



# 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).*

**A**t 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 Andhra 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 Andhra 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 through 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.