred in East Asia; and in Central Asia, the world price of the principal cash crop of Bank-financed irrigation projects, cotton, fell by more than half between 1994 and 2001.[11]

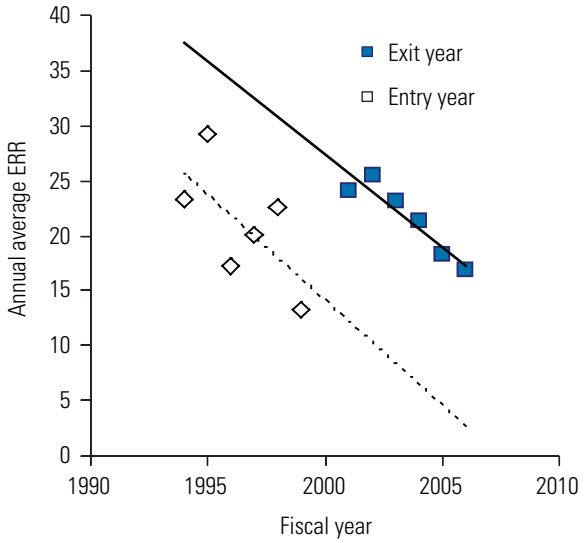
Smaller Benefits. In addition, the increased emphasis on rehabilitation over new construction, while reducing unit area costs, also produces much smaller incremental benefits. In China's Hunan Province, for example, the conversion of rain-fed grain to irrigated early rice increased crop value sevenfold compared with the impact of modernization and upgrading of existing irrigation (table 4.1), much larger than the relative incremental costs.[12]

Figure 4.8. Relatively Low Economic Impact of Rural Projects, 2001–04



Source: World Bank data.

Figure 4.9. Economic Efficiency is Declining



Source: World Bank data.

Table 4.1. Irrigation Benefits in China's Hunan Province Are Technology Dependent

Sector	Production value of main crop per ha (Yuan '000)		
	Before	After	Change
Modernization (early rice)	Irrigated	Irrigated	
	6.49	7.32	0.83
New Irrigation	Rain-fed	Irrigated	
	1.73	7.56	5.83

Source: Yangtze Basin Water Resources Project.

Delayed Benefits. This is of concern because delays increase costs and reduce benefit streams. Most delays are a symptom of institutional problems, lack of local capacity, and overly optimistic appraisal; but some are a result of exogenous events. Many projects are extended to take care of procedural problems. In Kazakhstan, for example, the irrigation and drainage project was extended for a year because of the government's restructuring of the project implementation unit. This delayed the awarding of contracts, but it did not increase engineering costs or reduce benefits—the ex-post ERR was 32 percent compared with 27 percent ex ante.

Delayed Benefits Affect Economic Efficiency

Completion of the Nepal irrigation sector project was delayed by two years and its estimated ex-post ERR was 10 percent compared with 15 percent ex ante. The main reasons for the delay were capacity limitations in the implementing agency, which slowed procurement and reduced civil works construction; underestimation of how long would be needed to build farmers' capacity to take over operation and management of irrigation systems; and the need to rebuild substandard works in the hills and Terai. India's Haryana and Tamil Nadu water resources consolidation project were both extended for similar reasons and both cost less than expected. Even so, a year's extension in Haryana reduced benefits and lowered the ERR from 18 to 14 percent: in Tamil Nadu a 30-month extension lowered its ERR from 15 to 11 percent. Peru's irrigation-subsector project delay of two years was caused by exogenous events: budget caps as a result of International Monetary Fund strictures, El Niño floods, and the withdrawal of cofinanciers. With overly optimistic appraisals this led to underachievement of physical targets and insufficient funding for a matching-grants program to induce farmers to adopt new irrigation technologies; even so, an ERR of 24 percent was achieved (against 39 percent anticipated).

Consequences of Inappropriate Lending Instruments

In Indonesia, the $350 million Water Sector Adjustment Loan was delayed by four years because project objectives were unrealistic in the time available. Although the first two tranches were disbursed on time against agreed policy actions and institutional reform, the third was cancelled because agreed actions were never completed, even though there were four one-year extensions—a realistic recognition of the time needed to undertake the ambitious water sector reforms—and acknowledgment that an adjustment loan to mitigate Indonesia's financial crisis was an inappropriate instrument to implement water sector reform. Although a new water sector law was issued in early 2004 and regulatory guidelines drafted, these were not issued. Consequently, procedures for water allocation, water rights, and regulations for farmer-managed irrigation systems remain temporary, undermining farmers' incentives to manage systems and pay operational and maintenance costs.

Keeping Procurement and Implementation Together

Having procurement managed independently of the implementing agency does not generally work well, as happened in Lebanon and Iran. In Lebanon's Irrigation Rehabilitation and Modernization Project, procurement by the national Council for Development and Reconstruction was not well coordinated with the Ministry of Agriculture. As a result, and compounded by problems over farmers' wishes to have agreed

works redesigned and resulting difficulties with variation orders, the project was delayed by 30 months. In Iran similar problems arose between the Ministry of Budget and the Ministry of Jihad and Agriculture over the Irrigation Rehabilitation Project, which led to cancellation of some project components.

Subcontracting Procurement Overcomes Capacity Constraints

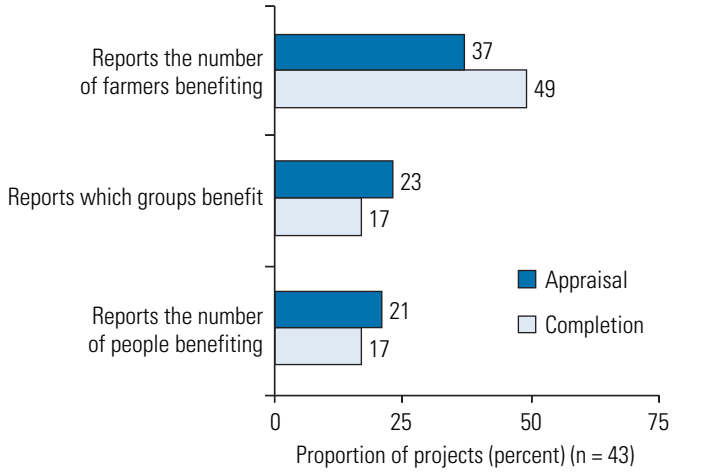
When the Dominican Republic's National Institute for Water Resources subcontracted the private sector to implement components of the Irrigated Land and Watershed Management Project, results were satisfactory. When the institute undertook its own design and procurement, however, the results were disastrous, leading to a year's delay. Delegation of implementation of Niger's Pilot Private Irrigation Project to a specialized nongovernmental organization worked very well, particularly in overcoming government's skepticism over the role of the private sector. Even so, the government support for the project was negligible until farmers became enthusiastic about the results achieved by the nongovernmental organizations, after which the government requested an extension of 18 months to build the conditions necessary for sustainability.

Social Impacts of AWM Projects

Reports on how many people benefit, their social status, and what benefit they realize are not very common. Slightly under half of the projects report how many farmers benefit but less than a fifth report how many people benefit or the social distribution of benefits (figure 4.10).

Reporting of the number of beneficiaries improved significantly after 1998 when the new-format PADs required this information in the project description.[13] In most AWM projects, beneficiaries are defined as the farmers within the project area and the number is primarily from general administrative surveys used to establish the basis for water user groups or associations. In many instances, particularly in South Asia, the same data provides revenue lists for recovery of O&M charges, water costs, and land taxes. These data typically contain nothing on the social attributes of the farmers unless there are social surveys. It is notable from figure 4.10 that while the number of projects reporting farmer numbers increased between appraisal and completion, the reverse is true of which particular social groups and which people (for example, women) benefit. While farmer numbers are associated with use of project inputs (training, credit, extension services, and cooperative or user group formation), very few social groups or individuals can be directly linked with such easily measured project inputs. The falloff in information on social impact is primarily because the special efforts to track the impact of the project interventions are not made because of poor M&E.

Figure 4.10. Neglect of Social Impacts in Completion Reports

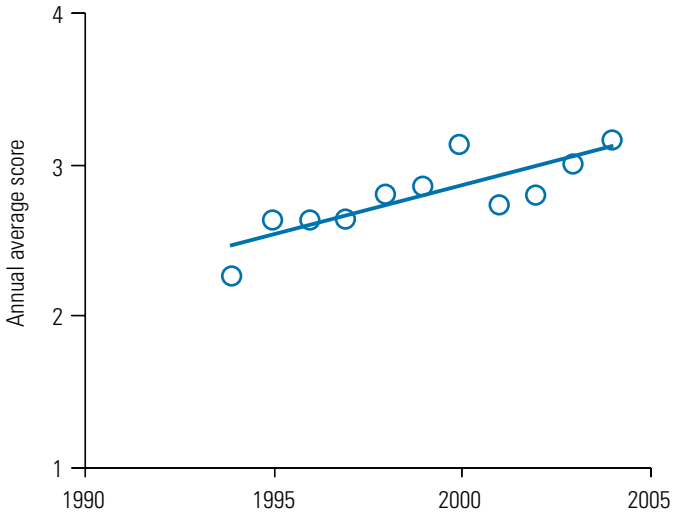


Source: IEG analysis of 71 ICRs.

Monitoring and Evaluation

All AWM projects that have civil works components have quite good M&E systems to track inputs and related outputs, but the quality of the system declines as evaluation focuses on outcomes and impacts.[14] Therefore, of the 32 projects that calculated ERRs only 2 created "without-project" controls prior to implementa-

Figure 4.11. Improved Designs of M&E Systems

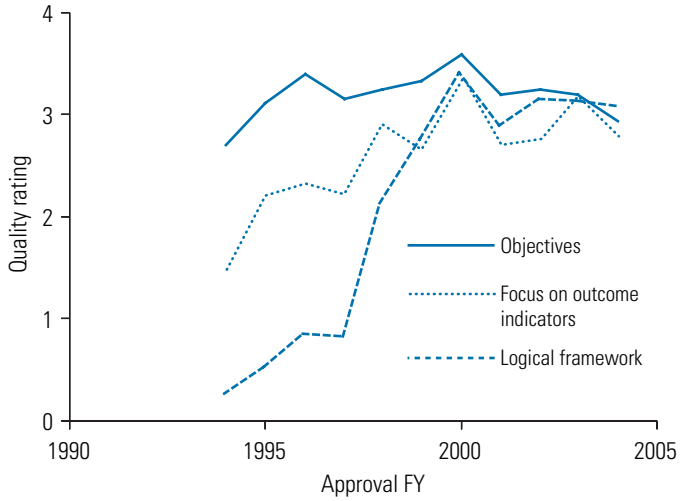


Source: IEG analysis of 80 PADs, by year of approval.

Note: 4 = high; 3 = substantial; 2 = modest; 1 = negligible.

tion and this rose to 3 by project completion. This clearly raises serious question about the robustness of the conclusions drawn by most projects that assert improvements in observed production, and that farmers' incomes can be attributed solely to the Bank's project-level interventions. The findings from a systematic evaluation of the design of M&E systems in the random selection of 80 AWM projects are discussed below. [15,16]

Figure 4.12. Logical Framework Greatly Improved M&E



Source: IEG analysis of 80 PADs, by year of approval.

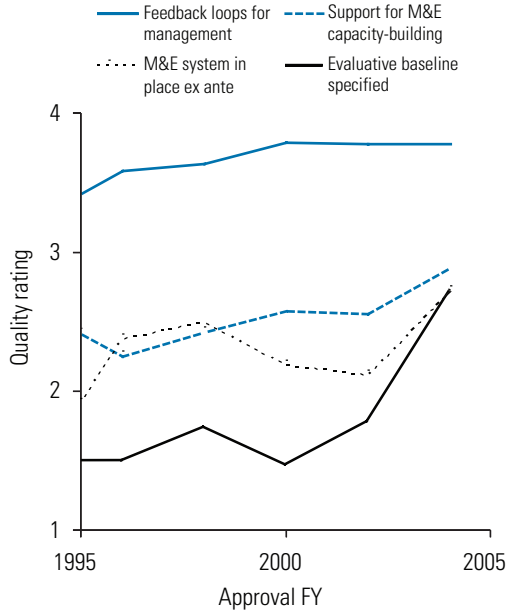
Note: 4 = high; 3 = substantial; 2 = modest; 1 = negligible.

Throughout the study period there was systematic improvement in the overall quality of M&E systems. The overall annual average rating increased from slightly above "modest" in FY94 to "substantial" 10 years later (figure 4.11). The primary reason for the improvement in the design of M&E was the introduction of logical frameworks in the late 1990s and their mandatory use in PADs (figure 4.12). This forced Bank task managers to develop results chains linking inputs to outputs, and in doing so, clarify and simplify development objectives. As a result, the focus on output indicators, and their overall quality, increased significantly—although there remains room for improvement.

A closer look at scores for individual questions reveals, however, that increased attention to monitoring the outcomes and impacts only occurred in the most recent two to three years—most attention was given to monitoring indicators of project implementation to provide feedback for better management (figure 4.13). At the same time, project documents showed increased support to build local M&E capacity, particularly as the quality of existing M&E among the new ECA borrowers caused the rating for this question to dip between 1997 and 2002.

While the overall quality of indicators improved, only a fifth of sampled projects have good poverty output indicators (figure 4.14). Omitting those projects that do not have direct social impacts—such as the ones that improve physical efficiency or build only infrastructure, or adjustment operations, the proportion of projects with substantial or better poverty indicators increases to almost 40 percent. Viewed statistically, dedicated and nondedicated projects show no significant difference in the 12 quality ratings, except for a much clearer definition of desired outputs.[17] This is not unexpected

Figure 4.13. But Attention to Outcome Indicators Needs Improvement



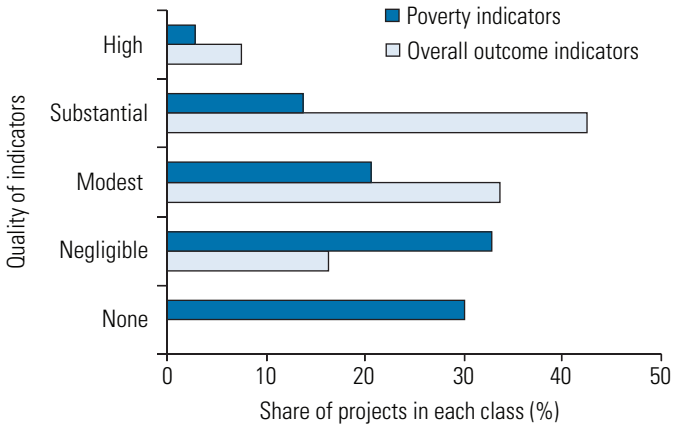
Source: IEG analysis of 80 PADs, by year of approval.

Note: 4 = high; 3 = substantial; 2 = modest; 1 = negligible.

given that dedicated irrigation and drainage projects almost always define physical works, crop yield improvements, or capacity-building targets such as the number of water user associations (WUAs)—and many of the outputs of nondedicated projects are difficult to define because of their CDD nature.

A rigorous evaluative framework is often missing in AWM projects and robust attribution of benefits is difficult. When projects in the sample are classified according to attributes that would allow exogenous and confounding factors to be eliminated, the results are less strong. Only 11 percent of projects were designed to have the tools that would allow rigorous impact assessment (figure 4.15). Specifically this includes well-defined output and outcome indicators, good baselines, and independent control groups unaffected by project interventions that would allow the counterfactual to be determined. Another 41 percent would allow determination of what happened before and

Figure 4.14. Unsatisfactory M&E of Outcome Indicators, Particularly for Poverty



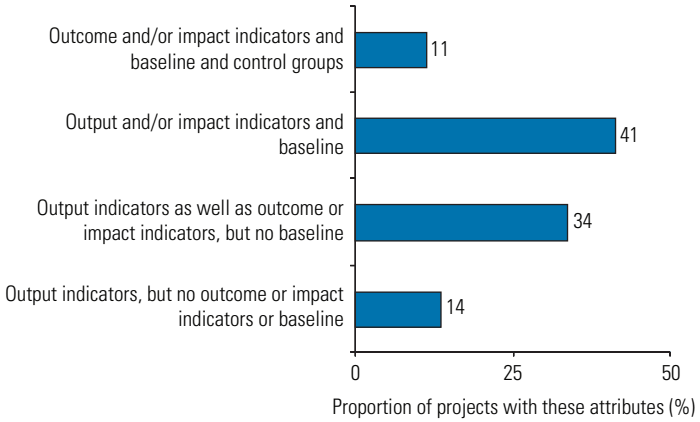
Source: IEG analysis of 80 PADs.

after project implementation, but not a robust attribution of observed changes. Slightly fewer than half of the projects did not have any means of verifying project impacts—no surveys or baselines—even though more than two-thirds of them included outcome or impact indicators. These results compare well with those of the World Bank's review of impact evaluation plans.[18]

Results of Poor M&E Design

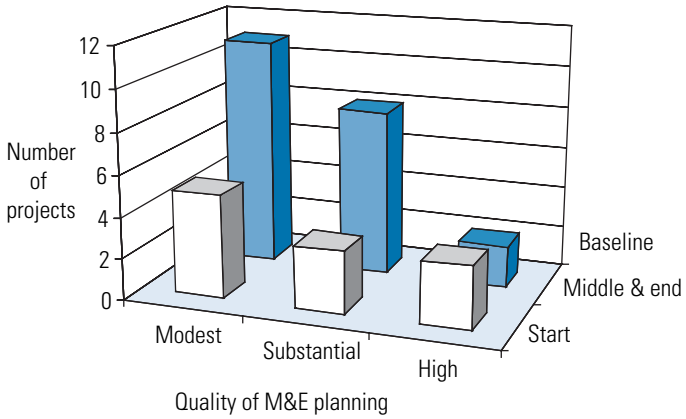
Only a third of 32 completed projects in the random sample had a baseline before the

Figure 4.15. Rigorous Evaluation Tools and Attribution of Benefits Needed



Source: IEG analysis of 80 PADs.

Figure 4.16. Poor M&E Planning Leads to Delayed Baseline Creation

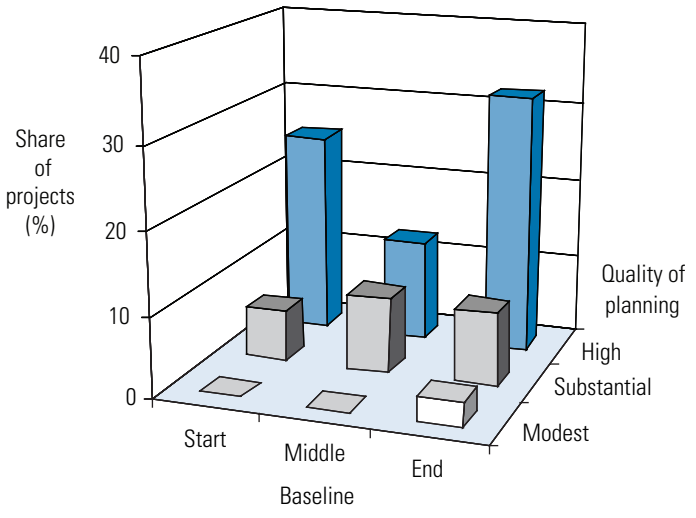


Source: IEG analysis of 32 randomly selected PADs with ICRs.

project started and less than half attempted to establish a baseline during the project. Other ex-post surveys only added another 3 percent. Slightly more than 20 percent never established a baseline. The primary reasons can be traced to project design and inadequate attention to M&E during supervision:

- When no evaluative baseline is specified it is likely to be established very late. Thirteen projects had no evaluative baseline specified; two had rectified this by the project start, five by the middle, and six at the completion. This may not be a fatal flaw if higher-level evaluation techniques are applied, such as random sampling of the project and control area and use of propensity-score matching—Brazil's Ceara project and Algeria's social safety net project are examples of this approach.
- Poorly designed and planned M&E almost always guarantees late attention to establishing a baseline (figure 4.16). The Madagascar Irrigation Rehabilitation Project paid almost no attention to the design of M&E systems and, consequently, no baseline was ever established. The Peru Irrigation Subsector Project's modest attention to M&E—which was assigned to the project coordination unit—only produced a logical framework and indicators during the final phase of the project. As a result, there was no baseline survey and economic benefits were based on a nonrandom ex-post survey of benefiting households. Conversely, Pakistan's Groundwater Privatization Project's excellent M&E design led to the early establishment of a baseline and controls, and excellent ex-post surveys and case studies.
- While good planning for M&E may lead to early baselines, without vigilant supervision or good local capacity it may not be implemented (figure 4.17). The Albania Irrigation Rehabilitation Project had substantial planning for M&E but it was only implemented at the end of the project. In Sri Lanka's Mahaweli Restructuring and Rehabilitation Project the inability of the project coordination unit to use consultants effectively negated the Bank's attempts to get a good M&E system established. Even so, an ERR was calculated using update appraisal data but it neglected to take account of the spillover benefits of an Asian Development Bank (ADB) project that overlapped the Bank's project area.
- Early baselines are most often associated with high-quality ex-post surveys (figure 4.18). Detailed impact assessment of the Jordan Agricultural Sector Adjustment Loan (ASAL) was undertaken in partnership with GTZ (*Gesellschaft für Technische Zusammenarbeit*). The good monitoring data of the Mexico

Figure 4.17. Good M&E Needs Vigilant Supervision

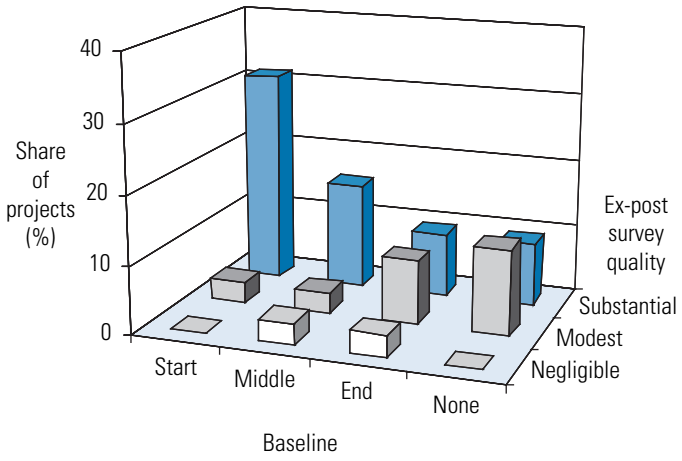


Source: IEG analysis of 32 randomly selected PADs with ICRs.

On-Farm and Minor Irrigation Networks Improvement Project enabled discrimination of incremental project benefits from the parallel Bank-financed Irrigation and Drainage Sector Project. Pakistan's Baluchistan Community Irrigation and Agricultural Project is probably the best practice, particularly in its candid and transparent description of how project impacts were estimated.

An econometric analysis of all the variables affecting the quality of M&E indicates that the major determinants of early baseline creation are (i) a clear definition of the outputs expected and (ii) discussion of the baseline and its use in the PAD.[19] Conversely, the lack of a baseline is strongly linked to the size of the project loan and the quality of the logframe analysis. The latter may seem surprising, but great attention to the logframe at appraisal may have led to subsequent complacency, particularly if a new task manager takes over soon after approval. This is quite often the case because senior staff in Bank headquarters tend to manage projects until Executive Board approval, after which supervision is delegated to country-based staff.

Figure 4.18. Early Baselines Lead to High-Quality Surveys



Source: IEG analysis of 32 randomly selected PADs with ICRs.

Thus, staff training in M&E needs to be improved at all levels. More importantly, greater efforts should be made to build and improve M&E capacity in borrowing countries to ensure continuity and sustainability of this essential function so as to ensure accountability and good governance.

Project Design and Impact

While the potential of agricultural water management projects to make substantial contributions to growth and poverty are high, most projects lack a results chain that links their interventions to outcomes and impacts.

Overview

This chapter shows that the design of Bank AWM projects for poverty impact is weak: beneficiaries need to be more clearly characterized, gender analysis need more attention, targeting needs improvement, and land- and water-asset ownership require more focus. There is room for closing the gap between the quite rich literature and the less rich project design through better training for staff and transfer of experience between countries.

Poverty Indicators Need More Attention

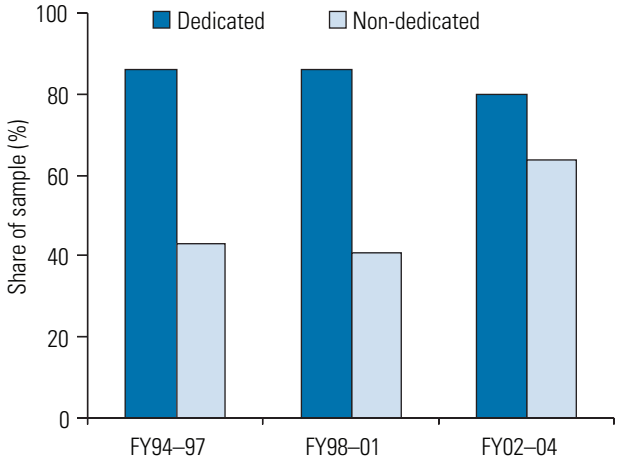
Only about 34 percent of the 80 projects reviewed had an explicit poverty objective (sometimes, surprisingly, even when the CAS had an explicit poverty statement that referred specifically to the rural sector). While the percentage among the nondedicated projects is about 45 percent, among the dedicated projects analyzed, only 24 percent mentioned poverty as an explicit objective.

The extent to which the project design itself was judged to have incorporated a poverty focus was rated independently of whether the objectives included an explicit poverty-alleviation element. This is because a well-focused poverty-targeted project design is possible even when there is not an explicit poverty statement. Until FY01 dedicated projects were far less effective than nondedicated projects at appraising the poverty aspects of projects. Since then the gap has closed, a notable achievement (figure 5.1a), and the quality of the analysis has improved significantly for all projects—although dedicated projects lag nondedicated projects (figure 5.1b).

Gender analysis is now undertaken for three-quarters of all AWM projects, up from the 50 percent prevalent during the 1990s. The quality of analysis has also improved following the same pattern as that for poverty aspects (figure 5.1b).

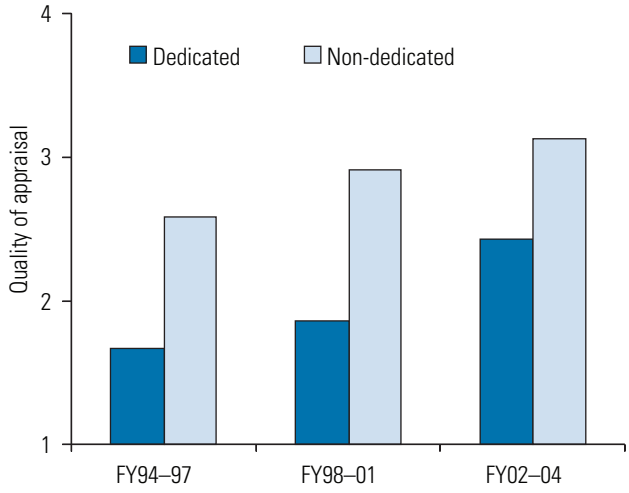
Analysis of distributional aspects has improved in both coverage and scope. A comparison of the pooled averages in FY94–FY04 for five social appraisal indicators (figure 5.2a) shows that more nondedicated projects identified beneficiaries and targeted them, identified who and which groups benefit (distributional benefits), and projected likely impacts on employment

Figure 5.1a. Poverty Coverage Is Improving



Source: IEG analysis of 80 PADs by year of approval.

Figure 5.1b. Quality of Appraisal of Poverty Aspects Is Improving



Source: IEG analysis of 80 PADs by year of approval.

Note: 4 = high; 3 = substantial; 2 = modest; and 1 = negligible.

and incomes. In contrast, there are slightly more dedicated projects with social assessment. Even so, high-quality analysis of the specific benefits is done for less than half of all AWM projects, and impacts on employment and incomes are projected for less than a third of projects.

As with the overall poverty focus, the quality of appraisal for benefit targeting has risen markedly for dedicated projects (figure 5.2b). And more attention is being given to distributional aspects by all projects.

These findings on employment and income benefits contrast with the now quite widespread use of social assessments. Overall, 53 percent of the projects in the sample indicate that a social assessment was carried out with no statistically significant difference between dedicated and nondedicated projects. However, there is a clear improvement: from only 22 percent of projects in FY94–FY99, the number with social assessments rose to 79 percent in the past five years.

Weak poverty indicators are attributable partly to the lack of poverty objectives or poverty design. Another explanation may be that many staff appear to feel that measuring poverty change is simply too difficult. While measuring poverty is clearly not easy, the literature offers a number of indicators.[1] Examples of somewhat better cases of monitoring impact include the 1997 Peru Natural Resources Management Project and the 2004 Nepal Poverty Alleviation Fund, both, not unexpectedly, nondedicated projects. The 2004 India Madhya Pradesh Water Sector Restructuring Project, a dedicated project, has a good analysis of the percentages of the poor in the selected areas and it projects how many will be lifted above the poverty line by the project, and how much employment will be generated. It outlines some actions to reach the poor, including support for fish ponds and the use of tribal development plans.

The contrast between the previous finding that analysis of poverty is weak and the increased application of social assessment is puzzling. One explanation might be simply that the social assessments are still not adequately analyzing who the poor are and why. A second explanation might be that more analysis is being done than is being revealed in the PAD. If so, this presents a problem for managers and reviewers. Another explanation might be that social assessments often come too late in preparation. Observation suggests that all three of these reasons may be involved.

Assessments of Water User Associations Are Too Optimistic

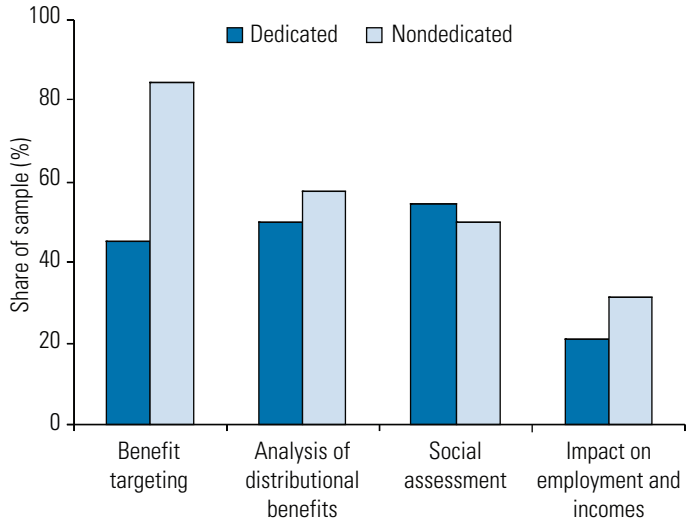
There is considerable disillusionment with the performance of water user groups or associations and a common view that, for some years, the Bank has had unrealistic expectations.[2] While there is widespread support for the principle of user participation to improve water management and maintain irrigation systems—and there is much evidence to show that user participation is effective—staff also recognize that farmers often lack the skills needed to manage the larger irrigation systems and that the need for continuing government support has been underestimated. Also, Bank staff have tended to treat the strengthening of user associations as an end in itself, rather than as part of a broader strategy of raising the efficiency of water use—this is a reflection of the increasing proportion of nonwater staff designing AWM projects. Staff expressed a concern that, in some cases, the Bank has bypassed long-standing public sector frameworks for water management, failing to appreciate the potential of existing institutions and overestimating the scope for reform.

Institutional Support for Water User Associations Is Neglected

Projects have tended to give more emphasis to strengthening WUAs than to strengthening the broader authorization and institutional framework in which they must function. Strengthening of user or community groups was substantial—a rating that holds for the nondedicated as well as the dedicated projects. By comparison, institutional strengthening at higher government levels was only modest. In the dedicated projects the point of reference was usually a WUA, whereas for nondedicated projects it was typically a broader community group only partly focused on managing water.[3]

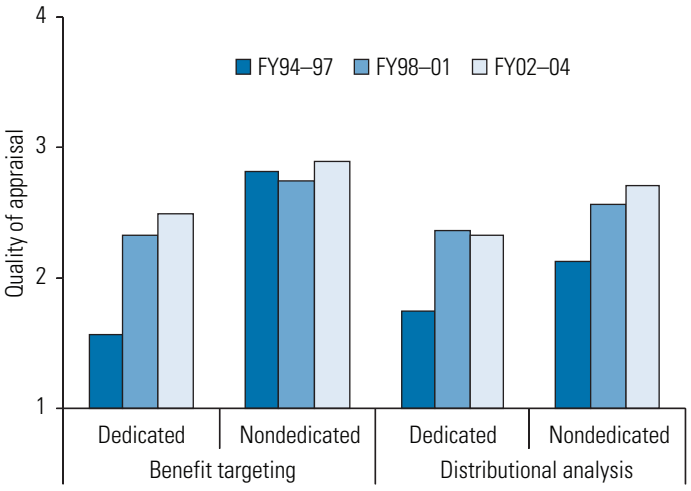
The appraisal documents reviewed suggest that there tends to be too narrow a focus on increasing participation by user or community groups. As illustrated in figures 5.3a and 5.3b, there has been insufficient attention to the critical issues that enable community groups to be effective managers of water.

Figure 5.2a. Less Appraisal of Social Impacts in Dedicated Projects



Source: IEG analysis of 80 PADs by year of approval.

Figure 5.2b. But All Projects Have Improved the Quality of Analysis

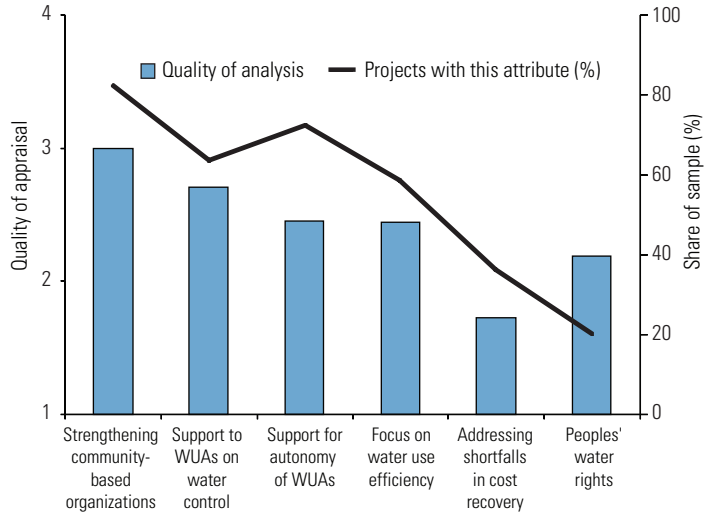


Source: IEG analysis of 80 PADs by year of approval.

Note: 4 = high; 3 = substantial; 2 = modest; and 1 = negligible.

The Bank has found that "User participation changes, but does not eliminate, the role of government agencies in irrigation development. Building support from policy makers and agency

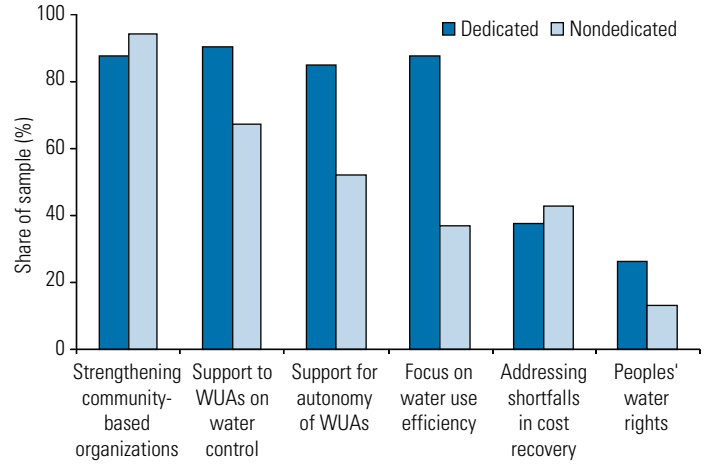
Figure 5.3a. Limited Focus on Good Water Management Essentials in All AWM Projects



Source: IEG analysis of 80 PADs, by year of approval.

Note: 4 = high; 3 = substantial; 2 = modest; and 1 = negligible.

Figure 5.3b. Focus of Essentials for Nondedicated Projects Are Particularly Limited



Source: IEG analysis of 80 PADs, by year of approval.

staff as well as farmers and other water users is essential for successful participatory projects and involves paying close attention to the incentives relevant to each group."[4] Bank strategy argues that irrigation reforms should be supported by broader institutional reforms if WUAs are to function effectively.[5]

Some projects seem to get the balance right between strengthening user associations and strengthening counterpart institutions. The 2000 Kyrgyz On-Farm Irrigation Project established and provided training to government support units for user associations. These support units, located in the Department of Water Resources at the *oblast* (regional) and *rayon* (district) levels, are expected to become a permanent part of the organizational structure.[6] The 1995 Egypt Irrigation Improvement Project invests $10 million in broad-based institutional support, and will spend a further $5 million to introduce an Irrigation Advisory Service that will provide information and technical support aimed at strengthening user groups, as well as a campaign to raise awareness of environmental issues. However, these are the exceptions. Few appraisal documents indicate how support to water-user groups will be backed up with support to the broader institutional framework of which they are a part or how support will be maintained when the project ends. The documents also do not contain a plan for the gradual phasing out of support as the user groups mature.

In Central Asia the institutional environment for WUAs is particularly weak. In Uzbekistan, Kazakhstan, and Kyrgyzstan, a number of problems have been reported: corrupt officials who interfere with the operation of user groups, illegal water withdrawals by the politically well connected, poorly managed government systems of credit and input supply, controlled commodity markets, and cases of extortion at highway checkpoints and in bazaars. This is compounded by severe inequalities in the distribution of land and assets and a backlog of irrigation maintenance that dates back to Soviet times.[7] All these issues hamper attempts to make WUAs effective.

Unrealistic Incentives for Cost Recovery

There are also unrealistic expectations about cost recovery following the handover to user groups. Many of the appraisal documents reviewed contain ambitious timetables for recovering operation and maintenance costs

Box 5.1. Madagascar: Unrealistic Strategy for Transferring Responsibility for O&M

The appraisal report for the 1995 Madagascar Second Irrigation Rehabilitation Project said about the first project (which had been completed) that "the level of financial contributions to O&M does not yet reflect a sufficient level of commitment." However, it is not clear in the appraisal report for the second project how the incentive for users to pay up would be increased, other than a mention that "new regulations on handover are being finalized" and that O&M responsibilities "will be defined." The completion report for the same project showed that cost recovery remained low, never exceeding 15 percent—according to the appraisal report, it had been projected to reach 15 percent in year 1, and rising to 90 percent by the final year. During implementation the incentive for groups to take O&M appeared to have been undermined by continued government support and no exit strategy. In response to this slow project progress, instead of reviewing strategy, the Bank pushed ahead with investments in large schemes—apparently in order to restore the level of disbursements. Yet, as the completion report shows, it was precisely in these larger schemes that the social cohesion needed to achieve satisfactory handover was lacking, and the challenge of cost recovery was largest.

from users (boxes 5.1 and 5.2). For dedicated projects the projected rate of increase in the recovery of operation and maintenance costs averaged 65 percent.[8] Several projects aimed both to establish user associations and to recover 100 percent of costs—within the span of a single project typically lasting less than seven years. The appraisal documents typically contain no fallback strategy if the targets prove to be unrealizable—particularly as the civil works required to provide timely and adequate water supplies take most of the project period to complete.

It is perhaps unfair to expect users to commit to handover if it is not clear to them how much they will be expected to pay for O&M following transfer.[9] While tariff projections may be difficult for public agencies to make given the variability of systems and handover changes, the lack of financial incentives and the considerable uncertainties in such a "blind" handover is a problem that project design usually overlooks. Assessments of the impact of WUAs are few. Notable exceptions are in the Philippines and Indonesia.[10] In Indonesia a 2002–03 study by the University of Gajah Mada compared the quality of irrigation improvements, with and without WUA involvement. They found conventional rehabilitation without WUA strengthening had ERRs in the range of 10–18 percent; in those with enhanced WUA capacity this increased to the range of 30–40 percent.

Morardet et al. 2005 found that, in eastern and southern Africa, irrigation management transfer was incomplete in all the countries they studied, with particularly marked lags in Nigeria and Madagascar. They note that the classic remedy has been to combine increased public

Box 5.2. Tanzania: The Extent of Cost Recovery

The appraisal report for the River Basin Management and Smallholder Irrigation Improvement Project states that "a system of water charges . . . would be put in place to ensure that the O&M costs . . . would be covered." The report goes on to say that full recovery will be achieved in three years. The completion report for this project fails to make clear to what extent this target was realized. The report notes that "Each scheme has devised its own mechanism of attending to O&M . . ." The annex on performance indicators quotes a dollar figure for the amount collected by basin, which is impossible to interpret given the absence either of the target or of some estimate of what 100 percent recovery would amount to in absolute terms. Another annex table shows what percentage of users paid up but, again, fails to specify the target set at appraisal. There is a vague statement that "funding . . . raised from water user fees . . . has increased over time . . ." Therefore, there is no clear indication of how close to recovering costs the project came—a failing shared by most of the completion reports reviewed for this study.

spending on O&M with higher water charges; but, typically, this has not led to better maintenance.

Incentives to Boost Water Use Efficiency Are Frequently Neglected

There is a disparity between the richness of the literature on water pricing and efficiency and the limited coverage of these issues in the appraisal documents reviewed for this study. It is often difficult to discern from these documents what system of water charging has been used in the past or is proposed for the future.[11]

The pricing of water to achieve efficiency is extremely complex; and in many borrowing countries, it is unrealistic to apply marginal water pricing through volumetric outlets and charges. There are exceptions to the general trend—South Africa, for example, is moving toward volumetric pricing, and in Armenia and Iran the principle is accepted. Even where volumetric pricing is, in principle, feasible, it may be thwarted: in Jordan, the rate of meter tampering was as high as 20 percent in some areas.[12]

Alternatives to water pricing may be more practical. One interesting variant is to charge by area according to crop type, applying average water consumption for that particular crop, but allowing farmers who think they can do better by using a volumetric charge, and providing the meters at their own cost. Various studies have shown that some alternatives to metering give almost as good water use efficiency at lower collection costs. Perry (2001) notes that many of the assumed advantages of water pricing at the margin can be achieved through physical rationing, which is easier and more transparent to farmers.[13] Furthermore, from an equity standpoint, it may not make much of a difference what pricing approach is used; farm size is far more important (Tsur et al. 2004).

Few appraisal documents or country water strategies offer a clearly articulated strategy for water use efficiency, whether it is through some form of volumetric pricing, an area/crop-based approach, a lower-cost proxy, or a restricted-supply approach, such as the South Asia *warabundi* system. It is rare for appraisal documents or country water strategies to detail the various steps that must be followed if real water use efficiency is to be achieved—"real" in the sense of allowing for the reuse of a percentage of "lost" water. This is perhaps surprising given the extensive literature on the issue (such as Perry 2001).[14] Most appraisal documents simply outline a strategy to fix water delivery infrastructure, to raise cost recovery, and to increase participation through handover.

The China Water Conservation Project is one of the few examples of an appraisal document offering clear guidance on how to achieve system and technical water efficiency. Drawing from the literature, it clearly articulates the issue of "real" water savings, noting that although systems higher in a basin may be inefficient, the basin as a whole may be efficient because it allows for recovery of losses. The appraisal document succinctly demonstrates how the design of the system and the operating process influence the level of *unrecoverable* losses. The project includes activities specifically designed to address efficiency—physical improvements to the system, agronomic measures, and management reforms.[15]

Even where there has been agreement to pay for water, the means to measure volumes delivered are not built into most Bank projects, except for the few concerned with groundwater. This is because most large surface water projects were designed for top-down supply management by public agencies, where equitable rotational distribution was more important than worrying about what individual distributaries or farmers received. As a result, the equipment and capability to regulate supplies according to demand is missing. What is needed is not only rehabilitation but modernization of hydraulic control structures to allow volumetric measurement.

Irrigation Is Only Part of the Solution

There is scope for increasing the complementarity among irrigation investments and extension, marketing, and credit services, partic-

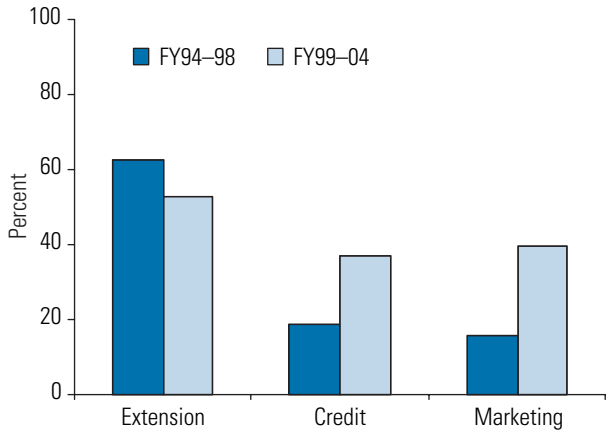
ularly for dedicated projects.[16] While there was a big increase in the share of irrigation projects that addressed credit and marketing constraints after FY98, most of this increase was for nondedicated projects (figures 5.4a and 5.4b). Complementarities among extension, marketing, and credit services find their strongest expression in the India Sodic Lands Project, the Azerbaijan Irrigation Distribution Systems and Management Improvement Project, and the Niger Northeast–Private Irrigation Promotion Project. Conversely, the 1994 Mexico On-farm and Minor Irrigation Networks Improvement Project—a $569 million project—apparently failed to marry extension and credit services effectively, compromising the objective of raising productivity.

Bank Staffing and Training Are Weak

Most sector managers interviewed reported a continual shortage of staff with the right irrigation and drainage expertise—even though about half had either recently hired persons with these skills or had some recruitment pending. In Africa, recruitment of a lead water management specialist is at the top of the regional priority list. The overall impression was of a slight increase in staff equipped to address policy reform and social issues relevant to irrigation, but also a continuing loss of staff with technical and engineering skills (mainly through retirement). Some managers have been hiring (or recruiting through cross-support from other regions) staff who know how to work through the details of policy and institutional reform, aiming to use these experts to convince wavering borrowers in their region to embrace the reform agenda.

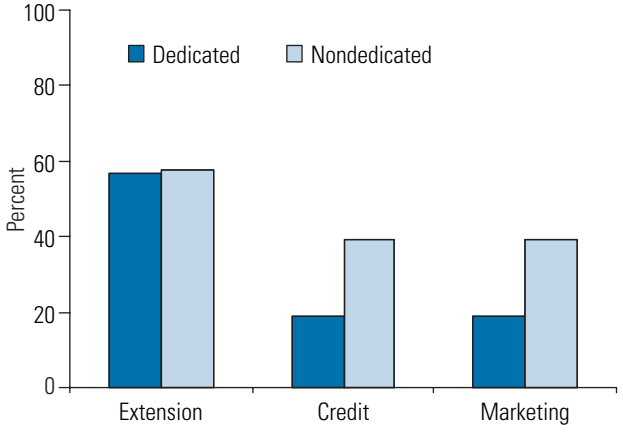
Managers expressed no strong views about training and most had no training plan, following Bank policy that it was up to staff to take the initiative. Some staff reported that training on institutional reform and water use efficiency had almost ground to a halt. The irrigation study tours are no more—even though these were well received by staff in the past. Informal lunchtime seminars are still common but are often sparsely attended, reflecting the pressure on staff to focus on the day-to-day details of project processing. Staff were moderately enthusiastic about "Water Week" but those specializing in agricultural water use tended to report that the event had been captured by the urban water and sanitation contingent.

Figure 5.4a. Coverage of Credit and Marketing Links Has Improved



Source: IEG analysis of 80 PADs.

Figure 5.4b. But Only in Nondedicated Projects



Source: IEG analysis of 80 PADs.

Findings and Conclusions

This study provides answers to three questions: Why has Bank investment in agricultural water management declined so precipitously? Are agricultural water projects relevant to the Bank's renewed focus on poverty alleviation and institutional and policy reform? What should be done to improve performance and relevance?

Changing Global and Bank Priorities

Four factors account for most of the decline in lending for agricultural water management: (i) a shift in borrowers' priorities, (ii) realignment of lending with the Bank's strategy for poverty reduction, (iii) changing development objectives for agricultural water management, and (iv) increased use of low-cost approaches.

Borrowers' Priorities Have Changed

Agriculture's contribution to growth and employment continues to shrink, lowering policy makers' attention to agricultural policy and water management. Between 1980 and 2000 the share of agriculture in global GDP fell from 8 percent to 5 percent, but the regions with the most agricultural water management infrastructure saw an even greater decline. The share fell by a quarter, to 25 percent, in South Asia and halved, to only 13 percent, in East Asia and Pacific. The only region where agricultural GDP remained unchanged was Sub-Saharan Africa (17 percent); and in the Middle East and North Africa it actually increased, from 10 percent to 14 percent. Among all low- and middle-income countries, agriculture's value added to growth in the 1990s shrank to about half of that added by the industry and service sectors, and about a quarter of that added by exports of goods and services. Food security concerns that were the focus of agricultural development in the 1960s to 1980s were mostly assuaged. Declining prices of staples—particularly irrigated rice, helped by improved nonwater inputs, markets, and trade—increased the food access of the poor. In most developing countries agricultural production has, therefore, met performance expectations.

Dramatic growth of urban populations in developing countries poses severe economic, political, and social challenges that have displaced the attention given earlier to rural development. The rural population is anticipated to decline slightly from 3.3 billion in 2003 to 3.2 billion in 2030. Forty-eight percent of the world's population lived in urban areas in 2003, and this is projected to rise to 61 percent by 2030. With competition for both water and scarce financial resources, political preference has been given to the provision of basic water

supply, sanitation, and environmental needs because agriculture is regarded as primarily a private sector activity. Disillusionment among governments and policy makers about poor performance and maintenance problems of public sector irrigation also quelled interest in the subsector. Much of this was because the expansion of irrigation infrastructure outpaced public management capacity and local institutions. Therefore, diminished attention to agriculture among the Bank's borrowers was consistent with increased attention to social issues, urbanization, and growth.

Realignment in Lending

Lending was realigned with the Bank's strategy for poverty reduction for two reasons. First, Bank policy changes increased the share of lending allocated to the social sectors. Second, agriculture was not on the fastest growth path. Following its 1990 *World Development Report on Poverty*, the Bank adopted a two-pronged strategy that targeted efficient, labor-intensive growth and greater attention to social concerns, including education and health care, a strategy later reemphasized in the 2000/2001 *World Development Report: Attacking Poverty*. With the renewed focus on poverty, lending to the social sectors increased while lending for infrastructure, agriculture, and the environment fell after 1993. IDA replenishment agreements (IDA10–12) also required increases in the share of investment lending in the social sectors, and the HIPC initiative required beneficiary countries to allocate funds released from debt service to public expenditures on the social sectors. As social sector investment increased, lending for infrastructure declined.

Underpinning the focus on poverty was growing evidence that accelerating economic growth was the fastest way to raise people out of poverty. Yet, though most of the poor live in rural areas, development of agriculture has not been the path to the most rapid economic growth. This fact, coupled with serious concern about the environmental and social impact of several large-scale projects—particularly those for water—caused the Bank to reduce its support for public investments in civil engineering works. Even so, Bank lending for agricultural water management was primarily to the poorest countries. As the volume of lending sharply contracted in the period after 1999, an increasingly larger portion went to the lower-income group and this reached more than 95 percent in 2002 (though investments in Africa also declined).

A new set of smaller clients also emerged as commitments for agricultural water management to the biggest borrowers declined. Before 1999, ECA accounted for only 11 percent of projects in the portfolio; afterward, with 29 loans, it accounted for a third. The Bank's smaller interventions in ECA not only assisted poverty alleviation in the medium term but also provided an entry point for policy discussions aimed at rationalizing the region's aging and oversized infrastructure, which was frequently environmentally damaging and uneconomic to operate.

Budget Constraints Squeezed AWM

Budget constraints within the Bank and new initiatives squeezed out AWM projects. The 1997 *Strategic Compact: Renewing the Bank's Effectiveness to Fight Poverty* significantly reduced budgets for project preparation, a trend accelerated by a substantial shift toward development policy lending during the mid- to late 1990s. At the same time, the skills mix of Bank staff was realigned with the *Compact*, by a loss of technical staff and replacement with staff having more fungible skills. Enhanced fiduciary and safeguard provisions increased the costs of project preparation such that AWM projects are among the most expensive to prepare. Squeezed by budget pressures, high costs, muted advocacy, and new development initiatives, country directors' interest in AWM waned. Since 2002, budgets and staffing have modestly improved and, refocused by the new rural and water sector strategies, lending for rural development and AWM has shown a resurgence. The main lesson is that vital investment in rural areas and AWM will not take place unless directors' incentive structures are reformed and budgets that are commensurate with the

challenge are provided to enable staff to be effective.

Changes in Development Objectives for AWM

Evaluation of the country assistance strategies and projects approved during the period 1994–2004 shows a change toward a more integrated approach to rural development, with a growing emphasis on building social capital. Project objectives encompassing community support and participation, income and employment, and support for capacity building and institutional development increased. Conversely, objectives that are central to the new policies—addressing poverty reduction, agricultural development and production, and environment and natural resources management—declined in importance. One reason for these changes is that development objectives have become more practical and achievable by focusing on measurable outcomes rather than global targets. For example, increased attention to income and employment almost balances the decrease in poverty-reduction objectives.

Attention to the technical and social issues of agricultural water management has become more polarized. This may not be an issue where agricultural water management projects are part of a broader package of rural development endeavors that deal with social, human, and economic development. But the more general projects, in which water-related activities are in the minority, are building water infrastructure with less attention to issues of technical efficiency and sustainability. These findings indicate the importance of integrating agricultural water management projects within country rural strategies and ensuring that they are adequately supported either by parallel operations that address critical omissions, or by improving the skills mix of appraisal teams preparing agricultural water management components of nonwater projects.

Low-Cost Approaches Are Increasingly Important

The average Bank commitment to agricultural water management projects declined for two reasons: a change in the type of infrastructure financed and the greater emphasis on nonstructural and capacity-building components. Freestanding projects dedicated to water management now comprise only about 40 percent of the agricultural water management portfolio. There is a marked difference in the type of infrastructure components financed by dedicated and nondedicated projects, even though most contain a mix of physical interventions ranging from some new-builds, redesign and upgrading, and repair of damage caused by deferred maintenance, referred to as rehabilitation. Among the dedicated projects, rehabilitation or improvement of large irrigation systems now account for more than 80 percent of Bank commitments. Nondedicated projects, with an initial focus on rehabilitation in the mid-1990s, now build new systems that are small scaled, community owned, and integrated in social development programs. Because rehabilitated projects averaged $2,900 per hectare, while new construction averaged $6,600 per hectare, there was a substantial fall in the cost of projects. As a result, the average loan amount per project fell from $59 million in 1994 to a low of $15 million in 2001.

AWM Remains Relevant

Demand for increased global agricultural production will require better management of increasingly scarce water resources. As the world's population grows from its present 6.5 billion to 8.2 billion in 2030, the FAO projects that a new round of investment in irrigation and drainage will follow, albeit at half the average rate of the preceding four decades. The balance of new arable land will come from developing countries that have the potential to add about 120 million hectares of new arable land. The expansion will be strongest in South Asia, East Asia, the Middle East, and North Africa regions where almost all arable land potential is utilized. Harvested irrigated area, subject to multiple cropping, is likely to increase by a third, or 83 million hectares by 2030.

Better regulation and management will be required because of more competition for water

and degradation of supplies owing to pollution and reduced investments for infrastructure maintenance. Globally, water is becoming an increasingly scarce commodity—more than a quarter of the developing world population will face severe water scarcity in the next 25 years. And groundwater, the mainstay of most private sector investment in South and East Asia, the Middle East, and North Africa regions, already is being extensively overexploited and mined. The net effect will be increasing real costs of water at the farm level and declining social profitability of irrigated agriculture.

Irrigation boosts growth and reduces poverty directly and indirectly, benefiting the poor in several ways. Poor farmers directly benefit from increases in their production, which may increase their own consumption and provide a surplus of marketed products for increased farm income. Small farmers and landless laborers benefit from agricultural employment opportunities and higher wages, and a wide range of rural and urban poor benefit from related growth in the rural and urban nonfarm economy. Crop harvest from irrigated areas leads to strengthened staple or nonstaple food output, which lowers prices and benefits all consumers, particularly the poor.

Agricultural growth generates important income and employment multipliers within the surrounding nonfarm economy. The multipliers are particularly large in Asia, between 1.5 and 2.0 of the incremental agricultural benefits generated, but they are only half as large in Africa and Latin America. Multipliers are higher in labor-abundant regions, and increase with regional development and per capita incomes. Specifically, irrigated regions dominated by medium-sized farms and modern input-intensive farming systems generate the largest multipliers. Multipliers are smaller in rain-fed farming systems and in regions dominated by very small farms or large estates. This poses a dilemma for decision makers: a poverty-targeted intervention aimed at small farmers may not be the most efficient way of increasing agriculture's contribution to economic growth.

Even so, it is the "package" that matters for effective poverty alleviation and not just the supply of irrigation water. Investments in agricultural water management may not reduce poverty directly in any significant way unless accompanied by other complementary interventions.

Increasing Relevance and Performance

The relevance of agricultural water management operations to borrowers and to Bank country directors can be increased through better analysis of links to economic growth, more attention to demonstrating social impact and poverty reduction, and better management. While most CASs discussed the importance of agriculture policy, less than half discussed it in the context of economic growth; greater prominence was given to community-driven development, general rural development, and reform of agricultural institutions.

Demonstrate Growth Impact

This is particularly important as the economic efficiency of all rural sector projects is less than most other sectors in the Bank, and is declining—it is ninth among the 13 sectors reporting measures of economic efficiency. Investment in agricultural water management is economically efficient but is becoming less competitive. The annual average economic rate of return for completed agricultural water projects steadily declined from 25 percent in FY00 to 17 percent in FY06. The primary reasons for this are diseconomies of scale, as average projects became smaller in area, global commodity prices declined, and benefits were smaller and delayed.

Measure Social and Financial Impact

Reports on how many people benefit, their social status, and how they benefit are not very common despite a substantial increase in the use of social assessment. Slightly less than one-half of the projects report how many farmers benefit but less than a fifth report how many people benefit or the social distribution of benefits. While the number of projects reporting farmer numbers increased between

appraisal and completion, reports on outcomes for particular social groups and people (particularly women) declined. While farmer numbers are associated with the use of project inputs (training, credit, extension services, and cooperative or water user group formation), very few social groups or individuals can be directly linked with such easily measured project inputs. The falloff in information on social impact is primarily because the results chains linking inputs to critical outcome indicators is frequently missing, a problem exacerbated by poor M&E.

Improve Monitoring and Evaluation

Current M&E does not provide adequate information to inform Bank management of progress toward strategic objectives—particularly poverty alleviation and the Millennium Development Goals—and needs an overhaul. Overall quality of M&E design improved in the late 1990s with the introduction of logical frameworks and their mandatory use in PADs. Even so, the quality of the M&E systems declined as evaluation has increasingly focused on outcomes and impacts. Only a third of completed projects had a baseline before the project started and less than half attempted to establish a baseline during the project. Slightly more than 20 percent never established a baseline. And only 9 percent of projects that calculated ERRs created "without-project" controls. This raises questions about the robustness of the conclusions drawn by most projects that assert improvements in observed production and farmers' incomes and that attribute it to the Bank's project-level interventions. Even when there was good M&E design, inadequate supervision—possibly because of the widespread practice of delegating supervision to country staff—sometimes reduced effective implementation of M&E. More training of all staff is indicated. Current ICR guidelines would benefit from a mandatory section on who the beneficiaries are and how they benefit. Much greater attention is needed to establish indicators and evaluative frameworks to unambiguously determine and attribute the development impacts of Bank lending.

Increase Focus on Policy and Institutional Reform

PADs make only modest proposals for policy reform and completion reports usually conclude that reform expectations at appraisal were unrealistic, particularly for cost recovery. Dedicated irrigation and drainage projects with policy content—large or small—only give it modest attention. Many appraisal documents implicitly assume either that policy reform is largely complete, or that it is beyond the project's scope—particularly where irrigation and drainage was only one of many components, or where the size of the investment was small. Yet, in many cases, important policy issues remain to be tackled. Therefore, the Bank frequently scaled back lending for irrigation before the policy reforms needed to get the balance right between public and private intervention were completed; examples are Morocco, Nepal, and the Philippines. Yet there have been notable successes, particularly in the ECA Region and Egypt.

Build Support for Water User Groups

There is considerable disillusionment with the performance of water user groups or associations and a widespread view that, for some years, the Bank has had unrealistic expectations for them. While the principle of user participation is still widely supported, farmers often lack the skills needed to manage the larger irrigation systems and the need for continuing government support has been underestimated. Projects have tended to give more emphasis to strengthening WUAs than to strengthening the broader authorization and institutional framework in which they must function. They also did not contain a plan for the gradual phasing out of support as the user groups mature.

Move Beyond Simple Cost Recovery

Expectations about cost recovery following handover to user groups are frequently unrealistic and too ambitious. Most appraisal documents simply outline a strategy to fix water delivery infrastructure, to raise cost recovery, and to increase participation through handover. Few

offer a clearly articulated methodology for improving water use efficiency, whether it be through some form of volumetric pricing, an area/crop-based approach, or lower-cost proxy, or a restricted-supply approach, such as the South Asia *warabundi* system, and too few link this to the redesign of water supply systems. Simultaneous attention to community operation, management, and physical modernization of water distribution networks is not very common, reducing the efficacy of both interventions. Where this is done, the results can be outstanding, as shown in China's Tarim Basin and in Armenia. Where the potential synergy is not captured, the outcomes have been disappointing.

Embed AWM in Sectorwide Approaches

The complementarity among irrigation investments and extension, marketing, and credit services can be improved, particularly for dedicated projects. While there was a big increase in the share of irrigation projects that addressed credit and marketing constraints after 1998—most of this increase derives from nondedicated projects.

Correct Staff Mix Is Important

Markedly different strengths and weakness between dedicated and nondedicated water projects are related to the skills base of task managers. Nondedicated projects scored highly on social and institutional factors but poorly on attention to the quality and sustainability of their (minor) water-engineering components. Conversely, dedicated projects were good on the engineering but tended to neglect institutional issues, social concerns, and incentives for farmers and organizations to improve their efficiency. In the past, these omissions were taken care of by parallel operations—but with the shrinkage of rural sector lending this is a problem. Sector managers expressed no strong views about training and most had no training plans, following Bank policy that it was up to staff to take the initiative—perhaps it is time to introduce training plans to mitigate revealed weaknesses.

APPENDIXES

APPENDIX A: STUDY METHODOLOGY

Overview

The report is based on a desk study that reviewed a wide range of instruments, products, and databases:

- **Portfolio analysis.** One hundred and sixty-one PADs approved from 1994 to 2004, covering all 6 regions and 56 countries were analyzed. A random selection of 80 projects were subjected to detailed evaluations of project design, including development objectives, results chain linkages, and M&E.
- **Analysis of country assistance strategies.** One hundred and thirty CASs, covering 54 countries during the past 10 years were analyzed in relation to five major areas of concern: irrigation, water resource management, agriculture, rural development, and poverty alleviation.
- **Meta-evaluation of IEG's country assistance evaluations.** Thirty-two Country Assistance Evaluations were analyzed to support the meta-evaluation of the Bank's performance in irrigation, water resources management, and agriculture; and to gather evaluative comments on effectiveness in identifying problems and strategies in those sectors.
- **Project completion and performance assessment reports.** ICRs and PPARs from 92 completed agricultural water projects were examined for common lessons from the past decade and to observe emerging trends.
- **Interviews with Bank managers and sector specialists.**
- **Literature review.**
- **Time series analysis.** Various time series data was gathered from the Bank's Statistical Information Management and Analysis database and the FAO's 2004–06 agricultural statistical databases.
- **Informal review of economic and sector work.** Forty-four documents from economic and social work, from 1999 to 2004, on agricultural water were used to update the database used for the 2002 "Bridging Troubled Waters" report, to identify common themes and emerging issues.

1. Portfolio Analysis

The trend analysis of the lending patterns in time and by region drew primarily upon sources within the World Bank and IEG, and particularly upon the Business Warehouse database, through December 2004. Most lending operations were recoded by the Bank back to FY1990 because that year was chosen as the base year for measuring progress toward the Millennium Development Goals.

The new coding system allows for up to five themes and five sectors per activity. Themes are clearly separated from sectors, with themes corresponding to the goals/objectives of Bank activities, and sectors indicating the parts of the economy that receive the Bank's support. Every operation is coded along both the sectoral and thematic dimensions. However, the system omits projects where the amount committed to irrigation and drainage is too small to be included as a sectoral component, which requires some caution in interpreting the figures (IEG's detailed sampling of appraisal documents found that in several dedicated projects the cost of agricultural water components was almost 20 percent more than those identified by using only the sector code). This is especially the case for

CDD projects,[1] such as many Social Funds projects, where there is not a detailed *ex ante* allocation of project costs.

Following this procedure a total of 161 projects were identified. Their main characteristics are detailed in appendix B.

Detailed Review of Project Documents

The analysis focused on 80 projects, randomly drawn from the larger population of 161 agricultural water projects. To facilitate the analysis, the projects were divided into two groups, dedicated and nondedicated. The former group identifies all those projects where the amount committed on irrigation and drainage is greater than 50 percent of the total IDA/IBRD amount committed for the whole project. Nondedicated projects have less than half of Bank financing devoted to agricultural water management activities. Each sampled project was rated against 34 criteria developed from issues raised by Bank poverty, rural and water strategy statements, and key documents in the literature related to poverty, institutions, and policy as regards water (table A1). ICRs and PPARs covering the closed projects in the sample were also reviewed where available, which provided a clearer picture of the design of the projects in relationship to the outcomes and the effectiveness of M&E.

Randomly sampled project documents were scrutinized and scored. The rating scale used was from 1 to 4. A blank was defined as no significant evidence of the feature, 1 was defined as occurrence of the feature to a small extent, 2 was defined as occurrence of the feature to a moderate extent, 3 was defined as occurrence of the feature to a substantial extent, and 4 was defined as occurrence of the feature to a very high level. There was also a Not Applicable (NA) and an Addressed Outside the project (AO) rating for some criteria, mainly policy. As is evident, the mid-point on the range where there was any occurrence at all lay between 2 and 3. In a few cases, there was simply a Yes/No rating. In a few cases, percentages were requested, for example, percentage cost recovery.

Sampling Procedure. The population was stratified twice according to the dedicated/nondedicated definition and according to the two time cohorts, FY94–FY98 and FY99–FY04. In this way it was possible to obtain four groups of projects (table A2). For each group, the number of projects obtained was sampled following a simple random-sample procedure. Therefore, the overall sampling procedure can be defined as a stratified, proportionate, random-sample procedure.

The final list of projects is quite representative of different project types, regions, and countries. In addition to the 80 selected projects, 18 dedicated projects were reviewed, to include the entire population of the 60 dedicated projects. In order not to introduce a selection bias, statistical data from these 18 projects were not used.

Each of the 161 projects was assigned a contiguous ascending number, and then tables of random numbers were used, blindly selecting a starting point in the table. Whenever the selected project happened to be a supplement, the original project was scored instead, but only if it belonged to the same time cohort. When this did not happen, another project was selected following the random-selection procedure described above. Records of the procedure have been kept. Sampling stopped when 80 projects had been selected. The projects selected and IEG's ratings of them are given in appendix C.

Assessment of Monitoring and Evaluation

The 80 random projects were independently reviewed to determine how well M&E had been designed. A follow-up analysis using ICR output and outcome data from these completed projects was used to determine how well M&E had been implemented. This was based on the application of 17 evaluation questions (table A3) and their overall categorization, to determine the overall quality of M&E from an evaluation and impact assessment perspective (table A4). Results are presented in appendix D.

Table A1. The 34 Criteria Used for Describing/Rating the Project Design

Poverty mentioned as explicit objective? (Y/N)
Extent to which project design incorporates a poverty focus (even if no poverty objective). (1 to 4 or NA)
Extent of direct targeting of benefits towards poorer, e.g. selection of location, communities, households. (1 to 4 or NA)
Given both the objectives and design, does this warrant classification as a poverty-focused intervention? (Y/N)
Quality of analysis distributional aspects (who, why poor, what to do, power relationships) incl. location (e.g., head/tail, elite). (1 to 4, NA)
Was a social assessment carried out? (Y/N or NA)
Is project employment impact or wages analyzed or substantively discussed? (Y/N or NA)
Extent of analysis of, or substantive discussion of, water rights of beneficiaries. (1 to 4 or NA/AO)
Extent of policy content including legislation, pricing, rights, but excluding institutional. (1 to 4 or NA/AO)
Extent of institutional reform, e.g., public/private shift, new organization (excludes pricing covered under policy). (1 to 4 or NA/AO)
To what extent does project aim to reform or significantly strengthen public institutions at central level? (1 to 4 or NA/AO)
To what extent does project aim to reform or significantly strengthen public inst. below central, e.g., region/district? (1 to 4 or NA/AO)
Extent of gender focus in project design. (1 to 4 or NA)
Total number of beneficiaries in household. (give no. or NG, for not given)
Percent of poor in beneficiary total if known. (% or NG)
Hectares of land benefiting. (ha or NA)
Predominant hectares benefiting large farms (L) or small (S) as defined by PAD. (or NA)
Quality of M&E indicators of poverty performance. (1 to 4 or NA)
Quality of M&E design. (1 to 4 or NA)
If not classified as poverty-focused, list in logical sequence any clearly plausible project poverty logic.
If not classified as poverty-focused, what might have been the poverty impact of the "without project" scenario? (qualitative)
If not classified as poverty-focused, to what extent do the previous two criteria suggest that the project is indirectly pro-poor? (1 to 4 or NA)
To what extent does project aim to strengthen community orgs. or participation, e.g., through WUAs? (1 to 4 or NA/AO)
To what extent does PAD propose autonomy for WUAs (in fee collection, retention, expenditure, and water management)? (1 to 4 or NA)
To what extent does PAD indicate support to WUAs on water management? (1 to 4 or NA)
To what extent is a broader sector strategy of which this project is a part clearly outlined in the PAD? (1 to 4 or NA)
Estimate approximate planned average percent cost recovery for capital investment. (give % or NA)
Estimate approximate preproject average percent cost recovery for O&M. (give % or NA)
Estimate approximate planned average percent cost recovery for O&M. (give % or NA)
To what extent does project address water efficiency, e.g., through water charges, regulations, or technical design? (1 to 4 or NA/AO)
To what extent does PAD indicate how shortfalls in cost recovery are to be handled, e.g., public subsidy, cross-subsidy? (1 to 4 or NA)
To what extent does PAD address environmental water issues such as quality, groundwater depletion, etc. (1 to 4 or NA)
Which of following are supported or linked to significant extent in project design? Marketing (M), Extension (E), Credit (C) (or NA/AO)
To what extent does the PAD propose collaboration with other water agencies, e.g., environment, fisheries, agriculture? (0 to 4 or NA)

Table A2. Distribution of Randomly Sampled Projects, by Project Type

Projects sampled	Dedicated	Nondedicated	Total
FY94–FY 98	20	17	37
FY99–FY 04	22	21	43
Total	42	38	80

2. Analysis of Country Assistance Strategies

CASs covered 54 countries, and during the period FY94–FY04 there were 130, each of which was entered into a special database. The primary analysis was textural, aided by the commercial software package Atlas Ti.[2] The analysis interrogated the whole text of each CAS to determine the presence of 21 key phrases (table A5). When a phrase was encountered, the paragraph in which that phrase occurred was extracted and stored. Following scrutiny to determine the relevance of each hit, the relevant hits were added to the summary database. In this way, 544 AWM references in 124 CASs, containing phrases relevant to this study's evaluation questions could be related to time, 51 countries, and region. Detailed results are presented in appendix E.

Table A3. Evaluation of M&E Design and Implementation

Evaluation Questions	Evaluative score
Objectives: level of clarity (1= negligible, 4 = high)	1 to 4
Logical framework (0 = absent, 1 = negligible, 4 = high)	0 to 4
M&E system in place ex ante	0 to 4
M&E system specified by project	0 to 4
Quality of M&E plan	0 to 4
Desired outputs clearly defined	0 to 4
Desired outcomes clearly defined	0 to 4
Indicators well structured	0 to 4
Focus on outcome indicators	0 to 4
M responsibility assigned	0 to 4
M coordination assigned	0 to 4
Support for M&E capacity building	0 to 4
Feedback loops for management?	0 to 4
Evaluative baseline specified	0 to 4
M&E as condition of lending?	0 or 1
ICR (0= active project, 1 = completed project)	0 or 1
Baseline status (0 = none, 3 = start, 2= middle, 1=end)	0 to 3
Ex-post survey(s)	0 to 4
Transparency of evaluation (0 = none, 1 = negligible, 4 = high	0 to 4

Table A4. Typology for Classification of M&E Findings from Project Design

Output indicators, but no outcome or impact indicators
Output indicators as well as outcome or impact indicators, but no baseline
Output and/or impact indicators and baseline
Output and/or impact indicators and control groups but no baseline
Outcome and/or impact indicators and baseline and control groups

Table A5. Topics Researched in 130 CASs

Irrigation
Institutional Development/Reform (Irrigation & Water)
Participation in Irrigation
Rural Development
Irrigation & Rural Development
Rural Poverty Alleviation
Role of Rural Development in Poverty Alleviation
Institutional Development in Rural Development
Participation in Rural Development
Rural Development & Agricultural Growth
Agricultural Development
Agricultural Growth and Irrigation
Agricultural Development & Economic Growth
Institutional Reform/Development in Agriculture
Participation in Agriculture
Water Resource Management
Irrigation & Water
Cost Recovery
Water Users
Water Tariffs
Technical Assistance

3. Meta-evaluation of IEG's Country Assistance Evaluations

The methodology for CAEs was similar to that used for the evaluation of CASs.

4. Project Completion and Performance Assessment Reports

Two types of analysis were undertaken: (i) a qualitative review of achievements, issues, problems, and a categorization of lessons learned; and (ii) a more detailed analysis of the outputs and outcomes reported by each ICR.

Analysis of planned and actual outputs and outcomes reported by each PAD and ICR in the portfolio. In addition to the qualitative evaluation of the objectives and components of each PAD and ICR, the study also analyzed the quantitative output data (table A6). Results are summarized in appendix F.

Categorization of achievements, issues, problems, and lessons learned. Sixty-three ICRS and eight PPARs of projects approved from FY94 were used to create a database and the lessons learned. After categorization, 408 lessons were classified into 11 types (table A7) for further analysis and review (detailed in appendix F).

5. Interviews of Bank Managers and Staff

A total of 17 managers were interviewed in the period April–May 2005. All of the interviews were conducted under a guarantee of confidentiality. The list of questions, presented below, was designed as a guide, rather than as a formal questionnaire, to allow the discussion to follow leads as they occurred. Despite the variety of respondents contacted (belonging to different departments, gender, etc.), the sample was not selected randomly, and for this reason no statistical inferences were drawn from this exercise. The main goal of the interview was to collect additional and competent views to inform the analysis conducted on the operational documents, and to have additional internal insights on reasons, causes, and impressions with respect to the role and the trends of the irrigation and drainage subsector. The main questions were as follows:

Table A6. Quantitative Comparison of Predicated and Actual Outputs from Projects

Irrigation—area planned and actually achieved (ha).
Drainage—area planned and actually achieved (ha).
Farmers/Farm families—number of household units or number of individual farmers targeted and reported as being reached at the end of the project.
People—number of individuals targeted and reached by the project.
Engineering costs—planned and actual costs.
Institutional development and capacity building costs—planned and actual costs.

Table A7. Typology Used to Classify Frequency of Lessons Drawn from ICRs and PPARs

Project Design
Implementation & Procedural
Community-Driven Development
Cost Recovery
Knowledge/Information/Skills Mobilization
Technology
Economics
Institutional
Bank Processes
Targeting
Disaster-Related

1. What are the main reasons Bank-wide for the decline/change in irrigation and drainage (I&D) lending (reasons prioritized)?
2. What does the I&D subsector need to do to be more relevant to evolving Bank priorities?
3. What has been and what could be the role of I&D in rural poverty alleviation?
4. What are your views on Bank staffing, training, skills, and management in the subsector?

6. Literature Review

A systematic review of the global state of irrigation and drainage and its impact on economic growth and poverty was conducted by the International Food Policy Research Institute (IFPRI), a policy research organization known worldwide for its studies on the role of irrigation in agricultural development. The main objective of this general review was to identify issues and challenges in the agricultural water sector in the period 1994–2004. The results of this review form a separate supporting paper.

Lending Analysis

From FY94 to FY04, the World Bank approved 161 agricultural water projects that designated "irrigation and drainage" (I&D) as a sector of intervention. The details of these projects are shown in table B6 at the end of this appendix. Because the system provides up to five sectors of intervention for each project, some of the selected projects show the I&D sector as the main sector of intervention; for others it is shown as the third, or even fifth, sector. For each project the system provides the amount specifically spent on I&D. Unfortunately, the system omits projects where the amount committed to I&D is too small or is considered too negligible to be included as a sectoral component. This is especially the case for CDD projects, for example, in many Social Funds projects, where the allocation of project costs is not detailed *ex ante*.

Table B1. Number of Dedicated and Nondedicated Projects per Year

FY	# dedicated	# nondedicated
1994	5	6
1995	8	11
1996	3	6
1997	5	11
1998	7	11
1999	8	18
2000	5	6
2001	4	9
2002	4	6
2003	2	9
2004	9	8
Total	60	101

Source: World Bank's Business Warehouse database.

A broader search among all the Bank projects approved in the period under review added at least 210 more projects that were likely to include some sort of intervention in agricultural water, 153 of which presented characteristics of CDD projects. This high number suggests the importance given to the participatory approaches of many irrigation projects, and it is not surprising to see almost half of the 161 projects present at least some characteristics of CDD projects.

Out of the 161 selected projects, 60 "dedicated" projects were identified (table B1) with more than 50 percent of the total IDA/IBRD amount committed for the whole project designated for I&D. These projects were subjected to particularly close scrutiny in the study. Note that the 50 percent cutoff was based on the planned allocation, not actual allocation.

Out of the 161 projects, 119 show Rural Development as the sector board, which means that 42 projects are not classified as Rural Development projects. These were classified as shown in table B2.

All but one of the dedicated projects have Rural Development as the sector board (the one exception lists the Environmental Department). Most (155 out of the 161 projects) have "investment" as the lending instrument type, while six projects are identified as "adjustment." None of the six is listed among the dedicated projects.

The 161 projects are in a total of 56 countries. The total amount committed by the Bank in these 161 projects is US$13.2 billion (in 2002 US$), roughly the 5.6 percent of the total Bank

Table B2. Sector Boards of 161 I&D Projects

Sector board	No.
Rural sector	119
Urban development	11
Social protection	10
Environment	4
Water supply	4
Social development	3
Transport	3
Financial sector	2
Private sector development	2
Public sector governance	2
Health nutrition and population	1

Source: World Bank's Business Warehouse database.

lending committed for the period. The total amount committed specifically on I&D (with all the caveats about the data) is US$5.56 billion (in 2002 US$), which represents about 2.36 percent of the total Bank lending committed for the period.

Regional Lending Patterns and Number of Operations

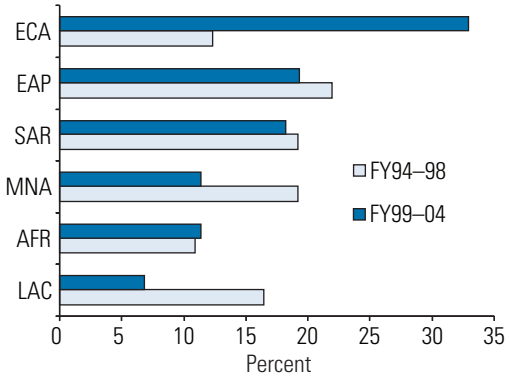
Table B3 and figure B1 show the geographical distribution of the operations. The ECA region leads with respect to the number of operations. Dividing the number of projects into two temporal cohorts (FY94–FY98 and FY99–FY04) shows the changes over time.

Table B3. Geographical Distribution of I&D Projects per Year

Fiscal Year	ECA	EAP	SAR	MNA	AFR	LAC	TOT
1994	0	3	3	2	0	3	11
1995	3	3	2	4	3	4	19
1996	2	2	2	2	1	0	9
1997	1	3	3	4	3	2	16
1998	3	5	4	2	1	3	18
1999	10	8	2	1	3	2	26
2000	5	0	2	2	2	0	11
2001	4	5	1	1	1	1	13
2002	2	0	5	1	1	1	10
2003	4	2	0	4	1	0	11
2004	4	2	6	1	2	2	17
TOTAL	38	33	30	24	18	18	161

Source: World Bank's Business Warehouse database.

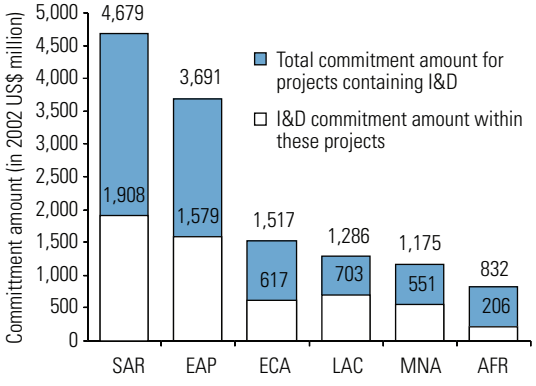
Figure B1. Distribution of Projects by Region, per Time Cohort



Source: World Bank's Business Warehouse database.

The most striking figure seems to be the increase in the number of operations in the ECA region.[1] However, looking at the cumulative lending amounts in projects containing I&D per region and at the amount specifically committed on I&D from FY94 to FY04 (in 2002 dollars) the picture changes (see figure B2). On the one hand, the Asia regions dominated irrigation lending (thus confirming the figures of the 1980s; see IEG 1995).[2] On the other hand, the ECA region had many small projects (on average, US$16 million per project committed specifically to I&D; figure B3).

Figure B2. Commitment Amount in Irrigation Projects per Region, FY94–FY04



Source: World Bank's Business Warehouse database.

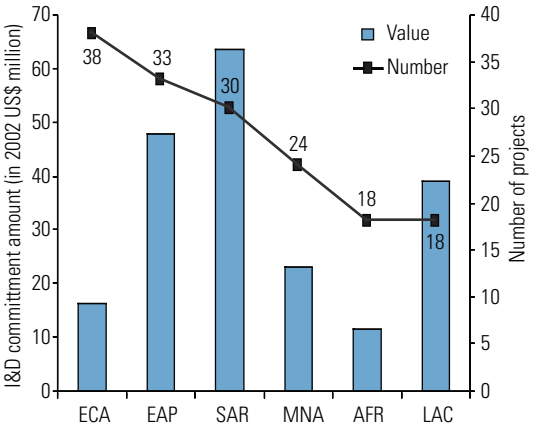
India alone has accounted for almost 23 percent of the total amount committed to I&D, China for 14 percent, Pakistan for 7 percent, and Indonesia for 6 percent. These countries are consistently the largest borrowers; they account for the highest number of operations in the period and for the greatest consistency (at least six years with at least one operation in the whole period). Mexico, with only two operations, is the third largest borrower, accounting for almost 8 percent of the total amount committed to I&D.

Concerning the number of operations per country, China, with 13 projects, accounts for 39 percent of the total number of operations in the EAP region (and 8 percent of the overall total); India, with 12 projects, for 40 percent of the total number of operations in the SAR region (7 percent of the total); Pakistan, with 9 projects, for 30 percent of the total number of operations in the SAR region (almost 6 percent of the total); Indonesia, with 8 projects, for 23 percent of the total number of operations in the EAP region (5 percent of the total).

Figure B4 shows that EAP has eclipsed SAR in its share of total I&D lending, with SAR experiencing the greatest drop in I&D commitment amount. ECA exhibits the greatest jump, but the share is still quite low.

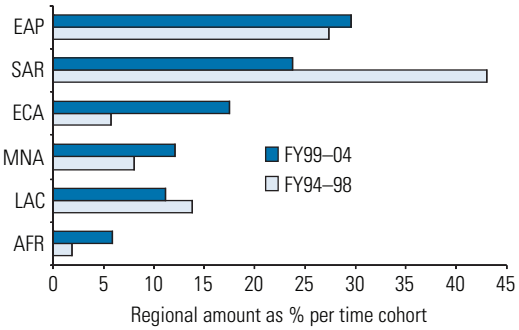
Figure B5 shows the amount committed by the Bank specifically to I&D, as a ratio of the total Bank committed amount.[3] The percentage fell from about 3 percent in the period 1990–94, to an average of less than 1.7 percent in the period 1999–2003, but rose sharply in 2004. However, 2004 had two big projects: the Mexico Irrigation

Figure B3. Average I&D Commitment Amount per Project and Number of Projects per Region



Source: World Bank's Business Warehouse database.

Figure B4. Specific I&D Amount Committed, per Region



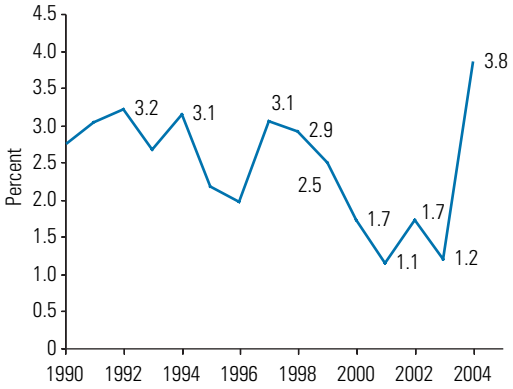
Source: World Bank's Business Warehouse database and calculations.

Table B4. Number of Projects and I&D Commitment Amount per Region

Projects	ECA	EAP	SAR	MNA	AFR	LAC	TOT
Number of I&D Projects	38	33	30	24	18	18	161
Total I&D Projects Commitment Amount (in 2002 US$ million)	1,517	3,691	4,679	1,175	832	1,286	13,181
I&D Commitment Amount (in 2002 US$ million)	617	1,579	1,908	551	206	703	5,563
Average I&D Commitment Amount per Project (in 2002 US$ million)	16	48	64	23	11	39	35

Source: World Bank's Business Warehouse database.

Figure B5. I&D Commitment Amount as Percentage of Total Bank Committed Amount



Source: World Bank's Business Warehouse database and calculations.

and Drainage Modernization Project and the Vietnam Water Resources Assistance Project. Totaling over $370 million overall (in 2002 US$), these two projects made up half of the lending to the subsector. Again, the figures are to be treated with caution (as stressed above, IEG's detailed sampling of appraisal documents found that in several dedicated projects the cost of agricultural water components was almost 20 percent more than those identified when using only the sector code). However, this additional information does not change the conclusions about the overall trend.

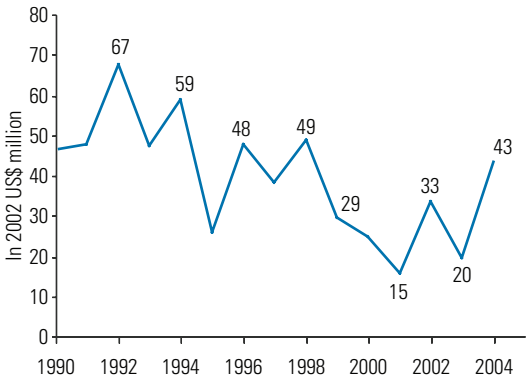
Lending and Time Periods

Figure B6 shows the average amount committed specifically on I&D per project per year (in 2002 US$). The average amount committed on I&D per project fell from above $50 million in the period 1990–94 to an average of less than $30 million in the last four years. The reason that the average project size got smaller is because there were fewer large dedicated irrigation projects and the size of the irrigation and drainage components in nondedicated projects shrank.

Figure B7 shows, in percentage terms, the trend in large projects (defined as projects where an amount larger than $80 million was committed specifically to I&D) versus the trend in small projects (defined as projects where an amount smaller than $30 million was committed to I&D). For the period 1990–2004 there is a decreasing trend for large projects and an increasing trend for small projects. (from 40 percent in 1990 to an average above 60 percent after 1995).

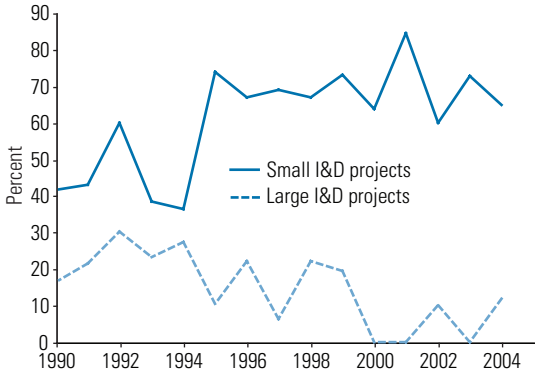
Figure B8 validates the previous analysis by showing, in percentage terms, the trend for the number of dedicated projects out of the total number of I&D projects approved per year; and the trend for the I&D amounts committed to dedicated projects as a percentage of the total amount committed by the Bank to I&D.

Figure B6. Average I&D Commitment Amount per Project



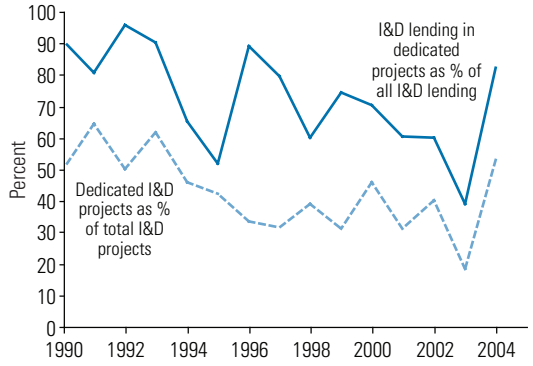
Source: World Bank's Business Warehouse database and calculations.

Figure B7. Percentage of Projects with Large versus Small I&D Committed Amounts



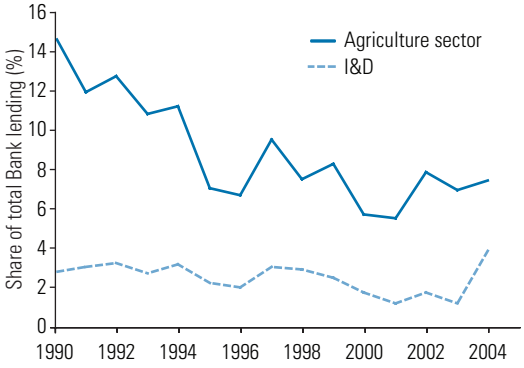
Source: World Bank's Business Warehouse database and calculations.

Figure B8. Lending and Number of Dedicated Projects Decreased



Source: World Bank's Business Warehouse database and calculations.

Figure B9. Agriculture Sector and I&D Lending as Percentage of Total Bank Lending



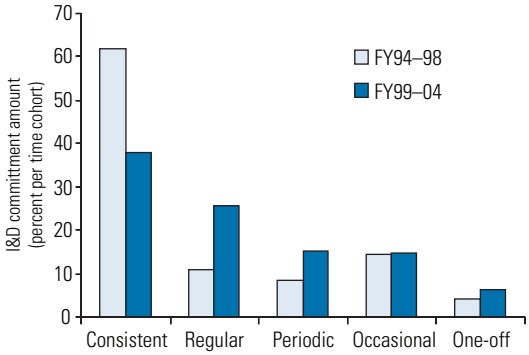
Source: World Bank's Business Warehouse database and calculations.

The same is true for the agriculture sector as a whole (figure B9). In fact, the decrease in the agriculture sector as a whole is greater than the one experienced by the I&D subsector alone.

As shown in table B5 and figure B10, the volume of lending to the four most consistent and large I&D borrowers of the last 15 years (India, China, Pakistan, and Indonesia) has declined.

The typology of borrowers was based on the number of operations per borrowers. However, a high correlation among the number of operations, consistency of operations per borrower (number of years with at least one operation, i.e., frequency of borrowing across

Figure B10. I&D Commitment Amount per Group of Borrowers



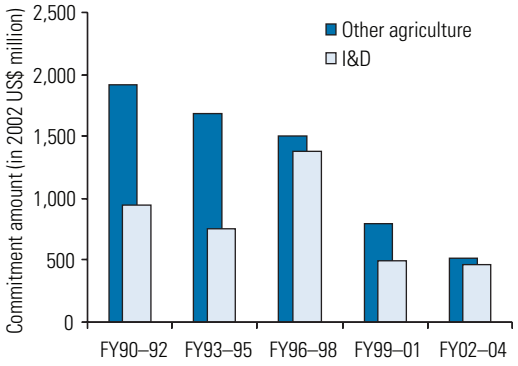
Source: World Bank's Business Warehouse database and calculations.

Table B5. Lending Pattern and Number of Projects per Borrower Type

Borrower typology (and number of projects)	FY94–FY98			FY99–FY04		
	I&D comm. amount			I&D comm. amount		
	US$ (millions)	Percent	Projects	US$ (millions)	Percent	Projects
Consistent (4)	1,884	62	24	956	38	18
Regular (9)	336	11	15	646	26	29
Periodic (10)	255	8	13	384	15	17
Occasional (12)	444	15	13	370	15	11
One-off (21)	131	4	8	157	6	13
Total	**3,050.5**	**100**	**73**	**2,512**	**100**	**88**

Source: World Bank's Business Warehouse database.

Figure B11. Consistently Large Borrowers: Commitment Amount in Other Agriculture versus I&D Commitment Amount



Source: World Bank's Business Warehouse database and calculations.

the years), and amount committed to I&D per borrower was found. In fact, the first four borrowers with respect to number of operations (Indonesia, Pakistan, India, and China) are also among the five more consistent borrower (along with Yemen) and among the five receiving the highest amount in the period (with Mexico). Mexico, one of the largest I&D borrowers, accounts only for a small number of operations containing I&D, and for this reason does not appear in the group of the consistently large I&D borrowers.

The decrease in "other agriculture" (all agriculture but I&D) for the consistently large borrower (figure B11) suggests a steady drop in agriculture-supportive interventions. The decrease in I&D commitment amount was, therefore, not matched by an increase in the amount committed elsewhere in the agriculture sector after 1999.

Table B6. Agricultural Water Management Portfolio, FY94–FY04

Projects randomly selected for detailed analysis are indicated by an asterisk (*)

Project Information								IEG Evaluation 1		
Bank ID	Country	Name	Entry FY	Total Cost US$ millions	Bank Lending US$ millions	Closing Date	Extension months	Outcome	Sustainability	Institutional Development
P000296	Burkina Faso	Agricultural Services	1998	50	41	Dec-04	36	MU	UL	M
P000771	Ethiopia	Social Rehabilitation	1996	242	120	Dec-04	36	MS	UL	M
P001522 *	Madagascar	Irrigation II	1995	26	21	Sep-00	3	MS	UL	M
P001738	Mali	Irrigation Promotion	1997	5	4	Mar-03	9	U	UL	NEG
P001799	Mozambique	Agric Sector Pep	1999	202	30	Dec-05				
P001994	Niger	Pilot Private Irrigation	1995	8	7	Dec-01	18	S	L	SU
P003218	Zambia	Agricultural Sector Invest	1995	60	60	Dec-01	24	U	UL	M
P003593	China	Songliao Plain ADP	1994	382	205	Jun-02	6	MS	L	M
P003594	China	Gansu Hexi Corridor	1996	259	150	Dec-06				
P003596*	China	Yangtze Basin Water	1995	552	210	Dec-05	48	S	L	SU
P003954*	Indonesia	Java Irr Imp & W R M	1994	304	166	Dec-02	24	U	UL	M
P004008*	Indonesia	Nusa Tenggara Dev.	1996	41	27	Sep-03	12	MU	UL	M
P004010	Indonesia	Dam Safety Project	1994	63	55					
P004613*	Philippines	Water Resources	1997	85	58	Jun-05				
P004834*	Vietnam	Irrigation Rehabilitation	1995	136	100	Jun-03	18	S	L	SU
P004845*	Vietnam	Mekong Delta Water	1999	148	102	Jun-07				
P004978*	Algeria	Social Safety I	1996	70	50	Mar-01	15	S	L	SU
P005173*	Egypt	Irrigation Improvement	1995	182	80	Jun-06				
P005310*	Jordan	ASAL	1995	80	80	Apr-97	4	MS	L	SU
P005321*	Jordan	TA For Agriculture	1995	7	7	Dec-00	18	MS	L	M
P005344*	Lebanon	Irrigation	1994	57	57	Apr-04	34	S	HL	SU
P005721*	Tunisia	Agricultural Sec Inv	1994	211	120					
P005731	Tunisia	Greater Tunis Sewerage	1997	107	60	Dec-05				

(Table continues on next page)

Table B6 (continued)

Project Information								IEG Evaluation 1		
Bank ID	Country	Name	Entry FY	Total Cost US$ millions	Bank Lending US$ millions	Closing Date	Extension months	Outcome	Sustainability	Institutional Development
P005736	Tunisia	Natural Resource Mgmt	1997	51	27	Jun-04	6	S	L	SU
P005902*	Yemen	AGRI Privatization	1998	46	25	Dec-05				
P006041	Argentina	Small Farmer Development	1998	100	75	Dec-06				
P006104	Belize	Belize City Infrastructure	1994	28	20	Jun-98		MS	NE	M
P007020*	Dominica	Irrig Land & Watersh	1995	43	28	Dec-04	12	U	UL	M
P008037*	Peru	Irrigation Subsector Project	1997	172	85	Dec-08		S	L	SU
P008173	Uruguay	Irrigation Natl Res Mgmt	1994	74	41	Dec-02	36	MU	UL	M
P008270	Albania	Irrig Rehabilitation	1995	45	10	Jun-01	0	S	L	SU
P008277*	Armenia	Irrig Rehabilitation	1995	57	43	May-01	24	S	L	SU
P008284*	Azerbaijan	Irrig/Drainage Rehab	2000	47	42	May-06				
P008286*	Azerbaijan	Irrig Dist Sys & Mgmt	2003	39	35	Mar-10				
P008403*	Estonia	Agriculture	1996	31	15	Jun-02	6	HS	L	H
P008510	Kazakhstan	Irrig & Drainage	1996	118	80	Dec-04	12	S	L	SU
P009072*	Turkey	Priv Of Irrigation	1998	59	20	Jun-04	18	S	L	SU
P009122	Uzbekistan	Cotton Subsector	1995	74	66	Jun-02	18	MS	UL	M
P009127*	Uzbekistan	Drainage, Irrig & Wetlands	2003	75	60	Jun-10				
P009964*	India	Haryana WRCP	1994	483	258	Dec-01	12	MS	L	M
P010447	Pakistan	Public Sector Adjust	1994	250	250	Dec-95		MS	NE	N
P010453	Pakistan	Balochistan NRM	1994	18	15	Jun-00		U	UL	M
P010461	India	Madras Wat Sup II	1995	421	276	Mar-04	21	MS	L	M
P010476	India	Tamil Nadu WRCP	1995	491	283	Sep-04	30	S	L	SU
P010482*	Pakistan	Balochistan Comm Irrig	1996	39	27	Jun-02	12	S	L	M
P010500*	Pakistan	Natl Drainage Program	1998	785	285	Dec-04				

(Table continues on next page)

Table B6 (continued)

Project Information								IEG Evaluation 1		
Bank ID	Country	Name	Entry FY	Total Cost US$ millions	Bank Lending US$ millions	Closing Date	Extension months	Outcome	Sustainability	Institutional Development
P010501*	Pakistan	Pvt Sector Groundwater	1997	105	56	Dec-01	0	MS	NE	M
P010529*	India	Orissa WRCP	1996	346	291	Sep-04				
P010530*	Nepal	Irrig Sector Devt	1998	103	80	Jun-04	24	MS	UL	M
P034212*	Sri Lanka	Mahaweli Restructuri	1998	74	57	Dec-06		U	UL	M
P034891*	Indonesia	Village Infrastructu	1995	84	73	Sep-98		HS	L	SU
P035158*	India	AP Irrigation III	1997	477	325	Jul-04	18	S	L	M
P035707*	Tunisia	Water Sector Investment	2000	258	103	Jun-06				
P035717	Brazil	Rural Pov. (Bahia)	1995	175	105	Jun-01	6	S	L	SU
P037079*	Philippines	Agrarian Reform Comm	1997	106	50	Dec-03	0	S	L	SU
P038399*	Macedonia	Irrig Rehab	1998	33	13	Mar-06				
P038570	Tanzania	Riv Basin Mgmt & Smll Hldr Irr	1997	26	26	Jun-04	18	S	L	SU
P038695	Algeria	Dz-Mascara Emerg.Recons	1995	84	51	Dec-99	12	S	L	M
P038884*	Brazil	Rural Pov.- Ceara	1995	117	70	Jun-01	6	HS	L	SU
P038885*	Brazil	Rural Pov.-Sergipe	1995	60	36	Jun-01	6	S	L	SU
P040085	Bolivia	Rural Investment	1998	87	63	Jun-06				
P040521	Indonesia	Village Infrastructure Ii	1997	140	140	Jul-00	7	HS	L	SU
P040544	Azerbaijan	Farm Privatization	1997	29	15	Dec-03	18	HS	HL	SU
P040610	India	Rajasthan WRCP	2002	180	140	Mar-08				
P041410*	Egypt	Pumping Station Rehabilitation 3	1999	253	120	Aug-06				
P041723*	Mali	Rural Infrastructure	2000	139	115	Jun-07				
P042442*	Peru	Sierra NRM	1997	51	51	Mar-04	9	S	L	M

(Table continues on next page)

Table B6 (continued)

Project Information								IEG Evaluation 1		
Bank ID	Country	Name	Entry FY	Total Cost US$ millions	Bank Lending US$ millions	Closing Date	Extension months	Outcome	Sustainability	Institutional Development
P043367	Yemen	Taiz Water Supply Pilot	1997	11	10	Dec-01	18	U	UL	NEG
P043881*	Romania	Irrigation Rehabilitation	2004	103	80	Mar-11				
P044711	Mauritania	Irrigated Agric	2000	46	38	Jun-05				
P045499	Egypt	National Drainage Ii	2000	278	50	Jun-07				
P046042*	Kyrgyz Republic	Irrigation Rehabilitation	1998	47	35	Dec-05				
P046043*	Uzbekistan	Rur Ent Support	2002	43	36	Jul-06				
P046045*	Kazakhstan	Syr Darya Control	2001	86	65	Feb-07				
P046563	China	Tarim Basin II	1998	273	150	Dec-04	0	HS	HL	H
P046952	China	Forest. Dev. Poor Ar	1998	364	200	Jan-06				
P048522*	Yemen	Emergency Flood Rehab	1997	35	30	Dec-01	17	S	L	SU
P048697	Madagascar	Urban Infrastructure	1997	46	35	Jun-05				
P049301	India	AP Emerg. Cyclone	1997	150	150	Jul-03	36	U	L	SU
P049385*	India	AP Econ Restructuring	1998	830	543	Mar-06				
P049665*	China	Anning Valley Ag.Dev	1999	240	120	Dec-06				
P049700	China	Iail-2	1998	849	300	Jun-05				
P049718*	Tajikistan	Farm Privatization Support	1999	24	20	Nov-05				
P049723*	Kyrgyz Republic	On-Farm Irrigation	2000	29	20	Mar-07				
P049791	Pakistan	Poverty Alleviation Fund	1999	90	90	Dec-04	0	HS	L	SU
P050418	Tunisia	ASIL 2	1998	69	42	Dec-02	6	MS	L	SU
P050601	Cambodia	Social Fund Ii	1999	25	25	Mar-05				
P050646*	India	UP Sodic Lands Ii	1999	287	194	Sep-07				
P050647*	India	UP WRCP	2002	174	149	Oct-07				
P050881	Brazil	Piaui Rural Poverty	2001	30	23	Jun-06				

(Table continues on next page)

Table B6 (continued)

Project Information								IEG Evaluation 1		
Bank ID	Country	Name	Entry FY	Total Cost US$ millions	Bank Lending US$ millions	Closing Date	Extension months	Outcome	Sustainability	Institutional Development
P050886	Burkina Faso	Private Irrigation TA	1999	5	5	Dec-04	12	MS	L	SU
P051171	Armenia	SAC 3	1999	65	65	Jun-01	12	MS	L	SU
P051309	Albania	Community Works	1999	17	9	Mar-03	0	S	L	SU
P051386	Philippines	Szopad Social Fund	1998	15	10	Dec-02	12	S	NE	M
P051888	China	Guanzhong Irrigation	1999	200	100	Jun-06				
P051922*	Madagascar	Rural Development Support	2001	106	89	Jun-07				
P055022*	Armenia	Irrig Devt	2002	31	25	Mar-07				
P055068*	Georgia	Irr/Drain Rehab	2001	33	27	Apr-08				
P055434	Bosnia-Herzegovina	Small Scale Com Agric	2003	14	12	Dec-09				
P055974*	Bolivia	El Niño Emergency	1998	28	25	Mar-01	3	S	UL	M
P056216	China	Loess Plateau Ii	1999	150	150	Jun-05				
P056491	China	Hebei Earthquake Rehab	1998	41	28	Dec-00	0	HS	HL	SU
P056516	China	Water Conservation	2001	186	74	Jun-06				
P056595	Kenya	El Niño Emergency	1999	40	40	Dec-01	18	S	L	M
P057271	Guyana	El Niño Emergency	1999	10	9	Mar-02	4	S	L	SU
P057925	Bulgaria	ASAL I	1999	76	76	Jul-00	0	S	L	SU
P057926	Bulgaria	ASAL 2	2001	50	50	Jul-02	0	MS	L	M
P057952	Armenia	SIF 2	2000	29	20	Dec-05				
P058070*	Sri Lanka	North-East Irrigated Agriculture Project	2000	32	27	Jun-05				
P058468	Bangladesh	Agricultural Services	2000	14	5	Mar-03	0	U	NE	M
P058841*	Cambodia	Northeast Village	1999	6	5	Jun-04	26	S	UL	M
P058877	Turkey	Emgy Flood Recovery	1999	685	369	Sep-03	15	S	L	M
P058898*	Tajikistan	Rural Infra Rehab	2000	24	20	Mar-06				

(Table continues on next page)

Table B6 (continued)

Project Information								IEG Evaluation 1		
Bank ID	Country	Name	Entry FY	Total Cost US$ millions	Bank Lending US$ millions	Closing Date	Extension months	Outcome	Sustainability	Institutional Development
P059055	Tajikistan	Emg Flood Asst	1999	6	5	Dec-01	6	U	UL	NEG
P059803*	Kazakhstan	Nura River Cleanup	2003	68	40	Sep-09				
P059931	Indonesia	Water Resources & Irrigation	2003	116	70	Dec-09				
P062682*	Kyrgyz Republic	Flood Emergency	1999	14	10	Mar-04	30	S	HL	SU
P062714*	Yemen	Irrigation Improvement	2001	26	21	Jun-07				
P062748*	Vietnam	Community Based Rural Infra.	2001	123	103	Dec-07				
P063123	China	Yangtze Flood Emergency	1999	133	80	Jun-02	0	HS	HL	SU
P063201	Dominica	Hurricane Georges Recovery	1999	125	111	Jun-03	17	S	L	M
P063622	Nigeria	Fadama II	2004	125	100	Dec-09				
P064118	Indonesia	WATSAL	1999	300	300	Nov-04	35	S	L	SU
P064879*	Armenia	Irrig Dam Safety	1999	30	27	Sep-07				
P064981	Yemen	Sana'a Basin Water Mgmnt	2003	30	24	Jun-09				
P065463	China	Jiangxi Integrated Agric. Modern.	2004	154	100	Jun-10				
P065898	Vietnam	Water Resources Assistance	2004	176	158	Dec-11				
P065973	Laos	Agricultural Development	2001	18	17	Jun-07				
P066335*	Albania	Comm Works Support	1999							
P068786	Tajikistan	Suplmt Emg Flood Asst	2000							
P069124	Morocco	Rainfed Agriculture	2003	41	27	Dec-09				
P069923	St. Vincent & Grenadines	Disaster Management	2002	7	6	Jan-06				
P070950	Turkey	Anatolia Watershed	2004	38	20	Jun-12				
P071033*	India	Karnataka Tank Mgmt	2002	125	99	Jan-09				
P071092*	Pakistan	NWFP OFWM	2001	32	21	Jun-06				
P072760*	Tajikistan	Farm Priv Supp. Supplmt	2001							

(Table continues on next page)

Table B6 (concluded)

Project Information								IEG Evaluation 1		
Bank ID	Country	Name	Entry FY	Total Cost US$ millions	Bank Lending US$ millions	Closing Date	Extension months	Outcome	Sustainability	Institutional Development
P072996*	Niger	Priv Irrigation Promotion SIL	2002	48	39	Dec-07				
P073310*	Cambodia	SUPPL Credit SOCIAL FUND II	2001							
P073394	Cambodia	Flood Emergency	2001	40	35	Jun-05				
P073531*	Morocco	Social Development Agency	2002	15	5	Jun-08				
P074018	India	Gujarat Earthquake Reconstruct	2002	504	443	Oct-07				
P074075	Egypt	Second Matruh Resource Mgmt	2003	40	12	Feb-05				
P074266*	Chad	Agr Services & Pos SIL	2004	25	20	Sep-08				
P074413*	Yemen	Groundwater & Soil Conservation	2004	53	40	Oct-09				
P076784	Algeria	Second Rural Employment	2003	143	95	Jun-09				
P077257*	Ecuador	Indigenous Peoples 2 (Prodepine2)	2004	45	34	Sep-09				
P077457	Ethiopia	ESRDF I Supplemental	2003							
P077533	Afghanistan	Emergency Community Empowerment Project	2002	42	42	Dec-04	0	S	NE	SU
P078936*	Afghanistan	Emer Irrig Rehab	2004	40	40	Sep-07				
P078997*	Pakistan	Sindh OFWM	2004	85	61	Dec-08				
P079156*	Indonesia	Third Kecamatan Development Project	2003	377	250	Dec-08				
P081968*	Nepal	Poverty Alleviation Fund	2004	17	15	Feb-09				
P082128*	Albania	Water Res Mgmt	2004	40	15	Jun-09				
P082977	Pakistan	Second Poverty Alleviation	2004	368	238	Jul-08				
P084329*	Afghanistan	Emergency National Solidarity	2004	95	95	Mar-07				
P086747*	Sri Lanka	NEIAP II	2004	81	65	Mar-11				
P088499	Armenia	Irrigation Dam Safety 2	2004	8	7	Mar-09				

Explanation of Evaluation Terms for Table B6

Outcome: The extent to which the project's major relevant objectives were achieved, or are expected to be achieved efficiently. *Possible ratings:* Highly Satisfactory (HS), Satisfactory (S), Moderately Satisfactory (MS), Moderately Unsatisfactory (MU), Unsatisfactory (U), Highly Unsatisfactory (HU).

Sustainability: The resilience to risk of net benefit flows over time. *Possible ratings:* Highly Likely (HL), Likely (L), Unlikely (UL), Highly Unlikely (HU), Not Evaluable (NE).

Institutional Development Impact: The extent to which a project improves the ability of a country or region to make more efficient, equitable, and sustainable use of its human, financial, and natural resources through: (i) better definition, stability, transparency, enforceability, and predictability of institutional arrangements and/or (ii) better alignment of the mission and capacity of an organization with its mandate, which derives from these institutional arrangements. Institutional Development Impact includes both intended and unintended effects of a project. *Possible ratings:* High (H), Substantial (S), Modest (M), Negligible (N).

APPENDIX C: DETAILED PROJECT DESIGN ANALYSIS

Detailed Review of Project Documents

The analysis focused on a total of 80 projects, randomly drawn from the larger population of 161 agricultural water projects. To facilitate analysis, the projects were divided into two groups: dedicated and nondedicated. The former includes all projects where the amount committed to I&D is larger than 50 percent of the total IDA/IBRD amount committed for the whole project. Nondedicated projects have less than half of Bank financing devoted to agricultural water management activities. Each sampled project was rated against 34 criteria, developed from issues raised by Bank poverty, rural, and water-strategy statements, as well as key documents in the literature related to poverty, institutions, and policy related to water (table A1). ICRs and PPARs covering the closed projects in the sample were also reviewed where available, which provided a clearer picture of the design of the projects in relationship to the outcomes and the effectiveness of M&E.

Randomly sampled project documents were scrutinized and scored using a rating scale from 1 to 4. A blank was defined as no significant evidence of the feature, 1 was defined as occurrence of the feature to a small extent, 2 was defined as occurrence of the feature to a moderate extent, 3 was defined as occurrence of the feature to a substantial extent, and 4 was defined as occurrence of the feature to a very high extent. There was also a Not Applicable (NA) and an Addressed Outside the project (AO) rating for some criteria, mainly policy. As is evident, the mid-point on the range where there was any occurrence at all lay between 2 and 3. In a few cases, there was simply a Yes/No rating. Percentages were asked for, such as percentage cost recovery, in some cases.

Table C.1. Questionnaire

	Bank Project ID P**** D**	**1,522**
	Dedicated	**1**
Q1	Proportion of poor in beneficiary total if known	
Is the project sensitive to the Bank's Poverty alleviation agenda?		
Q2	Is poverty alleviation mentioned as explicit objective?	1
Q3	Extent to which project design incorporates a poverty focus (even if no poverty objective)	
Q4	Extent of direct targeting of benefits towards poorer, e.g., selection of location, communities, households	
Q5	Given both the objectives and design, does this warrant classification as a poverty-focused intervention?	1
Q6	Quality of analysis distributional aspects	
Q7	Was a social assessment carried out?	
Q8	Is project employment impact or wages analyzed or substantively discussed?	
Q9	Extent of gender focus in project design	1
Q10	Predominant hectares benefiting large farms (L) or small (S) as defined by PAD	1
Q11	Extent of analysis of, or substantive discussion of, water rights of beneficiaries	
Institutional aspects		
Q12	To what extent is a broader sector strategy of which this project is a part clearly outlined in the PAD?	2
Q13	Extent policy content including legislation, pricing, rights, but excluding institutional reform	3
Q14	Extent institutional reform, e.g., public/private shift, new organization (excludes pricing covered under policy)	
Q15	To what extent does project aim to reform or significantly strengthen public institutions at central level?	4
Q16	To what extent does project aim to reform or significantly strengthen public institutions below central, e.g., region/district?	4
Community based organizations		
Q17	To what extent does project aim to strengthen community orgs. or participation, e.g., thru WUAs?	4
Q18	To what extent does PAD propose autonomy for WUAs (in fee collection, retention,expenditure, and water management)?	1
Q19	To what extent does PAD indicate support to WUAs on water management?	3
Cost Recovery		
Q20	Planned average cost recovery for capital investment (%)	
Q21	Preproject average cost recovery for O&M (%)	40
Q22	Planned average cost recovery for O&M (%)	90
Q23	To what extent does project address water efficiency, e.g., through water charges, regulations or technical design?	1
Q24	To what extent does PAD indicate how shortfalls in cost recovery are to be handled, e.g., public subsidy, cross-subsidy?	
Cross-sectoral linkages		
Q25	To what extent does PAD address environmental water issues such as quality, groundwater depletion, etc.?	3
Q26	To what extent does the PAD propose collaboration with other water agencies?	1
Q27	Which of following are supported or linked to significant extent in project design? Marketing (M), Extension (E), Credit (C)	E

Table C.2. Project Analysis Results

ID#	P00 3596	P00 3954	P00 4008	P00 4613	P00 4834	P00 4845	P00 4978	P00 5173	P00 5310	P00 5321	P00 5344	P00 5721	P00 5902	P00 7020	P00 7701	P00 8037	P00 8277	P00 8284
Dedi-cated		**1**		**1**	**1**	**1**		**1**		**1**	**1**			**1**	**1**	**1**	**1**	**1**
Q1			>40	53			HIGH	70					>75	80	50			
Q2				1	1	1	1	1			1		1					
Q3	1		3	2	1	2	4				1	1	4					
Q4	1		4	1		1	4			2	1	2	4			2		
Q5			1				1						1					
Q6			2				2			2	1		3					
Q7						1							1	1				1
Q8	1					1	1						1		1			
Q9			3	3		3	1				1		3		3			
Q10	1	1	1	1	1	1		1				1	1	1		3	1	1
Q11									2					3			2	
Q12	2	4	3	3	1	4	4	2	4	1	2	2	3	2	4	3	1	3
Q13				2					4		1	3					2	
Q14	2	3		2		3	1		4		1	3	2					3
Q15		3		4		2	1	1	3	2	2	3		1	3			3
Q16	3	3	3	2	2	3					2	2			3			3
Q17	4	3	3	4	1	2	1	4			2	2	3	3	3	4		
Q18	3	3		4	2	1		4			2	3	2	3	4	4		
Q19	3	2	1	2	2	3		3			2	3	3	3	3	2	3	
Q20	20		4	10								0	50	0	50	100		
Q21				66		60		60			30	73	0	30	78		20	<20
Q22	100	80		100		100		85			100	100	100	100	100	100	100	
Q23		3		3	1	2		2	4		2	3	2	2	4	4	1	2
Q24	4			1	2				2			2	3	1			4	1
Q25	3	4	1	4	1	4		4	3	4	3	2	3	2	4	2	2	3
Q26	2		1			2		3	3	3		2		2	1	1	1	
Q27	E		EMC			E	NA		EC	E	E	E	EC	E		EC		NA

(Table continues on next page)

Table C.2 (continued)

ID#	P00 8286	P00 8403	P00 9072	P00 9127	P00 9964	P01 0482	P01 0500	P01 0501	P01 0529	P01 0530	P03 4212	P03 4891	P03 5158	P03 5707	P03 7079	P03 8399	P03 8884	P03 8885
Dedicated	**1**		**1**	**1**			**1**	**1**	**1**	**1**	**1**		**1**	**1**		**1**		
Q1						43				>80		55	>70		40		66.2	45
Q2				1	1	1		1				1					1	1
Q3		1			1	2	1	2	1	2		4	3	1	2		4	4
Q4					1	1	2	1	1	2		4	3		2		4	4
Q5												1	1		1		1	1
Q6	2	2		4	2		3	3		2		2	1	2		2	2	2
Q7	1	1	1	1						1			1	1				
Q8		1					1			1		1	1				1	1
Q9	2		1			2	2		1	1			1	1	2	3	3	3
Q10	1	3			1	1	2	4	1	1		1	1	2	1	1		
Q11	1				4	2	3	3		3								
Q12	4	2	1	3	4	2	4	3	4	3	2	4	3	4	2	3	3	3
Q13		3			4		3	3	4	3			3	4		3		
Q14	2	3			4		4	4	4	3	3	1	4	3		4	1	1
Q15	3	3	2	2	4	3	4	2	4	3	3	1	3	3	3	3	1	1
Q16		1		2			4	3	1	2			3	3	3	3	2	2
Q17	4	3	2	3	3	2	2	4	4	2	3	2	4	3	4	3	3	3
Q18	2	3	3	2	4	2	3	4	3	2	2		2	3	2	2		
Q19	3	3	2	2	3	2	2	2	3	3	2		3	3		3		
Q20		20	70			95	25	55		25	10	7	0		10	0	10	10
Q21			100		20		<20	0	16	40	<20	0	0	>90	10	0	0	0
Q22		100	100	10	100	100	100	100	100	100	100	100	100	100	100	100	75	75
Q23	2		2	1	4	1	1		4	2			2	3		3		
Q24	1								2		1			2		1	1	1
Q25	3	4	2	4	3		1	4	2	2	1		3	4		2		
Q26	2	3		2	1	1	2	1		3	2		2	3				
Q27	MEC	E	NA			E	E			E MC	ME		E		MEC	EM AO		

(Table continues on next page)

Table C.2 (continued)

ID#	P04 1410	P04 1723	P04 2442	P04 3881	P04 6042	P04 6043	P04 6045	P04 8522	P04 9385	P04 9665	P04 9718	P04 9723	P05 0646	P05 0647	P05 1922	P05 5022	P05 5068	P05 5974
Dedi-cated	**1**			**1**	**1**		**1**					**1**	**1**			**1**	**1**	
Q1	HIGH		>80		48	HIGH			>40	74			75	47	>70			70
Q2			1						1						1			
Q3	2		4						4	2	1		3	2	4			2
Q4	3		4			1			2	3	1		4	3	4			2
Q5			1						1	1			1	1	1			
Q6			3	3		1	1		2		1	2	4	3	2			
Q7	1	1	1	1		1	1		1	1	1	1	1	1		1	1	
Q8			1	1					1				3	1				
Q9			3						2	2			4	3	3			
Q10	1	1	1	2	1	4			1	1	1	1	1	1	1	1	1	
Q11						1												
Q12	2	4	3	4	2	4	2		4	2	4	3	2	3	4	4	1	3
Q13				4		3			3			3	1	4		3	4	
Q14	2	3	2	4		3	1		3			4	3	4	2	4		
Q15	3	3	2	4	3	1	3		3	1	2	3	4	4	3	3		
Q16	4		2	3	3	1	3		2	1	3	3	4	4	3	3		
Q17		3	3	4		1			3		2	4	4	3	4	4	3	
Q18		4		3		2			2		1	3	4	2		3	4	
Q19			2	2		1			2	1	2	3	3	3	2	3	3	
Q20		30	>20	7		50	0		15			25	50		>15	30		
Q21			0	15	<20	0			0			<10	0		0	<20		
Q22		100	100	100	<20	100	0		100			100	100		100	100	100	
Q23		3		4	2	2	2		3		1	3	1	3		4	2	
Q24					1				1			1	3		1	1		
Q25	4	2	2	3	2		4		2	2	1	3	3	2	1	2	2	2
Q26	2	2					3	2		2	3	1	3	3	1			
Q27		EC	E	E		ECM			E	M	E		ECM	E	EMC			

(Table continues on next page)

Table C.2 (continued)

ID#	P05 7271	P05 8070	P05 8841	P05 8898	P05 9803	P06 2682	P06 2714	P06 2748	P06 4879	P06 5463	P06 6335	P07 1033	P07 1092	P07 2996	P07 3531	P07 4266	P07 4413	P07 7257
Dedi-cated				**1**					**1**			**1**	**1**	**1**			**1**	
Q1			64				28	>40		HIGH		37			HIGH			86
Q2			1					1				1	1		1			1
Q3	2	3	4				2	4		4	3	4	2	2	4	2	1	4
Q4	3	3	4				1	4		4	2	4	2	2	4	1	1	4
Q5		1	1					1		1	1	1	1	1	1			1
Q6		3	4					3		4		3	3	1	2		1	4
Q7		1	1	1	1		1	1	1	1	1	1		1			1	1
Q8		1								1		1						
Q9		3	3					3		4		4	1	3	3	2		4
Q10	1		1			1	1	1		1		1	1	1	1	1	4	1
Q11							2					3	1	2				
Q12	3	3	2	4			4	4	3	4	3	3	3	2	2	3	2	4
Q13				3	3		3	1		1		4				2	2	1
Q14		1	1	4	2	1	3	1	3	3	1	3		4	2	2		1
Q15			2	2		2	3	1	3		1	3		1	1	2	2	3
Q16			3	3	3		3	3	3	2	2	3			2	2	2	3
Q17		2	3	3			4	2		4	2	4	4	3	2	3	1	3
Q18				3			4			2		4	2	1		1		
Q19	2	1		3			3	2		3		3	3	2			3	3
Q20		10	20				30	5		5	10	12	22			20	50	27
Q21		0	0	0			0	0		0				30	0			0
Q22		100	100	100			50			100		100	100		100		100	
Q23				3			3			2		3	2	4				
Q24		1		2			3	2		2					2			1
Q25	2		1	3	4		3	2	3	1		4	1	2	1		4	2
Q26				1	2		2					4		1	1	4	3	1
Q27		CME	MC	E C-AO			E			M E	M C-	E AO		MEC	CM	EM		M

(Table continues on next page)

Table C.2 (concluded)

ID#	P07 8936	P07 8997	P07 9156	P08 1968	P08 2128	P08 4329	P08 6747
Dedicated	**1**	**1**			**1**		**1**
Q1		60		HIGH			
Q2			1	1		1	
Q3	3	3	2	4	1	3	3
Q4	2	3	2	4		3	3
Q5	1	1	1	1		1	1
Q6	1	3		4		1	3
Q7		1	1	1			1
Q8							1
Q9		3	4	3	1	2	2
Q10	1	1	1	1	1	1	1
Q11	2	1					
Q12	2	3	4	3	2	4	3
Q13					2		1
Q14				2	2		1
Q15			1	1	3	2	2
Q16	2		2	2	3		2
Q17	2	4	3	2	4	4	4
Q18	3	3	4		3	3	2
Q19	2	4		1	3	1	2
Q20		30	10	10	0	10	
Q21	50			0		100	
Q22	100	100		100	100	100	
Q23		3			3		1
Q24							
Q25	3	3		1	2		1
Q26	2	3			3		2
Q27		E	C	CM	E		E

APPENDIX D: ANALYSIS OF MONITORING AND EVALUATION

The 80 random projects were independently reviewed to determine how well M&E had been designed. A follow-up analysis, employing ICR output and outcome data from these completed projects, was used to determine how well M&E had been implemented. This was based on the application of 17 evaluation questions (table D1) and their overall categorization, to determine the overall quality of M&E from an evaluation and impact assessment perspective (table D2). Findings are presented in table D3; evaluation ratings are given in table D4.

Table D1. Evaluation of M&E Design and Implementation

Evaluation Questions	Evaluative score
Objectives: level of clarity (1= negligible, 4 = high)	1 to 4
Logical framework (0 = absent, 1 = negligible, 4 = high)	0 to 4
M&E system in place *ex ante*	0 to 4
M&E system specified by project	0 to 4
Quality of M&E plan	0 to 4
Desired outputs clearly defined	0 to 4
Desired outcomes clearly defined	0 to 4
Indicators well structured	0 to 4
Focus on outcome indicators	0 to 4
M responsibility assigned	0 to 4
M coordination assigned	0 to 4
Support for M&E capacity building	0 to 4
Feedback loops for management	0 to 4
Evaluative baseline specified	0 to 4
M&E as condition of lending	0 or 1
ICR (0= active project, 1 = completed project)	0 or 1
Baseline status (0 = none, 3 = start, 2= middle, 1=end)	0 to 3
Ex post survey(s)	0 to 4
Transparency of evaluation (0 = none; 1 = negligible; 4 = high	0 to 4

Table D2. Typology for Classification of M&E Findings from Project Design

Output indicators, but no outcome or impact indicators
Output indicators as well as outcome or impact indicators, but no baseline
Output and/or impact indicators and baseline
Output and/or impact indicators and control groups but no baseline
Outcome and/or impact indicators and baseline and control groups

Table D3. Summary of M&E Arrangements Implemented in Completed Projects

Project ID	Country	Project	Baseline Late	Baseline Without Project	Control Without Project	Ex-ante Survey Without	Survey During Project	Ex-post Survey With	Ex-post Survey Without	Reworked PAD
P001522	Madagascar	Irrigation II						P		x
P001994	Niger	Pilot Private Irrigation						P		
P003593	China	Songliao Plain ADP		x		x		x		
P003596	China	Yangtze Basin Water Resources		x				x		
P003954	Indonesia	Java Irriagtion Improvement		x		x				x
P004008	Indonesia	Nusa Tenggara Development			x			x	x	
P004834	Vietnam	Irrigation Rehabilitation		x		x		x		
P005344	Lebanon	Irrigation		x						x
P005721	Tunisia	Agricultural Sector Investment				x				x
P005736	Tunisia	Natural Res Management		x		x		x		
P007701	Mexico	On-Farm & Minor Irrigation		x				x		
P008037	Peru	Irrigation Subsector Project	x				x	P		
P008270	Albania	Irrigation Rehabilitation		x				x	x	
P008277	Armenia	Irrigation Rehabilitation		x				x		x
P008403	Estonia	Agriculture		x				P		x
P008510	Kazakhstan	Irrigation & Drainage		x		x	x	x		
P009072	Turkey	Privatization of Irrigation				x		x		
P009964	India	Haryana WRCP		x		x		P		x
P010476	India	Tamil Nadu WRCP		x		x		x		
P010482	Pakistan	Balochistan Irrigation		x		x	x	x		
P010501	Pakistan	Private Sector Groundwater		x	x	x		x	x	
P010529	India	Orissa WRCP		x				x		
P010530	Nepal	Irrigation Sector Project						P		x
P034212	Sri Lanka	Mahaweli Restructuring						P		x
P035158	India	Andrah Pradesh Irrigation III		x		x		P		x
P037079	Philippines	Agrarian Reform		x			x	x		
P038570	Tanzania	RBM and Smallholder Irrigation	x			x		x		
P042442	Peru	Sierra Natural Resources								
P043367	Yemen	Taiz Water Supply Pilot				x		P		x
P050418	Tunisia	ASIL 2				x		x		
P057271	Guyana	El Niño Emergency Assistance								x
P058070	Sri Lanka	NE Irrigation	x					x		
		Total	3	18	2	15	4	27	3	12
		Percent of all projects	9%	56%	6%	47%	13%	84%	9%	38%

Key: X = occurrence of this measure in full; P = partial occurrence; "without" means either before or after the project or as an independent control.

Table D4. Evaluation Ratings for M&E of 80 Randomly Sampled Projects

	Bank Project ID: P######	1522	3596	3954	5344	5721	7701	8277	9964	4834	5173	5310	5321	7020
	FY Approved	**1994**	**1994**	**1994**	**1994**	**1994**	**1994**	**1994**	**1994**	**1995**	**1995**	**1995**	**1995**	**1995**
	Evaluation Questions	y	n	y	y	n	y	y	n	y	y	n	y	
1	Objectives clear	3	3	3	3	2	3	2	2.5	2.5	4	4	2.5	2.5
2	Logical framework	0	0	0	0	0	0	2	0	0	0	0	2	?
3	M&E system in place ex ante	2	0	2	2	2	2	1	2	0	3	3	2	2
4	M&E system specified by project	2	2	0	3	2	4	1	3.5	2	2.5	3	2.5	2
5	Quality of M&E plan	1	2	1	2	2	3	2	3.5	2	3	2.5	2.5	2
6	Desired outputs clearly defined	1	4	4	3	3	4	3	3	3	4	3	3	3
8	Desired outcomes clearly defined	1	2	3	2	2.5	4	2	2	1	3	4	2.5	2
9	Indicators well structured	1	2	1	2	2.5	4	2	3	0	3	3	3	?
10	Focus on outcome indicators	0	0	2	2	2	3	1	2	0	2.5	3	2.5	2
5	M responsibility assigned	4	3	4	3	4	4	4	4	4	2.5	4	3	4
6	M coordination assigned	2	4	2	3	2.5	4	4	3	4	2	4	3	4
7	Support for M&E capacity building	2	3	1	2	3	1	2	3	2	3	3	3	2
11	Feedback loops for management	3	3	4	3	3	4	3	4	3	4	4	3	3
12	Evaluative baseline specified	0	2	0	0	2.5	3	0	3	0	3	3	2	0
	FY Completed	2002	2003	2003	2004	2001	2003	2002	2002	2004		1997	2001	2005
	ICR	1	1	1	1	1	1	1	1	1		1	1	1
13	Baseline status	0	1	0	0	1	1	0	2	3		1	2	3
14	Ex post survey(s)	2	3	3	2	2.5	3	2	2	2		4	3	2.5
15	Transparency of evaluation	2	2	4	3	2	4	3	3	2		3	3	3.5
	Impact Evaluation Typology													
1	Output indicators, but no outcome or impact indicators	1	1	1										1
2	Output indicators as well as outcome or impact indicators, but no baseline				1			1		1				
3	Output and/or impact indicators and baseline					1	1		1		1	1	1	
4	Output and/or impact indicators and control groups but no baseline													
5	Outcome and/or impact indicators and baseline and control groups													

(Table continued on next page)

Table D4 (continued)

	Bank Project ID: P######	7020	43178	34891	38884	38885	4978	8037	8403	10482	10501	10529
	FY Approved	**1995**	**1995**	**1995**	**1995**	**1995**	**1996**	**1996**	**1996**	**1996**	**1996**	**1996**
	Evaluation Questions	y	y	n	n	n	n	y	n	n	y	y
1	Objectives clear	2.5	3.5	3.5	2.5	3	3	3	4	3.5	2.8	4
2	Logical framework	?	0	0	0	2	0	0	3	0	0	2
3	M&E system in place ex ante	2	2	1	2.5	4	2	2	3	2	3	3
4	M&E system specified by project	2	3	1.5	4	4	3.5	1	2.5	3	3.5	3
5	Quality of M&E plan	2	3	2	4	3.5	3.5	2	2.5	2.5	4	3
6	Desired outputs clearly defined	3	4	2	3	4	3.5	4	3	2.5	4	3
8	Desired outcomes clearly defined	2	2	3	2	3	2.5	2	2	2	3	2
9	Indicators well structured	?	4	2	2	3	3	3	2	2.5	3	2
10	Focus on outcome indicators	2	3	1	2	4	3	2	2	2	3	2
5	M responsibility assigned	4	3	4	4	4	4	4	4	3	4	4
6	M coordination assigned	4	4	2	4	4	4	3	2.5	2	3.8	4
7	Support for M&E capacity building	2	2	2	3	4	3	2	1	2	4	2
11	Feedback loops for management	3	3	3	4	4	4	3	3	3.5	4	4
12	Evaluative baseline specified	0	0	0	3	4	0	0	2	0	1	2
	FY Completed	2005	2006	1999	2002	2002	2001	2005	2003	2003	2002	2005
	ICR	1	1	1	1	1	1	1	1	1	1	1
13	Baseline status	3	3	0	2	1	1	3	1	1	1	0
14	Ex post survey(s)	2.5	3	2.5	4	3	3	3	2	4	4	3
15	Transparency of evaluation	3.5	3	3	4	3	2.5	4	3	4	4	2
	Impact Evaluation Typology											
1	Output indicators, but no outcome or impact indicators	1		1								
2	Output indicators as well as outcome or impact indicators, but no baseline		1				1	1		1		1
3	Output and/or impact indicators and baseline								1			
4	Output and/or impact indicators and control groups but no baseline											
5	Outcome and/or impact indicators and baseline and control groups				1	1					1	

(Table continues on next page)

Table D4 (continued)

	Bank Project ID: P######	4008	4613	37079	42442	48522	5902	9072	10500	10530	34212	35158
	FY Approved	**1997**	**1997**	**1997**	**1997**	**1997**	**1998**	**1998**	**1998**	**1998**	**1998**	**1998**
	Evaluation Questions	n	y	n	n	n	n	y	y	y	y	y
1	Objectives clear	3.5	2.8	3	2.5	4	4	3	2.5	3	4	3
2	Logical framework	2	0	0	0	2	4	0	2.5	0	4	3
3	M&E system in place ex ante	2.5	3	4	1	2	1	2	2.5	2.5	3	3
4	M&E system specified by project	3	3.5	3	2	2	2.5	2	3	3	2	3
5	Quality of M&E plan	3	3.5	3	2.5	1	3	2	3	2.5	2	3
6	Desired outputs clearly defined	3.5	3	3	3	4	4	2.5	3	3	4	4
8	Desired outcomes clearly defined	3	4	2	2	3	4	2.5	3	3.5	4	3
9	Indicators well structured	3	3.5	2	3	2	4	2	3	3	4	4
10	Focus on outcome indicators	3	4	2	2	0	4	2	3.5	3	4	3
5	M responsibility assigned	3	3	4	4	0	4	3	4	3	4	4
6	M coordination assigned	2.5	2.5	3	2	4	2.5	2.5	4	2	4	4
7	Support for M&E capacity building	3	2	3	3	0	2	2	3	2	1	3
11	Feedback loops for management	4	4	4	3.5	3	3	3.5	4	4	3	4
12	Evaluative baseline specified	2.5	4	2	1.5	3	4	2	2.5	1	0	4
	FY Completed	2004		2004	2005	2002		2006		2005	2004	2005
	ICR	1		1	1	1		1		1	1	1
13	Baseline status	2		2	2	1		2		3	3	3
14	Ex post survey(s)	3		4	2.5	3		1		2	1	2
15	Transparency of evaluation	3		3	2.5	2		4		2.5	2	3
	Impact Evaluation Typology											
1	Output indicators, but no outcome or impact indicators					1						
2	Output indicators as well as outcome or impact indicators, but no baseline							1		1	1	
3	Output and/or impact indicators and baseline		1	1	1		1		1			1
4	Output and/or impact indicators and control groups but no baseline											
5	Outcome and/or impact indicators and baseline and control groups	1										

(Table continues on next page)

Table D4 (continued)

	Bank Project ID: P######	38399	46042	49385	55974	4845	41410	49665	49718	50646	58841	62682
	FY Approved	**1998**	**1998**	**1998**	**1998**	**1999**	**1999**	**1999**	**1999**	**1999**	**1999**	**1999**
	Evaluation Questions	y	y	n	n	y	y	n	n	y	n	n
1	Objectives clear	3	4	3	3	3	3	4	3.5	4	2.8	4
2	Logical framework	0	3	2.5	2	3	2.5	2.5	2.5	3	3	2.5
3	M&E system in place ex ante	2	2.5	2.5	3	2	2.5	3	2.5	3	1	2.5
4	M&E system specified by project	2.5	2.5	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5
5	Quality of M&E plan	2	2.5	3	2	2	2.5	2.5	2	2.5	2.5	2.5
6	Desired outputs clearly defined	4	4	3	2	4	3.5	4	2.5	4	3	3.5
8	Desired outcomes clearly defined	4	4	3	2.5	3	3.5	2.5	3	3	2.5	2.5
9	Indicators well structured	3	3	2	1	3	2.5	2.5	3	3	2.5	2
10	Focus on outcome indicators	3	3	2	2	3	3	2	3	2.5	2	2.5
5	M responsibility assigned	4	4	3	2	3	4	2	4	3	4	4
6	M coordination assigned	2.8	2.5	2	2	2	4	2	4	2.5	3.5	3
7	Support for M&E capacity building	2.5	4	2	1	2	4	2	3	2	3	2
11	Feedback loops for management	4	3.5	4	3	3	3	4	4	4	3	4
12	Evaluative baseline specified	2.5	0	2	0	0	0	0	3	4	0	1
	FY Completed				2001							2005
	ICR				1							1
13	Baseline status				0							1
14	Ex post survey(s)				2							3
15	Transparency of evaluation				2							4
	Impact Evaluation Typology											
1	Output indicators, but no outcome or impact indicators											
2	Output indicators as well as outcome or impact indicators, but no baseline		1	1	1	1	1				1	
3	Output and/or impact indicators and baseline	1						1	1	1		1
4	Output and/or impact indicators and control groups but no baseline											
5	Outcome and/or impact indicators and baseline and control groups											

(Table continues on next page)

Table D4 (continued)

	Bank Project ID: P######	64879	66335	73310	8284	35707	41723	49723	58070	58898	46045	50647
	FY Approved	**1999**	**1999**	**1999**	**2000**	**2000**	**2000**	**2000**	**2000**	**2000**	**2001**	**2001**
	Evaluation Questions	y	n	n	y	y	n	y	n	y	y	n
1	Objectives clear	3.5	2.5	3	4	3	3.5	4	3	4	3.5	4
2	Logical framework	2.5	3	3	4	4	3	3.5	2.8	3	3	2.5
3	M&E system in place ex ante	2.5	3.5	3.5	3	3	2.5	2.5	3	2	2	2
4	M&E system specified by project	2.5	2.5	3	3.5	2	3	3	3	2	4	2
5	Quality of M&E plan	2.5	2.5	3	3.8	2	3.5	3.5	2.5	2	3	2
6	Desired outputs clearly defined	2.8	3.5	3	4	3	3.5	4	2.8	4	3	3
8	Desired outcomes clearly defined	4	2.5	3.5	4	2	4	4	2	3	3	2
9	Indicators well structured	2.5	3	3.5	4	2	3.5	3	2.8	3	2.5	3
10	Focus on outcome indicators	3	2	3.5	4	3	3.5	4	3	3	3	2
5	M responsibility assigned	4	4	3.5	4	2	4	4	4	4	4	4
6	M coordination assigned	2.5	3	4	4	3	4	2.8	3	4	3	4
7	Support for M&E capacity building	2	3.5	2	3	2	2	2	4	3	4	2
11	Feedback loops for management	4	4	4	4	3	4	4	4	4	4	4
12	Evaluative baseline specified	4	0	4	3	0	1	3	3	0	0	0
	FY Completed											
	ICR											
13	Baseline status											
14	Ex post survey(s)											
15	Transparency of evaluation											
	Impact Evaluation Typology											
1	Output indicators, but no outcome or impact indicators		1	1								
2	Output indicators as well as outcome or impact indicators, but no baseline					1				1	1	1
3	Output and/or impact indicators and baseline	1			1		1		1			
4	Output and/or impact indicators and control groups but no baseline											
5	Outcome and/or impact indicators and baseline and control groups							1				

(Table continues on next page)

Table D4 (continued)

	Bank Project ID: P######	51922	55022	55068	62714	62748	71092	46043	71033	72996	73531	8286
	FY Approved	**2001**	**2001**	**2001**	**2001**	**2001**	**2001**	**2002**	**2002**	**2002**	**2002**	**2003**
	Evaluation Questions	n	y	y	n	n	y	n	y	y	n	y
1	Objectives clear	2	3	4	3	3	3	3.5	3	3.5	3	3
2	Logical framework	3.5	3.5	3	2	2.5	3	3	3	4	2.5	4
3	M&E system in place ex ante	1.5	3	1	2	1	2	3	2	2	1	3
4	M&E system specified by project	3	3.5	2	1	3	2	2.5	2	2	3.5	3
5	Quality of M&E plan	3.5	3.5	2	1	3	2.5	2.5	2	3	3.5	3
6	Desired outputs clearly defined	3	4	3	2	2.5	3.5	4	3	4	3	4
8	Desired outcomes clearly defined	3	3.5	2	2	3	2.5	3	3	4	2	3
9	Indicators well structured	3.5	3.5	3	2.5	3	2.5	2.5	2	4	2.5	3
10	Focus on outcome indicators	3.5	3	2	2	3	3	3	2	4	2	4
5	M responsibility assigned	4	4	2	2	3	4	4	2	2	4	4
6	M coordination assigned	3.5	3	2	2	2.5	4	2.5	2	2	3	3
7	Support for M&E capacity building	3	3	2	1	2	3	2	3	3	3	3
11	Feedback loops for management	4	4	3	3	4	4	4	3	3	4	4
12	Evaluative baseline specified	4	2.5	0	2	0	2	3	2	2	0	3
	FY Completed											
	ICR											
13	Baseline status											
14	Ex post survey(s)											
15	Transparency of evaluation											
	Impact Evaluation Typology											
1	Output indicators, but no outcome or impact indicators				1							
2	Output indicators as well as outcome or impact indicators, but no baseline			1		1				1	1	
3	Output and/or impact indicators and baseline	1	1				1	1	1			
4	Output and/or impact indicators and control groups but no baseline											
5	Outcome and/or impact indicators and baseline and control groups											1

(Table continues on next page)

Table D4 (continued)

	Bank Project ID: P######	9127	59803	78936	79156	43881	74266	74413	77257	78997	81968	82128
	FY Approved	**2003**	**2003**	**2003**	**2003**	**2004**	**2004**	**2004**	**2004**	**2004**	**2004**	**2004**
	Evaluation Questions	y	n	y	n	y	n	y	n	y	n	y
1	Objectives clear	4	3	3	3	2	2.5	3.5	2	3	2.5	4
2	Logical framework	4	2.5	2	3	3.5	3.5	3	3.5	4	3	3
3	M&E system in place ex ante	2	3	0	3	2.5	3	2.5	3.5	3	2	4
4	M&E system specified by project	2	2.5	3	4	3	3	2.5	4	4	3	3.5
5	Quality of M&E plan	2	2.5	4	3	2.5	3	3	3.5	3	3	3.5
6	Desired outputs clearly defined	4	3	4	4	3.5	3	4	4	4	3	4
8	Desired outcomes clearly defined	3	2.5	3	3	3	3	4	4	3	3	3
9	Indicators well structured	3	2.5	3	3.5	2.8	3.5	3.5	4	4	2.5	3
10	Focus on outcome indicators	3	3	3	3	2	2.5	3	3	3	3	3.5
5	M responsibility assigned	3	2.5	4	4	2.5	3	4	4	4	2.5	4
6	M coordination assigned	3	2.5	4	3	2	2.5	2.5	4	4	2.5	4
7	Support for M&E capacity building	2	2	3	2	2	3	2.5	4	3	2.5	3
11	Feedback loops for management	4	4	4	4	4	3.5	3.5	4	4	4	4
12	Evaluative baseline specified	0	0	3	3	3	3.5	0	4	4	3	4
	FY Completed											
	ICR											
13	Baseline status											
14	Ex post survey(s)											
15	Transparency of evaluation											
	Impact Evaluation Typology											
1	Output indicators, but no outcome or impact indicators	1	1									
2	Output indicators as well as outcome or impact indicators, but no baseline							1				
3	Output and/or impact indicators and baseline			1		1	1			1		1
4	Output and/or impact indicators and control groups but no baseline											
5	Outcome and/or impact indicators and baseline and control groups				1				1		1	

(Table continues on next page)

Table D4 (concluded)

	Bank Project ID: P######	84329	86747	Total	Percent
	FY Approved	**2004**	**2004**		
	Evaluation Questions	n	y		
1	Objectives clear	4	3		
2	Logical framework	0	4		
3	M&E system in place ex ante	1	3		
4	M&E system specified by project	3.5	3.5		
5	Quality of M&E plan	3.5	4		
6	Desired outputs clearly defined	3	4		
8	Desired outcomes clearly defined	3	3		
9	Indicators well structured	2.5	3		
10	Focus on outcome indicators	2	3		
5	M responsibility assigned	4	4		
6	M coordination assigned	3.5	4		
7	Support for M&E capacity building	4	2		
11	Feedback loops for management	4	3		
12	Evaluative baseline specified	0	3		
	FY Completed				
	ICR				
13	Baseline status				
14	Ex post survey(s)				
15	Transparency of evaluation				
	Impact Evaluation Typology				
1	Output indicators, but no outcome or impact indicators			11	14%
2	Output indicators as well as outcome or impact indicators, but no baseline	1		27	34%
3	Output and/or impact indicators and baseline		1	33	41%
4	Output and/or impact indicators and control groups but no baseline				0%
5	Outcome and/or impact indicators and baseline and control groups			9	11%

APPENDIX E: ANALYSIS OF COUNTRY ASSISTANCE STRATEGIES

One hundred and thirty CASs were reviewed, covering 54 countries during the period FY94–FY04, each of which was entered into a database. The primary analysis was text-based, aided by the commercial software package Atlas Ti.[1] The analysis interrogated the entire text of each CAS to determine the presence of 21 key phrases (table E1). When a phrase was encountered, the paragraph in which that phrase occurred was extracted and stored. Following scrutiny to determine the relevance of each hit, the relevant hits were added to the summary database. By this method, 544 AWM references, in 124 CASs containing phrases relevant to this study's evaluation questions could be related to time, 51 countries and regions. Detailed tables of the results follow.

Table E1. Topics Researched in 130 CASs

Irrigation
Institutional Development/Reform (Irrigation & Water)
Participation in Irrigation
Rural Development
Irrigation & Rural Development
Rural Poverty Alleviation
Role of Rural Development in Poverty Alleviation
Institutional Development in Rural Development
Participation in Rural Development
Rural Development & Agricultural Growth
Agricultural Development
Agricultural Growth and Irrigation
Agricultural Development & Economic Growth
Institutional Reform/Development in Agriculture
Participation in Agriculture
Water Resource Management
Irrigation & Water
Cost Recovery
Water Users
Water Tariffs
Technical Assistance

Table E1. CAS Analysis Results

CAS Year	1994	1994	1994	1994	1994	1995	1995	1995	1995
Country	**Burkina Faso**	**Mexico**	**Niger**	**Peru**	**Vietnam**	**Argentina**	**Bangladesh**	**Brazil**	**Cambodia**
Irrigation			1	1	1		2		
Institutional Development/Reform of Water							2	1	
Participation in Irrigation	1	1	1	1			3	1	
Rural Development			2		1			2	3
Irrigation & Rural Development					1			1	
Rural Poverty Alleviation				1	2			2	2
Role of Rural Development in Poverty Alleviation									
Institutional Development in Rural Development									
Participation in Rural Development					1			1	
Rural Development & Agricultural Growth		2			1				3
Agricultural Development	5	1	5			2	4	1	6
Agricultural Growth and Irrigation		1							
Agricultural Development & Economic Growth	2	1	2			1	1		2
Institutional Reform/Development in Agriculture			1	1		1			
Participation in Agriculture	1	1	1						1
Water Resource Management		1		2	1		4	2	1
Irrigation & Water				1	1		1	1	
Cost Recovery				1	1				
Water Users				1					
Water Tariffs				1					
Technical Assistance									1
Number of mentions	*9*	*8*	*13*	*10*	*10*	*4*	*17*	*12*	*19*
Number of topics	*4*	*7*	*7*	*9*	*9*	*3*	*7*	*9*	*8*
Agriculture (value added as a % of GDP 1997)	*35*	*5*	*38*	*7*	*27*	*6*	*30*	*14*	*50*
Freshwater Resources (cubic meters/capita 1996)	*1,640*	*3,836*	*375*	*1,647*	*4,990*	*19,705*	*11,153*	*32,163*	*8,574*

(Table continues on next page)

Table E1 (continued)

CAS Year	1995	1995	1995	1995	1995	1995	1995	1995	1995
Country	**China**	**Ethiopia**	**India**	**Indonesia**	**Jordan**	**Macedonia**	**Mexico**	**Pakistan**	**Uzbekistan**
Irrigation			2	1		2		4	1
Institutional Development/Reform of Water			3	1	1			1	
Participation in Irrigation			1					4	
Rural Development									1
Irrigation & Rural Development									1
Rural Poverty Alleviation		1					1	1	1
Role of Rural Development in Poverty Alleviation							1		
Institutional Development in Rural Development				1					
Participation in Rural Development									
Rural Development & Agricultural Growth		1					1	1	
Agricultural Development	3	6	2	5	4	4	1	4	3
Agricultural Growth and Irrigation	1	1							2
Agricultural Development & Economic Growth	1	3		1		1	1		1
Institutional Reform/Development in Agriculture			1				1	1	
Participation in Agriculture		1				1			
Water Resource Management		1	2	1	2				2
Irrigation & Water			1					1	2
Cost Recovery			2					2	2
Water Users									
Water Tariffs			1					1	
Technical Assistance									
Number of mentions	5	14	15	10	7	8	6	20	16
Number of topics	3	7	9	6	3	4	6	10	10
Agriculture									
(value added as a % of GDP 1997)	20	56	27	16	5	11	5	26	26
Freshwater Resources									
(cubic meters/capita 1996)	2,304	1,889	1,957	12,839	158		3,836	1,858	702

(Table continues on next page)

Table E1 (continued)

CAS Year	1995	1996	1996	1996	1996	1996	1996	1996	1996
Country	**Vietnam**	**Algeria**	**Azerbaijan**	**Bulgaria**	**Burkina Faso**	**Chad**	**Ecuador**	**Laos**	**Mexico**
Irrigation	1						1		
Institutional Development/Reform of Water Participation in Irrigation							1		
Rural Development	4					1	4	2	
Irrigation & Rural Development	1								
Rural Poverty Alleviation	1						3	2	
Role of Rural Development in Poverty Alleviation							2	1	
Institutional Development in Rural Development	1								
Participation in Rural Development	1						1		
Rural Development & Agricultural Growth	1					1	1		
Agricultural Development	1	3	5	3	5	2	2	1	2
Agricultural Growth and Irrigation	1		1					1	
Agricultural Development & Economic Growth			3		1				
Institutional Reform/Development in Agriculture							2		
Participation in Agriculture					1		1		1
Water Resource Management	1	1			1				
Irrigation & Water Cost Recovery									
Water Users Water Tariffs									
Technical Assistance									
Number of mentions	*13*	*4*	*9*	*3*	*8*	*4*	*18*	*7*	*3*
Number of topics	*10*	*2*	*3*	*1*	*4*	*3*	*10*	*5*	*2*
Agriculture (value added as a % of GDP 1997)	*27*	*12*	*22*	*10*	*35*	*39*	*12*	*52*	*5*
Freshwater Resources (cubic meters/capita 1996)	*4,990*	*483*	*1,068*	*2,154*	*1,640*	*2,269*	*26,842*	*9,840*	*3,836*

(Table continues on next page)

Table E1 (continued)

CAS Year	1996	1996	1996	1996	1996	1996	1997	1997	1997
Country	**Philippines**	**Sri Lanka**	**Tajikistan**	**Tunisia**	**Yemen**	**Zambia**	**Argentina**	**Armenia**	**Bosnia**
Irrigation		2	1					1	
Institutional Development/Reform of Water Participation in Irrigation	2								
Rural Development	4								
Irrigation & Rural Development					1				
Rural Poverty Alleviation	4	1							
Role of Rural Development in Poverty Alleviation	3								
Institutional Development in Rural Development Participation in Rural Development	2								
Rural Development & Agricultural Growth		1			1				
Agricultural Development		3	2	2	2	5	1		1
Agricultural Growth and Irrigation			1						
Agricultural Development & Economic Growth		1			1	3			
Institutional Reform/Development in Agriculture Participation in Agriculture				1					
Water Resource Management	2				3			2	
Irrigation & Water	1								
Cost Recovery			1						
Water Users									
Water Tariffs									
Technical Assistance									
Number of mentions	*18*	*8*	*5*	*3*	*8*	*8*	*1*	*3*	*1*
Number of topics	*7*	*5*	*4*	*2*	*5*	*2*	*1*	*2*	*1*
Agriculture (value added as a % of GDP 1997)	*20*	*22*		*14*	*18*	*16*	*6*	*44*	
Freshwater Resources (cubic meters/capita 1996)	*4,492*	*2,361*	*11,186*	*385*	*260*	*8,703*	*19,705*	*2,411*	

(Table continues on next page)

Table E1 (continued)

CAS Year	1997	1997	1997	1997	1997	1997	1997	1997	1997
Country	**Brazil**	**Cambodia**	**China**	**Colombia**	**Egypt**	**Ethiopia**	**Georgia**	**India**	**Indonesia**
Irrigation					2				
Institutional Development/Reform of Water	1			2		1		1	
Participation in Irrigation				1				2	
Rural Development	2	2	1	4	2			6	6
Irrigation & Rural Development			2		1				
Rural Poverty Alleviation	3			1	1			2	
Role of Rural Development in Poverty Alleviation	1			1	2			1	1
Institutional Development in Rural Development				1				1	
Participation in Rural Development								2	1
Rural Development & Agricultural Growth		1	2	2	3			1	1
Agricultural Development	1	6	5	3	4	2		5	
Agricultural Growth and Irrigation	1		3			1		1	
Agricultural Development & Economic Growth		3	1			2			
Institutional Reform/Development in Agriculture		1	1					2	
Participation in Agriculture		1	1					2	
Water Resource Management	6		2			1		2	3
Irrigation & Water Cost Recovery					1	1		1	1
Water Users			1	1					
Water Tariffs								2	
Technical Assistance					1				
Number of mentions	*15*	*14*	*19*	*16*	*17*	*8*	*0*	*31*	*13*
Number of topics	*7*	*6*	*10*	*9*	*9*	*6*	*0*	*15*	*6*
Agriculture (value added as a % of GDP 1997)	*14*	*50*	*20*	*16*	*16*	*56*	*35*	*27*	*16*
Freshwater Resources (cubic meters/capita 1996)	*32,163*	*8,574*	*2,304*	*28,571*	*47*	*1,889*	*10,737*	*1,957*	*12,839*

(Table continues on next page)

Table E1 (continued)

CAS Year	1997	1997	1997	1997	1997	1997	1997	1998	1998
Country	**Madagascar**	**Morocco**	**Niger**	**Peru**	**Romania**	**Tanzania**	**Turkey**	**Uzbekistan**	**Albania**
Irrigation	2		1	1				1	1
Institutional Development/Reform of Water		1		1					
Participation in Irrigation	1						1		2
Rural Development	3	13		1			1		
Irrigation & Rural Development				1					
Rural Poverty Alleviation		4							
Role of Rural Development in Poverty Alleviation		2							
Institutional Development in Rural Development		1							
Participation in Rural Development	2		1						
Rural Development & Agricultural Growth	1	3		1					
Agricultural Development	6	1	1	2	2	3	1	4	5
Agricultural Growth and Irrigation	1		1					1	
Agricultural Development & Economic Growth		1			1	2		1	
Institutional Reform/Development in Agriculture								1	1
Participation in Agriculture									
Water Resource Management		2	2	1					
Irrigation & Water			1	1				1	
Cost Recovery		1						1	
Water Users	1						1	3	2
Water Tariffs									
Technical Assistance									1
Number of mentions	*17*	*29*	*7*	*9*	*3*	*5*	*4*	*13*	*12*
Number of topics	*8*	*10*	*6*	*8*	*2*	*2*	*4*	*8*	*6*
Agriculture (value added as a % of GDP 1997)	*32*	*20*	*38*	*7*	*21*	*48*	*17*	*31*	*54*
Freshwater Resources (cubic meters/capita 1996)	*24,590*	*1,110*	*375*	*1,647*	*1,637*	*2,623*	*3,126*	*5,476*	*12,758*

(Table continues on next page)

Table E1 (continued)

CAS Year	1998	1998	1998	1998	1998	1998	1998	1998	1998
Country	**Bangladesh**	**Nepal**	**Vietnam**	**Bolivia**	**Bulgaria**	**Macedonia**	**Tajikistan**	**Tanzania**	**Kenya**
Irrigation		1				1			
Institutional Development/Reform of Water									
Participation in Irrigation	1	2							
Rural Development	6		2	1					
Irrigation & Rural Development									
Rural Poverty Alleviation									
Role of Rural Development in Poverty Alleviation	1								
Institutional Development in Rural Development				1					
Participation in Rural Development									
Rural Development & Agricultural Growth			1					2	
Agricultural Development	2	4	1		5	1	4		
Agricultural Growth and Irrigation		2							
Agricultural Development & Economic Growth		1			2				
Institutional Reform/Development in Agriculture		1							
Participation in Agriculture	1								
Water Resource Management									
Irrigation & Water	2								
Cost Recovery									
Water Users									
Water Tariffs									
Technical Assistance									
Number of mentions	*13*	*11*	*4*	*2*	*7*	*2*	*4*	*2*	*0*
Number of topics	*6*	*6*	*3*	*2*	*2*	*2*	*1*	*1*	*0*
Agriculture									
(value added as a % of GDP 1997)	*21*	*41*	*26*	*16*	*18*	*11*	*6*	*48*	*27*
Freshwater Resources									
(cubic meters/capita 1996)	*9,636*	*9,199*	*11,647*	*38,625*	*24,663*	*3,483*	*13,017*	*2,770*	*1,031*

(Table continues on next page)

Table E1 (continued)

CAS Year	1999	1999	1999	1999	1999	1999	1999	1999	2000
Country	**Philippines**	**Mexico**	**Azerbaijan**	**Laos**	**Zambia**	**Dominica**	**Yemen**	**Jordan**	**Burkina Faso**
Irrigation			2				4		
Institutional Development/Reform of Water			1				1		
Participation in Irrigation									
Rural Development	4	2		2		1			6
Irrigation & Rural Development		1		1					
Rural Poverty Alleviation	1			1					
Role of Rural Development in Poverty Alleviation				1	1				1
Institutional Development in Rural Development					1				2
Participation in Rural Development									1
Rural Development & Agricultural Growth	1	1			1	1			1
Agricultural Development	2	1	8	2	2	3			2
Agricultural Growth and Irrigation	1		3						
Agricultural Development & Economic Growth		1	1		1				1
Institutional Reform/Development in Agriculture						1			
Participation in Agriculture			1						1
Water Resource Management	1								
Irrigation & Water	1	1					3		
Cost Recovery	1						1	1	
Water Users	1								
Water Tariffs		1							
Technical Assistance									
Number of mentions	*13*	*8*	*16*	*7*	*6*	*6*	*9*	*1*	*15*
Number of topics	*9*	*7*	*6*	*5*	*5*	*4*	*4*	*1*	*8*
Agriculture (value added as a % of GDP 1997)	*17*	*5*	*19*	*53*	*17*	*11*	*17*	*2*	*32*
Freshwater Resources (cubic meters/capita 1996)	*4,393*	*4,779*	*3,831*	*56,638*	*12,001*	*2,467*	*254*	*198*	*1,671*

(Table continues on next page)

Table E1 (continued)

CAS Year	2000	2000	2000	2000	2000	2000	2000	2000	2000
Country	**Mozambique**	**Cambodia**	**Tunisia**	**Brazil**	**Uruguay**	**Argentina**	**Belize**	**Tanzania**	**Turkey**
Irrigation	1				3		1		
Institutional Development/Reform of Water Participation in Irrigation				1					
Rural Development	4	6	1					4	
Irrigation & Rural Development	1								
Rural Poverty Alleviation		3		3					
Role of Rural Development in Poverty Alleviation	1	1							
Institutional Development in Rural Development Participation in Rural Development			1	2					
Rural Development & Agricultural Growth		1	1						
Agricultural Development	4	7	1						7
Agricultural Growth and Irrigation									
Agricultural Development & Economic Growth	2	2	1						
Institutional Reform/Development in Agriculture Participation in Agriculture	1	1							
Water Resource Management									
Irrigation & Water	1		1	3	1	3			
Cost Recovery					1	1			
Water Users									
Water Tariffs									
Technical Assistance									
Number of mentions	*15*	*21*	*6*	*9*	*5*	*4*	*1*	*4*	*7*
Number of topics	*8*	*7*	*6*	*4*	*3*	*2*	*1*	*1*	*1*
Agriculture (value added as a % of GDP 1997)	*32*	*51*	*13*	*9*	*9*	*6*		*48*	*18*
Freshwater Resources (cubic meters/capita 1996)	*12,746*	*41,407*	*439*	*42,459*	*37,971*	*27,865*		*2,770*	*3,213*

(Table continues on next page)

Table E1 (continued)

CAS Year	2000	2001	2001	2001	2001	2001	2001	2001	2001
Country	**Bosnia**	**India**	**Bangladesh**	**Egypt**	**Indonesia**	**Chad**	**Morocco**	**Armenia**	**Ethiopia**
Irrigation		2		3	2				
Institutional Development/Reform of Water		1	2		2				
Participation in Irrigation		1					1		
Rural Development		8	4	3	1	6	3		
Irrigation & Rural Development		1				1		1	
Rural Poverty Alleviation		3		3		1	1		1
Role of Rural Development in Poverty Alleviation		4	2	1	1				
Institutional Development in Rural Development		3	2			3	1		
Participation in Rural Development			2						
Rural Development & Agricultural Growth		3	5	1		2			1
Agricultural Development		8	1	3	2	1	4	1	1
Agricultural Growth and Irrigation								1	
Agricultural Development & Economic Growth		2		2					1
Institutional Reform/Development in Agriculture		1	1		1				
Participation in Agriculture									
Water Resource Management				1		1			
Irrigation & Water			3	4	3		1		
Cost Recovery			1	1	1				
Water Users		1		1	1		1	2	
Water Tariffs		1	1		1			1	
Technical Assistance		1							
Number of mentions	*0*	*40*	*24*	*23*	*15*	*15*	*12*	*6*	*4*
Number of topics	*0*	*15*	*11*	*11*	*10*	*7*	*7*	*5*	*4*
Agriculture (value added as a % of GDP 1997)		*28*	*21*	*17*	*20*	*38*	*17*	*33*	*49*
Freshwater Resources (cubic meters/capita 1996)		*1,947*	*9,636*	*949*	*12,625*	*5,904*	*1,080*	*2,767*	*1,795*

(Table continues on next page)

Table E1 (continued)

CAS Year	2001	2001	2002	2002	2002	2002	2002	2002	2002
Country	**Romania**	**Nigeria**	**Albania**	**Bulgaria**	**Chile**	**Guyana**	**Jordan**	**Mauritania**	**Mexico**
Irrigation	1		1	1		2			
Institutional Development/Reform of Water									
Participation in Irrigation			2	1					
Rural Development	1		2				2	2	
Irrigation & Rural Development									
Rural Poverty Alleviation			1					1	
Role of Rural Development in Poverty Alleviation			1						1
Institutional Development in Rural Development								1	2
Participation in Rural Development				1				1	1
Rural Development & Agricultural Growth			1	3		1	1		5
Agricultural Development		2							
Agricultural Growth and Irrigation						1	1		1
Agricultural Development & Economic Growth									
Institutional Reform/Development in Agriculture				1					1
Participation in Agriculture							1		
Water Resource Management							2		1
Irrigation & Water									
Cost Recovery			1						1
Water Users									
Water Tariffs									
Technical Assistance				1				1	
Number of mentions	*2*	*2*	*9*	*8*	*0*	*4*	*7*	*6*	*13*
Number of topics	*2*	*1*	*7*	*6*	*0*	*3*	*5*	*5*	*8*
Agriculture									
(value added as a % of GDP 1997)	*16*	*41*	*25*	*12*	*9*		*2*	*19*	*4*
Freshwater Resources									
(cubic meters/capita 1996)	*9,222*	*2,318*	*12,758*	*24,663*	*32,007*		*198*	*4,508*	*4,779*

(Table continues on next page)

Table E1 (continued)

CAS Year	2002	2002	2002	2002	2002	2002	2003	2003	2003
Country	**Pakistan**	**Peru**	**Philippines**	**Uzbekistan**	**Vietnam**	**Yemen**	**Algeria**	**Azerbaijan**	**Brazil**
Irrigation	1		1	2	1	2		1	
Institutional Development/Reform of Water							1		1
Participation in Irrigation	1		1				1		
Rural Development	3	1	5		3		3		2
Irrigation & Rural Development			2				1		1
Rural Poverty Alleviation	1		3		1				2
Role of Rural Development in Poverty Alleviation	2	1	3				1		2
Institutional Development in Rural Development									
Participation in Rural Development			6			1	5		
Rural Development & Agricultural Growth	3		7	2			1		1
Agricultural Development	1						2		1
Agricultural Growth and Irrigation	1						1		
Agricultural Development & Economic Growth	1		2						
Institutional Reform/Development in Agriculture									
Participation in Agriculture			2						
Water Resource Management	1			1		1	2		
Irrigation & Water				2		1			
Cost Recovery	1			1		1			
Water Users		1						1	
Water Tariffs									
Technical Assistance						1			
Number of mentions	*16*	*3*	*32*	*8*	*5*	*7*	*18*	*2*	*10*
Number of topics	*11*	*3*	*10*	*5*	*3*	*6*	*10*	*2*	*7*
Agriculture (value added as a % of GDP 1997)	*23*	*8*	*14*	*35*	*23*	*15*	*11*	*16*	*6*
Freshwater Resources (cubic meters/capita 1996)	*1,938*	*1,641*	*4,393*	*5,476*	*11,647*	*254*	*485*	*3,831*	*42,659*

(Table continues on next page)

Table E1 (continued)

CAS Year	2003	2003	2003	2003	2003	2003	2003	2003	2003
Country	**Chad**	**China**	**Ecuador**	**Ethiopia**	**Georgia**	**Indonesia**	**Macedonia**	**Madagascar**	**Mali**
Irrigation				1		2	1	1	
Institutional Development/Reform of Water							1		
Participation in Irrigation					1	1			2
Rural Development	3	3		1	1	1		1	2
Irrigation & Rural Development	1				2			2	1
Rural Poverty Alleviation	2	3		2	1	1		2	1
Role of Rural Development in Poverty Alleviation									1
Institutional Development in Rural Development				1					
Participation in Rural Development	2			1	2	1		2	4
Rural Development & Agricultural Growth	2	2		7	3	3		1	4
Agricultural Development				1					1
Agricultural Growth and Irrigation		1		3	3				
Agricultural Development & Economic Growth	1			1		2			1
Institutional Reform/Development in Agriculture	1								
Participation in Agriculture					1				
Water Resource Management		1		1					2
Irrigation & Water				1					2
Cost Recovery									1
Water Users					1				
Water Tariffs									1
Technical Assistance									
Number of mentions	*12*	*10*	*0*	*20*	*15*	*11*	*2*	*9*	*23*
Number of topics	*7*	*5*	*0*	*11*	*9*	*7*	*2*	*6*	*13*
Agriculture (value added as a % of GDP 1997)	*38*	*15*	*9*	*42*	*21*	*17*	*12*	*29*	*36*
Freshwater Resources (cubic meters/capita 1996)	*5,904*	*2,285*	*26,305*	*1,795*	*11,632*	*12,625*	*3,483*	*23,094*	*9,438*

(Table continues on next page)

Table E1 (continued)

CAS Year	2003	2003	2003	2003	2003	2003	2004	2004	2004
Country	**Mozambique**	**Nepal**	**Niger**	**Sri Lanka**	**Tajikistan**	**Turkey**	**Argentina**	**Armenia**	**Bolivia**
Irrigation		2	1	1	1			1	
Institutional Development/Reform of Water									
Participation in Irrigation								1	
Rural Development	2	1	2	2		1	3	1	
Irrigation & Rural Development			1			1	2	1	
Rural Poverty Alleviation	3		2				1		
Role of Rural Development in Poverty Alleviation			1	2					
Institutional Development in Rural Development			1						
Participation in Rural Development	3	2	1	2					
Rural Development & Agricultural Growth	14		1	2	1	1			
Agricultural Development		3	1					1	
Agricultural Growth and Irrigation	1			1					
Agricultural Development & Economic Growth	8		1	1	1				
Institutional Reform/Development in Agriculture	1			1					
Participation in Agriculture									
Water Resource Management				1			3		
Irrigation & Water								1	
Cost Recovery								2	
Water Users						1			
Water Tariffs									
Technical Assistance		1						1	
Number of mentions	*32*	*9*	*12*	*13*	*3*	*4*	*9*	*9*	*0*
Number of topics	*7*	*5*	*10*	*9*	*3*	*4*	*4*	*8*	*0*
Agriculture									
(value added as a % of GDP 1997)	*23*	*40*	*40*	*20*	*23*	*13*	*11*	*24*	
Freshwater Resources									
(cubic meters/capita 1996)	*12,746*	*9,199*	*3,204*	*2,329*	*13,017*	*3,213*	*27,865*	*2,676*	*38,625*

(Table continues on next page)

Table E1 (concluded)

CAS Year	2004	2004	2004
Country	**Bosnia**	**India**	**Tunisia**
Irrigation		3	
Institutional Development/Reform of Water	1	1	
Participation in Irrigation		1	
Rural Development	2		1
Irrigation & Rural Development		2	
Rural Poverty Alleviation	1	2	1
Role of Rural Development in Poverty Alleviation		2	2
Institutional Development in Rural Development			
Participation in Rural Development	1	2	1
Rural Development & Agricultural Growth	5	9	3
Agricultural Development	1		2
Agricultural Growth and Irrigation		1	
Agricultural Development & Economic Growth		1	
Institutional Reform/Development in Agriculture			
Participation in Agriculture			
Water Resource Management	2	6	3
Irrigation & Water		6	2
Cost Recovery		2	2
Water Users		1	1
Water Tariffs			2
Technical Assistance			
Number of mentions	*13*	*39*	*20*
Number of topics	*7*	*14*	*11*
Agriculture (value added as a % of GDP 1997)	*17*	*23*	*13*
Freshwater Resources (cubic meters/capita 1996)		*1,947*	*439*

APPENDIX F: ANALYSIS OF PROJECT COMPLETION REPORTS

Two types of analysis were undertaken:

(i) A more detailed analysis of the outputs and outcomes reported by each ICR, and
(ii) A qualitative review of the achievements, issues, and problems, and a categorization of lessons learned.

Analysis of planned and actual outputs and outcomes reported by each PAD and ICR in the portfolio. In addition to the qualitative evaluation of the objectives and components of each PAD and ICR, the study also analyzed the quantitative output data (table F1).

Categorization of achievements, issues, problems and lessons learned. Sixty-three ICRs and 8 PPARs of projects approved from FY94 were used to create a database, and the lessons were extracted. After classification, 408 lessons were classified into 11 types (table F2) for further analysis and review.

Table F1. Quantitative Comparison of Predicated and Actual Outputs from Projects

Irrigation—area planned and actually achieved (ha).
Drainage—area planned and actually achieved (ha).
Farmers/Farm families—number of household units or number of individual farmers targeted and reported as being reached at the end of the project.
People—number of individuals targeted and reached by the project.
Engineering costs—planned and actual costs.
Institutional development and capacity-building costs—planned and actual costs.

Table F2. Typology for Classifying Frequency of Lessons Drawn from ICRs and PPARs

Project Design
Implementation & Procedural
Community-Driven Development
Cost Recovery
Knowledge/Information/Skills Mobilization
Technology
Economics
Institutional
Bank Processes
Targeting
Disaster-Related

Table F3. Irrigated Area Planned and Achieved

Project Description				Irrigation Area, ha	
Project ID	**Country**	**Project Name**	**Approval FY**	**PAD Planned**	**ICR Achieved**
P008270	Albania	Irrigation Rehabilitation	1995	73,486	100,149
P004978	Algeria	Social Safety I	1996	115,000	154,000
P008277	Armenia	Irrigation Rehabilitation	1995	148,000	146,800
P058468	Bangladesh	Agricultural Serv. Innovation & Reform	2000	100	122
P038884	Brazil	Rural Poverty—Ceara	1995	12,000	11,700
P050886	Burkina Faso	Pilot Private Irrigation		270	500
P003593	China	Songliao Plain ADP	1994	35,500	36,590
P003596	China	Yangtze Basin Water Resources Project	1995	457,800	465,600
P063123	China	Yangtze Flood Emergency Rehabilitation	1999	44,200	44,000
P007020	Dominica	Irrigated Land & Watershed Management	1995	7,259	397
P063201	Dominica	Hurricane Georges Emergency Recovery	1999	15,000	15,000
P008403	Estonia	Agriculture	1996	60,000	76,819
P057271	Guyana	El Niño Emergency Assistance Project	1999	72,430	275,000
P004964	India	Water Resources Consolidation Haryana	1994	280,000	280,000
P035158	India	Andrah Pradesh Irrigation Iii	1997	318,000	318,000
P010529	India	Water Resources Consolidation Orissa	1996	265,358	314,953
P010476	India	Water Resources Consolidation Tamil Nadu	1995	508,108	435,529
P003954	Indonesia	Java Irrigation Improvement & WRM	1994	218,000	285,377
P005321	Jordan	TA For Agriculture	1995	17,500	17,500
P008510	Kazakhstan	Irrigation & Drainage	1996	30,000	32,200
P062682	Kyrgyz	Flood Emergency	1999	39,000	34,300
P005344	Lebanon	Irrigation	1994	27,000	24,300
P001522	Madagascar	Irrigation II	1995	20,000	25,295
P001738	Mali	Irrigation Promotion	1997	1,000	20
P007701	Mexico	On-Farm & Minor Irrigation	1994	400,000	394,000
P010530	Nepal	Irrigation Sector Develeopment	1998	59,600	46,250
P072996	Niger	Pilot Private Irrigation	1995	2,000	1,735
P063622	Nigeria	Fadama II	2004	50,000	35,000
P010453	Pakistan	Balochistan Community Irrigation And Agriculture	1996	4,089	6,478
P010501	Pakistan	Private Sector Groundwater	1997	1,400,000	900,000
P042442	Peru	Sierra Natural Resources Management	1997	12,350	26,843
P008037	Peru	Irrigation Subsector Project	1997	200,000	435,000
P03079	Philippines	Agrarian Reform	1997	9,750	10,019
P034212	Sri Lanka	Mahaweli Restructuring	1998	31,500	28,790
P038570	Tanzania	River Basin Mgmt & Small Holder Irrigation	1997	7,000	5,059
P005721	Tunisia	Agricultural Sectoe Investment	1994	9,292	9,292
P050418	Tunisia	ASIL 2	1998	4,250	6,151
P009072	Turkey	Privatization Of Irrigation	1998	1,497,900	220,000
P004834	Vietnam	Irrigation Rehabilitation Project	1995	67,700	133,889
P043367	Yemen	Taiz Water Supply Pilot	1997	596	596
		Total		*6,521,038*	*5,353,253*
		Average (ha/project)		*163,026*	*133,831*

Table F4. Actual and Planned Costs: Engineering and Infrastructure, Institutional Development and Capacity-Building

		Total Engineering & Infrastructure Costs US$ millions			Total Institutional Development & Capacity-building Costs US$ millions		
Project ID	Country	PAD Planned	ICR Actual	Percent of Planned	PAD Planned	ICR Actual	Percent of Planned
P008270	Albania	31.50	35.84	114%	4.30	3.87	90%
P004978	Algeria	18.70	17.00	91%	na	na	–
P008277	Armenia	37.43	39.67	106%	8.78	12.18	139%
P058468	Bangladesh	1.80	1.56	87%	na	na	–
P038884	Brazil	28.44	23.32	82%	4.60	3.90	85%
P050886	Burkina Faso	0.95	1.82	192%	3.01	2.59	86%
P003593	China	29.40	40.10	136%	4.00	5.90	148%
P003596	China	166.31	187.45	113%	na	26.78	–
P063123	China	7.47	7.76	104%	na	na	–
P007020	Dominica	23.18	8.15	35%	5.00	5.29	106%
P063201	Dominica	13.38	11.78	88%	na	na	–
P008403	Estonia	10.90	9.07	83%	13.30	9.33	70%
P057271	Guyana	4.14	4.95	120%			
P004964	India	449.60	461.57	103%	33.80	12.80	38%
P035158	India	366.00	390.00	107%	2.47	0.97	39%
P010529	India	223.40	257.96	115%	39.30	14.09	36%
P010476	India	240.90	218.10	91%	17.70	21.80	123%
P003954	Indonesia	na	na	–	na	na	–
P005321	Jordan	5.15	na	–	1.04	na	–
P008510	Kazakhstan	108.14	90.19	83%	5.93	4.46	75%
P062682	Kyrgyz	13.40	12.09	90%	0.70	0.60	86%
P005344	Lebanon	61.00	67.02	110%	16.18	11.37	70%
P001522	Madagascar	13.80	10.96	79%	7.40	9.15	124%
P001738	Mali	0.57	0.22	39%	2.34	0.86	37%
P007701	Mexico	568.80	396.70	70%	39.60	21.20	54%
P010530	Nepal	72.42	73.86	102%	16.02	16.49	103%
P072996	Niger	2.60	2.24	86%	2.90	3.51	121%
P063622	Nigeria	74.80	64.20	86%	16.80	40.00	238%
P010453	Pakistan	17.10	19.50	114%	17.00	14.70	86%
P010501	Pakistan	97.50	25.31	26%	7.30	4.37	60%
P042442	Peru	67.20	85.10	127%	31.00	5.10	16%
P008037	Peru	140.50	79.90	57%	6.00	13.00	217%
P03079	Philippines	18.60	19.00	102%	7.50	6.10	81%
P034212	Sri Lanka	79.20	75.80	96%	28.90	24.70	85%
P038570	Tanzania	15.87	14.49	91%	11.57	10.32	89%
P005721	Tunisia	105.20	110.40	105%	3.60	1.50	42%
P050418	Tunisia	22.50	24.30	108%	9.10	9.60	105%
P009072	Turkey	50.05	40.37	81%	6.50	4.16	64%
P004834	Vietnam	108.10	110.90	103%	4.60	7.00	152%
P043367	Yemen	0.40	0.75	188%	0.30	0.30	100%
	Total	*3,296.40*	*3,039.40*		*378.54*	*327.99*	
Average per project		*84.52*	*79.98*	*95%*	*9.96*	*8.41*	*84%*

Note: na = not available.

Table F5. Engineering and Infrastructure: Average Costs Per Hectare

		Total Engineering Costs US$/ha			Total Engineering Costs (Excluding expensive projects) US$/ha		
Project ID	Country	PAD Planned	ICR Actual	Percent of Planned	PAD Planned	ICR Actual	Percent of Planned
P008270	Albania	429	358	83%	429	358	83%
P004978	Algeria	163	110	68%	163	110	68%
P008277	Armenia	253	270	107%	253	270	107%
P058468	Bangladesh	18,000	12,787	71%			
P038884	Brazil	2,370	1,993	84%	2,370	1,993	84%
P050886	Burkina Faso	3,519	3,640	103%	3,519	3,640	103%
P003593	China	828	1,096	132%	828	1,096	132%
P003596	China	363	403	111%	363	403	111%
P063123	China	169	176	104%	169	176	104%
P007020	Dominica	3,193			3,193		
P063201	Dominica	892	785	88%	892	785	88%
P008403	Estonia	182	118	65%	182	118	65%
P057271	Guyana	57	18	32%	57	18	32%
P004964	India	1,606	1,648	103%	1,606	1,648	103%
P035158	India	1,151	1,226	107%	1,151	1,226	107%
P010529	India	842	819	97%	842	819	97%
P010476	India	474	501	106%	474	501	106%
P003954	Indonesia						
P005321	Jordan	294	—	0%	294	—	
P008510	Kazakhstan	3,605	2,801	78%	3,605	2,801	78%
P062682	Kyrgyz	344	352	103%	344	352	103%
P005344	Lebanon	2,259	2,758	122%	2,259	2,758	122%
P001522	Madagascar	690	433	63%	690	433	63%
P001738	Mali	570	10,774	1890%			
P007701	Mexico	1,422	1,007	71%	1,422	1,007	71%
P010530	Nepal	1,215	1,597	131%	1,215	1,597	131%
P072996	Niger	1,300	1,291	99%	1,300	1,291	99%
P063622	Nigeria	1,496	1,834	123%	1,496	1,834	123%
P010453	Pakistan	4,182	3,010	72%	4,182	3,010	72%
P010501	Pakistan	70	28	40%	70	28	40%
P042442	Peru	5,441	3,170	58%	5,441	3,170	58%
P008037	Peru	703	184	26%	703	184	26%
P03079	Philippines	1,908	1,896	99%	1,908	1,896	99%
P034212	Sri Lanka	2,514	2,633	105%	2,514	2,633	105%
P038570	Tanzania	2,267	2,864	126%	2,267	2,864	126%
P005721	Tunisia	11,322	11,881	105%			
P050418	Tunisia	5,294	3,951	75%	5,294	3,951	75%
P009072	Turkey	33	184	549%	33	184	549%
P004834	Vietnam	1,597	828	52%	1,597	828	52%
P043367	Yemen	671	1,258	188%	671	1,258	188%
Average per project		*2,146*	*2,123*	*99%*	*1,494*	*1,293*	*87%*

Note: na = not available.

Table F6. Institutional Development and Capacity-Building: Average Costs per Hectare

		Total Institutional Development & Capacity-buildingCosts US$/ha			Total Institutional Development & Capacity-building Costs Excluding expensive projects) US$/ha		
Project ID	Country	PAD Planned	ICR Actual	Percent of Planned	PAD Planned	ICR Actual	Percent of Planned
P008270	Albania	59	39	66%	59	39	66%
P004978	Algeria	—	—	0%	—	—	0%
P008277	Armenia	59	83	140%	59	83	140%
P058468	Bangladesh	—	—	0%	—	—	—
P038884	Brazil	383	333	87%	383	333	87%
P050886	Burkina Faso	11,148	5,180	46%	11,148	5,180	46%
P003593	China	113	161	143%	113	161	143%
P003596	China	—	58	0%	—	58	—
P063123	China	—	—	0%	—	—	—
P007020	Dominica	689	13,325	1935%	—	—	—
P063201	Dominica	—	—	0%	—		—
P008403	Estonia	222	121	55%	222	121	55%
P057271	Guyana	—	—	0%	—	—	0%
P004964	India	121	46	38%	121	46	38%
P035158	India	8	3	39%	8	3	39%
P010529	India	148	45	30%	148	45	30%
P010476	India	35	50	144%	35	50	144%
P003954	Indonesia	—	—	0%	—	—	0%
P005321	Jordan	—	—	0%	—	—	0%
P008510	Kazakhstan	198	139	70%	198	139	70%
P062682	Kyrgyz	18	17	97%	18	17	97%
P005344	Lebanon	599	468	78%	599	468	78%
P001522	Madagascar	370	362	98%	370	362	98%
P001738	Mali	2,340	42,116	1800%	—	—	—
P007701	Mexico	99	54	54%	99	54	54%
P010530	Nepal	269	357	133%	269	357	133%
P072996	Niger	1,450	2,023	140%	1,450	2,023	140%
P063622	Nigeria	336	1,143	340%	336	1,143	340%
P010453	Pakistan	4,157	2,269	55%	4,157	2,269	55%
P010501	Pakistan	5	5	93%	5	5	93%
P042442	Peru	2,510	190	8%	2,510	190	8%
P008037	Peru	30	30	100%	30	30	100%
P03079	Philippines	769	609	79%	769	609	79%
P034212	Sri Lanka	917	858	94%	917	858	94%
P038570	Tanzania	1,653	2,040	123%	1,653	2,040	123%
P005721	Tunisia	387	161	42%	387	161	42%
P050418	Tunisia	2,141	1,561	73%	2,141	1,561	73%
P009072	Turkey	4	19	436%	4	19	436%
P004834	Vietnam	68	52	77%	68	52	77%
P043367	Yemen	503	503	100%	503	503	100%
Average per project		795	1,860	234%	720	487	68%

Note: na = not available.

Table F7. Economic Rates of Return

Project ID	Country	Project	Approval FY	Exit FY	PAD Predicted	ICR Actual
P008270	Albania	Irrigation Rehabilitation	1995	2000	17.0	38.0
P008277	Armenia	Irrigation Rehabilitation	1995	2001	50.0	29.0
P003593	China	Songliao Plain	1994	2003	26.0	40.0
P003596	China	Yangtze Basin Water Resources	1995	2006	24.0	26.0
P008403	Estonia	Agriculture	1996	2002	16.0	14.6
P057271	Guyana	El Niño Emergency Assistance	1999	2002	19.0	16.0
P009964	India	Haryana WRCP	1994	2002	18.0	14.0
P010476	India	Tamil Nadu WRCP	1995	2005	13.3	11.9
P010529	India	Orissa WRCP	1996	2006	16.7	13.9
P035158	India	Andrah Pradesh Irrigation III	1997	2005	24.0	14.7
P003954	Indonesia	Java Irrigation Improvement	1994	2003	16.6	15.5
P004008	Indonesia	Nusa Tenggara Develeopment	1996	2004	17.0	14.5
P008510	Kazakhstan	Irrigation & Drainage	1996	2005	27.0	32.0
P005344	Lebanon	Irrigation	1994	2004	19.0	23.0
P001522	Madagascar	Irrigation II	1995	2005	27.0	12.0
P007701	Mexico	On-farm & Minor Irrigation	1994	2003	19.0	28.0
P010530	Nepal	Irrigation Sector Project	1998	2004	15.3	9.7
P001994	Niger	Pilot Private Irrigation	1995	2002	na	67.0
P010482	Pakistan	Balochistan Community Irrigation	1996	2002	14.0	11.4
P010501	Pakistan	Private Sector Groundwater	1997	2002	23.9	29.0
P008037	Peru	Irrigation Subsector Project	1997	2005	38.7	24.1
P042442	Peru	Sierra Natural Resources	1997	2004	12.0	12.3
P037079	Philippines	Agrarian Reform	1997	2004	22.0	26.0
P034212	Sri Lanka	Mahaweli Restructuring	1998	2005	14.0	15.0
P058070	Sri Lanka	NE Irrigation	1999	2006	14.0	10.5
P038570	Tanzania	RBM & Smallholder Irrigation	1997	2004	12.1	10.4
P005721	Tunisia	Agricultural Sector Investment	1994	2001	15.0	19.0
P0075736	Tunisia	Natural Resources Management	1997	2005	13.7	18.5
P050418	Tunisia	ASIL 2	1998	2003	18.2	11.4
P009072	Turkey	Privatization of Irrigation	1998	2004	72.0	54.0
P004834	Vietnam	Irrigation Rehabilitation Project	1995	2003	17.0	20.5
P043367	Yemen	Taiz Water Supply Pilot	1997	2002	na	26.0
		Simple Average			21.7%	22.1%
		Weighted Average by Area			24.3%	22.9%
		Weighted Average by Engineering Costs			21.10%	19.50%

Note: na = not available.

Table F8. Number of People Benefiting from AWM Projects

Project ID	Country	Project Description	PAD Projected	ICR Actual
P062682	India	Tamil Nadu WRCP	700,000	636,500
P003596	China	Yangtze Flood Emergency Rehabilitation		442,000
P003954	Vietnam	Irrigation Rehabilitation Project		338,388
P010501	China	Songliao Plain	240,000	240,800
	Indonesia	Nusa Tenggara Development	40,000	166,000
P034212	Pakistan	Private Sector Groundwater	234,000	150,000
P057271	Peru	Irrigation Subsector Project	50,000	135,000
P008277	Albania	Irrigation Rehabilitation	56,800	110,300
P003218	Philippines	Agrarian Reform	na	73,000
P051171	Peru	Pe Sierra Natural Resources Management	31,061	31,061
P035717	Lebanon	Lb-Irrigation	175,943	26,528
P058877	Brazil	Rural Poverty—Ceara	na	11,126
P009964	Estonia	Agriculture	5,000	10,515
P010476	Kyrgyz	Flood Emergency		10,000
P034891	Pakistan	Balochistan Community Irrigation		8,922
P040521	Kazakhstan	Irrigation & Drainage		6,622
P056595	Tanzania	RBM and Smallholder irrigation	7,000	5,317
P055974	Niger	Pilot Private Irrigation	4,000	3,469
P051386	Yemen	Taiz Water Supply Pilot		1,949
P059055	Burkina Faso	Pilot Private Irrigation	900	1,600
P010461	Dominica	Irrigated Land & Watershed	1,500	1,300
P008270	Armenia	Irrigation Rehab	100,000	
P038695	Madagascar	Irrigation II	40,000	
P009122	Sri Lanka	Northeast Irrigated Agriculture Project	24,000	
		Total	*1,710,204*	*2,410,397*
		Average per project	*106,888*	*114,781*

Note: na = not available.

Table F9. Typology of Lessons from Completed Projects (in percentages)

Class	Typology	EAP	LAC	ECA	MNA	SAR	AFR	Total	Class Total
Designing & Managing Projects	Project Design	9.0	2.5	4.5	6.0	2.5	3.5	28	
	Implementation & Procedures	4.9	4.9	4.1	4.1	2.0	2.0	22	57
	Bank Processes	1.4	0.7	1.2	1.0	1.7	1.0	7	
Development Enhancing Lessons about Professional Knowledge and Technologies	Community-Driven Development	3.9	2.5	2.5	0.9	1.7	0.5	12	
	Institutional	2.9	2.2	2.7	1.7	1.0	0.5	11	
	Technology	1.4	0.6	0.6	1.0	1.4	1.0	6	
	Cost Recovery/O&M	1.5	0.5			1.5	0.5	4	43
	Disaster-Related	0.5	2.0	0.5				3	
	Targeting	1.2	1.0	0.4	0.2	0.2		3	
	Knowledge Management Mobilization	1.4	0.2			1.2	0.2	3	
	Economics	0.3		0.3	0.5			1	
	Total	**28**	**17**	**17**	**15**	**13**	**9**		**100**

Chapter 1

1. FAO 2002. Cereals and cereal products accounted for 58 percent of food consumed by weight.
2. Abdel-Dayam et al. 2004.
3. This was because investment in drainage was deferred until poor drainage became a problem—a rational economic decision. In most cases in South Asia, for example, drainage only became an issue 40–60 years after surface water canal irrigation was introduced.
4. IEG 2004a. With total construction costs of $750 per hectare and maintenance costs of $10 per hectare per year, the payback period is only three to four years.
5. Lipton, Litchfield, and Faures 2003.
6. IEG 1992.
7. IEG 1994. This report covers Bank activities in the period 1950–93.
8. World Bank 1997a.
9. IEG 1999 and 2000.
10. IEG 2002a.
11. World Bank 2004f.

Chapter 2

1. Costs are expressed in constant 2002 U.S. dollars. Full details of how the amount lent for agricultural water was determined are in appendix A.
2. Camdessus Panel 2003. The Camdessus report notes: "There are no reliable estimates of global investment in irrigation. Large public sector schemes are funded mainly by local public agencies and international aid, with smaller schemes and on-farm investments mainly financed by farmers, informal credit and banks."
3. A number of bilateral donors have given grants and loans for agricultural water management, particularly France, Japan, the Netherlands, the United Kingdom, and the United States, but the amount is not easily determined.
4. "CDD is broadly defined as giving control of decisions and resources to community groups and local governments. CDD programs operate on the principles of local empowerment, participatory governance, demand-responsiveness, administrative autonomy, greater downward accountability, and enhanced local capacity" (CDD Web site, World Bank).
5. Other client services include: technical assistance and aid coordination; country program support; client training; knowledge management; sector strategy; quality assurance; external partnerships and outreach; business development; network, council, and sector board activities and research.
6. The Bank budget for lending preparation was $99.7 million in 2001; by 2005 this had increased to $146.3 million. The U.S. GDP deflator was 88.4 in 1993 and 112.1 in 2005 (year 2000 = 100).
7. There were 256 loans in 1993 and 223 in 2000; average direct preparation costs per project fell from $349,000 to $288,000 over the same period.
8. For example, during the period FY01–FY05, typical public-sector governance/rule-of-law projects took 11.5 months to prepare and 3.7 years to implement. Conversely, rural projects took 18 months to prepare and 6.8 years to implement. Water supply and sani-

tation projects take longer still: 25 months for preparation and 7.3 years to implement.

9. The Bank offers two basic types of lending instruments: investment loans (which typically have a long-term focus of 5 to 10 years and finance goods, works, and services) and development policy loans (which typically have a shorter time horizon of 1 to 3 years and provide quick-disbursing external financing to support policy and institutional reforms). For an overview of these two lending instruments, see World Bank 2000b and 2004e.
10. The increase in staff dealing with "other client services" was also significant between 1997 and 2000: external affairs staff increased from 42 to 124; legal staff increased from 91 to 119; and information technology staff increased from 485 to 699.
11. The 2002 rural strategy states: "another staffing issue is how long and to what extent the Bank should maintain expertise in the technical aspects of agriculture, irrigation and natural resources management. The Bank will keep this expertise at "core" level [currently 16 staff] … and use FAO/CP to provide specialized expertise … " (World Bank 2002c, p. 99).
12. Survey by the Bank's Human Resources Department in 2005.
13. Its share of project preparation costs has doubled since 1994 and is now 21 percent.
14. The combined share of adjustment lending in total IBRD and IDA lending has exceeded one-third since FY98, reaching 53 percent in FY99, peaking during the East Asian crisis and again in FY02 with the Turkey crisis, and dropping back to a 33 percent share in mid-FY04. The share of adjustment lending on a three-year rolling average peaked at 42 percent, and remained flat at about 39 percent in the ensuing years. The share for IBRD alone has exceeded 37 percent since FY98, reaching 63 percent in FY99, and receding to 33 percent in mid-FY04. IDA's share since FY98 has been in the range of 15 to 27 percent.
15. Value added to economic growth in the period 1990–99 was as follows: agriculture 2.2 percent, industry 3.9 percent, services 3.7 percent, and export of goods and services 8.2 percent. In the period 1980–90, agricultural value added was 3.4 percent (World Bank 2000a).
16. IRRI 2005; from data on population, labor force, and wages.
17. United Nations 2005.
18. Picciotto, van Wicklin, and Rice 2001.
19. World Commission on Dams 2000.
20. IEG 1995.
21. IEG 2002a.
22. This analysis is based on 129 cases covering 47 countries in which the Bank had water operations.
23. MNA is the only region in which agricultural GDP increased in the 1990s. More detailed regional analysis is given in appendix D.
24. The typology of borrowers was based on the number of operations per borrowers. A high correlation was found among the number of operations, consistency of operations per borrower (number of years with at least one operation), and amount committed on irrigation and drainage per borrower.
25. For agriculture and irrigation in the period 1988–91, the Bank covered 53 percent of total project costs and 10 percent of Bank financing was from IBRD; in the period 1995–2000, the Bank covered 45 percent of total costs and 76 percent of Bank financing was from IBRD.
26. World Bank 2002d. In FY98, 54 percent of all projects in the country portfolio were classified as "at risk," and water projects featured prominently in that list.
27. The assessment separated policy reform from institutional reform, although sometimes the two are hard to treat separately.
28. A better practice was the Albanian Irrigation and Drainage Rehabilitation Projects I (1995) and II (1999). Both projects received strong policy support from the government. With every change in the institutional setting the government changed or amended legislation and action was taken.
29. World Bank 2003c.
30. Berkoff 2003.

31. World Bank 2005e.
32. IEG 2005c.

Chapter 3

1. Draft paper on Ethiopia, Country Water Resources Assistance Strategy, World Bank.
2. IEG 2005a.
3. India Planning Commission.
4. The rural nonfarm sector includes small-scale food-processing plants, machinery repair shops, and increasingly modern and technology-intensive industries.
5. Indian agriculture accounts for about 25 percent of GDP. Instead of growing at its historic rate of about 4 percent, agricultural growth slowed to 2 percent in the late 1990s.
6. IEG 2005b.

Chapter 4

1. This is discussed in detail with respect to figures 2.7 and 2.8 and in the discussion of result chains in chapter 5.
2. Assuming that a tenth to a quarter of 12 million households in the nondedicated projects participate in agricultural water-management activities.
3. Such as in Yemen (2004), Tunisia (2000), Peru (1997), Lebanon (1994), and Mexico (2004).
4. This figure is taken only from PADs where hectares are reported; because we think there is more reporting of this in the larger projects, this may bias the true average upward.
5. Therefore, the 1998 Bolivia El Niño Emergency Project reported only the length of flood protection provided but not the area benefited; the 1999 Turkey Flood Recovery Project only reported that 31 villages benefited. Others, such as the 1994 Indonesia Dam Safety Project only reported 94 dams and dam safety institutions were established.
6. Two pilot projects were extremely costly: the 1997 Mali Pilot Private Irrigation Promotion Project cost $12,787 per hectare for small-scale groundwater irrigation; and the 2000 Bangladesh Agricultural Services and Innovation Project cost $10,774 per hectare for demonstration of high-tech irrigation. The 1994 Tunisia Agricultural Sector Investment Project cost $11,321 per hectare for dams and conveyance, which also provided water supplies in addition to modernization and extension or irrigation.
7. Kikuchi and Inocencio (forthcoming) analyzed the 314 World Bank projects implemented during the period 1967–2003, with more than 95 percent of them designed before 1990; the mode peaked in 1981.
8. This is based on analysis of 2,908 projects Bank-wide and includes 550 rural sector projects, of which 161 are classified by IEG as agricultural water.
9. For example, the Bulgaria and Jordan Agricultural Sector Loans; the Bolivia and Kenya El Niño Projects; the Dominican Republic's Hurricane George Recovery Project; and the Tajikistan, Kyrgyzstan, Tajikistan, and Yemen flood emergency projects.
10. Regression of entry on exit ERRs yields: ERR (entry) = 0.852 (exit ERR) + 4.254. The same exercise on all AWM that were designed before FY94 and completed later yields: ERR (entry) = 0.427 (exit ERR) + 15.472. In the earlier cohort designed between 1982 and 1993, 78 percent of ERRs predicted at appraisal were not achieved.
11. The world price for cotton was $2,079 a ton in 1994 and fell to $922 a ton in 2001.
12. The example is taken from the Tieshan subproject, which improved 14,272 hectares of early-rice production and converted 1,707 hectares of mixed rain-fed grains to 1,446 hectares of irrigated early-season rice.
13. The new PADs were introduced in 1998 and Section C3 requires a summary statement of benefits and target population.
14. M&E systems typically have four components: (1) monitoring of financial inputs and physical outputs during implementation; (2) process monitoring; (3) post-implementation monitoring, including inspection of completed works, physical and financial audits; and (4) outcome and impact evaluation.
15. To facilitate this more-detailed analysis of project design, a stratified random sample

of 80 projects was taken from the portfolio to give representative subsamples of dedicated and nondedicated projects. Because of the smaller sample size and two data subsets, the time comparison was reduced to two time periods, FY94–FY98 and FY99–FY04, as compared with the analysis in chapter 2.

16. The detailed evaluation is presented in appendix D. It is based on 12 questions on the design quality of ICR M&E systems, and an additional three questions for completed projects.
17. A t-test of the difference between dedicated and nondedicated projects on this measure of M&E quality was significant at the 99 percent level.
18. Ezemenari, Owens, and Soto 2000.
19. An ordered probit analysis of the 18 variables associated with IEG's M&E analysis is reported in appendix C. The four variables reported above are significant with $0.037 < Pr > 0.003$.

Chapter 5

1. From Van Koppen and Safilios-Rothschild 2005: food-short months; school attendance changes; wage employment; income (from existing household surveys); levels of indebtedness; changes in key assets; inclusion of those identified as marginalized in community associations (but this is a means rather than an end); changes in cash crop production; use of health services (and in some cases exemptions from payments); receipt of funds from relatives; input purchase; prostitution; home improvements; and, more generally, participatory wealth ranking and wealth perception changes. In Pakistan, Jehangir et al. (2004) found the presence of flush toilets and the number of people per room to be correlated with poverty level.
2. This is based on an open-ended survey of 18 Bank managers and senior staff responsible for AWM.
3. For example, the Egypt Matrouh Natural Resources Management Project (IEG 2003).
4. World Bank 1996, annex II.
5. World Bank 2004f; IEG 1995.
6. Beside the difficulties at the political level, the poverty focus is still weak, despite a certain degree of evident awareness there is not a clear poverty strategy with respect to WUA support and processes.
7. Thurman 2002.
8. This means that if the preproject average cost recovery is 20 percent, the average project plans to set up a system to recover more than 85 percent of the O&M cost.
9. For example, in the 1994 India Haryana Water Resources Consolidation Project, in the Memorandum of Understanding with WUAs, there is nothing mentioned about fees other than a reassertion of the right of the government of Haryana (GOH) in "levying irrigation fees as fixed by GOH." However, an SAR annex, not the main report, mentions that, "as further information relating to operating costs becomes available [adjustments in rates] will be made, particularly to the extent that farmers undertake operation and maintenance of facilities below the distributary level." This statement did not find its way into the Memorandum of Understanding with communities. So, in this case, for WUA members, there could not be any evident relationship between contributions to O&M through the WUA and reduced fees to the government.
10. A notable exception is Banyopadhyay, Shyamsundar, and Xie 2005.
11. Hussain and Wijerathna (2004) identify four main charge methods in Asia: (1) cultivated area by crop type (much of South Asia); (2) area and output by crop type (Vietnam); (3) multiple criteria: area, productivity, location, service level, and capacity to pay (Indonesia—transferred systems); (4) layered criteria: volumetric at the main canal and cropped area at lower levels (China).
12. 1994 Jordan Agricultural Sector Adjustment Operation.
13. This is the essence of the *warabundi* system, spreading water thinly and thereby forcing farmers to make individual intensive/extensive land/water ratio choices, none of which can ever cover 100 percent of the land up to the

crops' maximum (or even optimal) water need (duty).

14. In one case in the early 1990s, Bank staff showed that a proposed Tanks Improvement Project in Tamil Nadu, India, would be uneconomical because the net water saved would not be sufficient to cover the high cost of lining watercourses. A high proportion of water lost to the ground was recovered by wells or tanks lower in the system (some tanks were actually managed as percolation tanks) and nearly all incremental water intercepted by any tank whose holding capacity was enlarged would simply be at the expense of another tank lower in the basin.
15. These measures include a judicious mix of the following: some lining, low-pressure pipes, groundwater recharge facilities, conjunctive use, improvements to on-farm surface systems, sprinkler systems, microirrigation systems, land leveling, reduced or differently timed tillage, some deep plowing, soil fertility improvement and balanced fertilization, mulching, seed improvement, improved planting techniques, changed cropping patterns, shelterbelts to reduce evaporation, volumetric pricing, and community management. The key, however, is the complementary package.
16. Of the 40 dedicated irrigation projects reviewed, the appraisal documents showed that for 57 percent of them there was a link to extension, for 19 percent a link to marketing, and for another 19 percent a link to credit. Nondedicated projects scored better: 58 percent showed links to extension, 39 percent to credit, and 39 percent also to marketing. The difference was significant at the 10 percent level.

Appendix A

1. "CDD is broadly defined as giving control of decisions and resources to community groups and local governments. CDD programs operate on the principles of local empowerment, participatory governance, demand-responsiveness, administrative autonomy, greater downward accountability, and enhanced local capacity" (CDD Web site, World Bank).
2. IEG 2004b.

Appendix B

1. If the additional 153 CDD-type projects that may include a minor agricultural water component were added to overall project numbers, the number of projects reported for LAC and AFR would increase dramati-cally, although the Africa region would then account for almost the 20 percent of the total number of operations in both time periods.
2. Note, though, that the largest part of the developing world's irrigation area (70 percent) is in Asia.
3. Most lending operations were recoded back to fiscal year 1990 because it was chosen as the base year for measuring progress toward the Millennium Development Goals. This should allow us to be quite confident about these figures.

Appendix E

1. IEG 2004b.

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