



INTERNATIONAL IRRIGATION
MANAGEMENT INSTITUTE

NEWS

VOLUME 1 No. 3

OCTOBER 1997

Comparing the Performance of Irrigated Agriculture Systems

Important basic information on irrigated agriculture system performance can be gained by measuring the outputs against the key inputs of land and water. By standardizing this process, the performance of different types of irrigated agriculture systems in diverse areas can be compared.

Over several years, IIMI has been developing a set of standard indicators that can measure the key attributes of irrigation system performance. The results shown by the indicators can be used to compare the performance of different irrigation systems. The indicators measure the major output—crop production—against the major inputs of water, land, and financial investment. The main users of this information will be policy makers and managers who make long-term strategic decisions, along with researchers doing comparative studies of irrigation system performance.

Measuring "Crop Per Drop"

As water supplies become more limited, an indicator is required that will show how much crop is produced for each unit of water used. In short, how much crop per drop? Achieving such a measurement, however, requires a more detailed understanding than we have of crop production in relation to water balances.

In an effort to measure productivity, four performance indicators are calculated: output per crop area (\$/ha), output per command area (\$/ha), output per unit of irrigation supply (\$/m³), and output per unit of water consumed (\$/m³). These indicators make it possible to compare production from different irrigated agriculture systems. Accurate comparison also requires measuring gross value of crops at both

local and world prices, the area under cultivation during the period of analysis, the design area of irrigation, the volume of water diverted to irrigation, and the volume of water consumed by the crops or evapotranspiration.

Standard Gross Value of Production

When only one crop is considered, measuring the productivity of irrigated land is easily done by following the procedure outlined above. To compare the value of different crops, say wheat and tomato in different parts of the world, is more complex. To solve this problem, the Standard Gross Value of Production (SGVP) was developed. To calculate SGVP, yield of various crops is converted into an equivalent yield of a predominant, traded field crop in local prices. This mass of production is then converted into a monetary unit using world prices.

Comparison of Water Supply and Financial Indicators

For comparison purposes, IIMI includes additional indicators on water supply and finances. The indicators of basic water supply include the calculation of relative water supply, relative irrigation supply, and water delivery capacity. These estimations require the provision of data on several aspects of water delivery and use, including crop water demand, total irrigation supply (irrigation, groundwater, and precipitation), irrigation supply (irrigation and groundwater), irrigation demand, the capacity of the system to deliver water, and the peak consumptive demand of the crops.

Policy makers are keenly interested in the returns on investments, so researchers are interested in making rec-

ommendations that will yield acceptable returns. Evaluations of gross return on investment relate SGVP to the investments made in water delivery infrastructure. The measure of financial self-sufficiency tells us what percentage of

Continued overleaf ►

Copenhagen Workshop on Health Issues in Irrigation

A workshop on the problems of controlling the principal vector-borne diseases associated with irrigation systems—malaria, schistosomiasis, and Japanese encephalitis—was held in Copenhagen from August 18 to 20. Researchers studied draft proposals for future collaborative research between the participants on the control of these diseases and heard presentations of past research. The gathering was hosted by IIMI, the Danish Bilharziasis Laboratory, and DANIDA. Attending were specialists in disease and water resources research centers from Denmark (the Danish Bilharziasis Laboratory, the Danish Hydraulics Institute, and the Technical University of Denmark), the international agricultural research centers ICIPE, IIMI, and WARDA, and the World Health Organization. Experts from universities and research institutes in Guatemala, India, Kenya, The Netherlands, Sri Lanka, Tanzania, UK, USA, and Zimbabwe also were at the session.

expenditure on operations and maintenance (O&M) is generated locally versus that obtained through government subsidies. If government subsidies are high then financial self-sufficiency is low, and vice versa.

Application of the Indicators to Real Irrigation Systems

The minimum set of external indicators was tested and applied in 18 systems distributed among Burkina Faso, Colombia, Egypt, Malaysia, Mexico, Morocco, Niger, India, Pakistan, Sri Lanka, and Turkey. The work was done in collaboration with our partners and collaborators in these countries. Three types of data were collected: water supply, agricultural production, and revenue and irrigation costs. The information was obtained mostly from national Irrigation Departments, Agricul-

ture Departments, and Revenue and State Statistics Departments.

In systems where water is the constraining resource, the value of output per unit of water consumed by evapotranspiration is important (see figure). The striking feature in the graph is the large variation in the productivity per unit of water consumed.

When using the indicators, a major difficulty is that numerous data are unreliable and consequently so are the subsequent estimates. In particular, there are large uncertainties in estimates of actual evapotranspiration and effective precipitation. If the basic data are not dependable, how can we be confident that the indicators show real differences in irrigation performance? When the differences are large, we can be confident that we are measuring differences between systems. When the differences are small, however, we cannot be confident. A focus of ongoing work, consequently, is further research on the sensitivity of the parameter estimations.

The external indicators allow us to identify irrigation systems that perform well, along with those that do not. The indicators also help identify the system components that influence the level of performance. These components then may be examined in detail, using more refined techniques. The indicators are not intended to replace the day-to-day

monitoring techniques that improve system management performance—such as consideration of the question, “are we doing things right?” The indicators are intended instead to address the broader issue—“are we doing the right thing?” The external indicators thus enable the identification of long-term performance trends, which facilitates the setting of long-term strategic objectives to improve and sustain irrigation system performance.

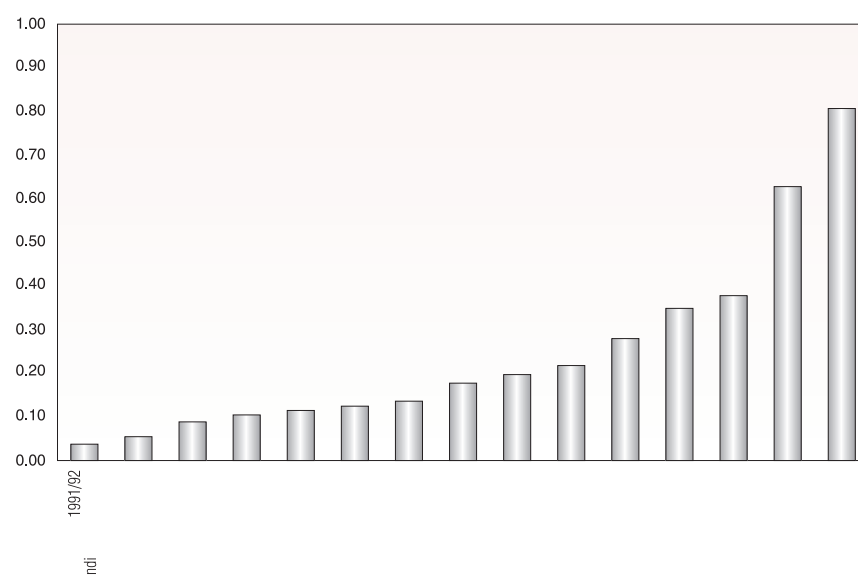
The External Indicators

IIMI's minimum set of external indicators required to enable comparisons of the performance of different irrigation systems are:

- Output per crop area (\$/ha)
- Output per command area (\$/ha)
- Output per unit of irrigation supply (\$/m³)
- Output per unit of water consumed (\$/m³)
- Relative water supply
- Relative irrigation supply
- Water delivery capacity
- Gross return on investment
- Financial self-sufficiency

[For further information about this work and its application, contact David Molden, Head, Performance Program, IIMI]

Production per unit of water consumed.



STAFF AND VISITORS

New Research Staff

- *Wim van der Hoek*, a medical doctor with a master's degree in epidemiology from The Netherlands Institute for Health Sciences, joined IIMI on 1 September to head the Health and Environment program. Wim's career experience in the tropics includes working in the Philippines since 1995 as an independent consultant on epidemiology and public health, in Sri Lanka from 1993 to 1995, in Zambia from 1989 to 1992, and in Mozambique from 1981 to 1984.

- *Wim Bastiaanssen*, an Associate Professor at the International Institute for Aerospace Survey and Earth Sciences (ITC) at Enschede in The Netherlands, has been offered a consultancy contract with us from 1 October 1997 to 30 September 1999. A specialist in remote sensing, Wim will work on regional water balance determinations using advanced technologies. He will be involved in projects in Turkey, Pakistan, and Sri Lanka as part of our activities in the Performance Program.

- *Herb Blank*, formerly of USAID and now based in Kenya, has been offered a part-time consultancy to represent IIMI in East and Southern Africa. Herb will attend major workshops, conferences, and other meetings and will advise us of significant research opportunities in the region. Currently engaged in a brief survey of irrigation activities and issues in Kenya, he reports he has found a number of irrigation specialists who are interested in IIMI activities.

Relocated Staff

- *Jeff Brewer*, one of our social scientists, was transferred from our India program to IIMI's new branch in Ismir, Turkey. Jeff will be Team Leader, coor-

inating the work of the branch (see first box on the second page). Jeff took up his duties on 1 July 1997.

Carlos Garcés-Restrepo, an engineer earlier working for us in Colombia, will become Program Leader in the IIMI Mexico Office. Carlos will coordinate IIMI's work in Mexico and Latin America on the impact of irrigation management transfer to the water user associations.

Associate Experts

- *Peter Jensen*, an environmental engineer, arrived at IIMI last April to study water quality and reuse of water in irrigation. Peter is Danish and holds a master's degree in environmental engineering from the Technical University of Denmark. As a member of IIMI's Health and Environment Program, Peter will conduct research in Sri Lanka, Pakistan, and West Africa.

- *Charlotte de Fraiture*, a specialist in tropical water and land management, transferred from IIMI-Colombia to HQ in April. A citizen of the Netherlands, Charlotte holds a master's degree from the Agricultural University there. Charlotte is a member of IIMI's Performance Program and is continuing the work on irrigation performance indicators that she started in Colombia. She also is involved in developing and testing procedures for water accounting. Her research takes her to the Huruluwewa

watershed and the Kirindi Oya Irrigation Project in Sri Lanka.

- *Margaretha Bakker*, also of the Netherlands, arrived at HQ last May to work on the shared control of natural resources (SCOR) project. She holds a master's degree in rural development with a major in development economics. In August, Margaretha was reassigned to the Multiple Uses of Water study where she is now conducting data collection, analysis, and valuation of the different uses of irrigation water in the Kirindi Oya system in Sri Lanka.

IIMI Fellows

- *Martin Birley*, a leading epidemiologist at the Liverpool School of Tropical Medicine, UK, visited IIMI during the last two weeks of January to review and develop IIMI's project proposals on disease vector control in irrigation systems. Martin also participated in the Copenhagen workshop on health issues.

- *Prof. Asit K. Biswas*, Chairman of the Technical Programme Committee of the World Water Council, and Editor of the International Journal of Water Resources Development, visited us for one week in June to discuss IIMI's overall program, with special emphasis on the communication aspects. He gave a seminar on "Environment and Irrigation Development: Urgent Need for a New Analytical Framework."

Chief Minister of the Punjab Visits IIMI Pakistan

Mian Shahbaz Sharif, Chief Minister of the Punjab Province and Zulfiqar Khosa, Minister of Finance, together with Chaudhry Muhammad Iqbal, Minister of Irrigation visited IIMI on 4 July 1997. They were seeking a better understanding of the research activities of IIMI and our collaborators in Pakistan. In his address to the institute, the Chief Minister declared that his government was determined to make Pakistan self-reliant in agriculture. He said he would appreciate any and all practical assistance toward that goal which might result from IIMI's research efforts.

BOOKSHOP

Research Reports

- *Impacts of Irrigation Management Transfer: A Review of the Evidence.* Research Report 11 by Douglas Vermillion.
- *Water Distribution Rules and Water Distribution Performance: A Case Study in the Tambraparani Irrigation System.* Research Report 12 by Jeffrey Brewer, R. Sakthivadivel, and K. V. Raju.
- *A Methodology for Rehabilitation Planning for Small Tanks in Cascades.* Research Report by Jeffrey Brewer, R. Sakthivadivel, and Nihal Fernando.
- *Impact Assessment of Rehabilitation Intervention in the Gal Oya Left Bank.* Research Report by U. Amarasinghe, R. Sakthivadivel, H. Murray-Rust. (Forthcoming)
- *Management Transfer in Mexico: A Strategy to Achieve Irrigation District Sustainability.* Research Report by Sam Johnson III. (Forthcoming)
- *The IIMI Indicator of International Water Scarcity.* Research Report by David Seckler, Radhika de Silva, and Upali Amarasinghe. (Forthcoming)

Reprint Series

- *Reorganizing Irrigation: Local Level Management in the Punjab (Pakistan).* Reprint 2. Doug Merrey
- *Irrigation Management on the Indo-Gangetic Plain.* Reprint 3. D. J. W. Berkoff.

Research Reports and Reprints are available from the IIMI Information Office, Colombo and on IIMI's website at <http://www.cgiar.org/iimi>

SWIM Papers

- *Accounting for Water Use and Productivity.* SWIM Paper 1 by David Molden.

BOOK REVIEW

UNITED STATES DEVELOPMENT ASSISTANCE: THE DOMESTIC POLITICS OF FOREIGN ECONOMIC AID. Vernon W. Ruttan, The Johns Hopkins University Press, Baltimore, Maryland, pp. 657, 1996. ISBN 0-8018-5051-7.

This recently published book by an IIMI Fellow, Vern Ruttan, presents a comprehensive analysis of U.S. Foreign Economic Aid Policy since World War II. The author attempts to explain the rationale for U.S. assistance to other countries, the elements that influenced changing commitments of the U.S., and prospects for continued assistance. The work is important for policy makers, administrators, and scholars concerned with the various aspects of economic development, whether through aid from the United States or from elsewhere. Following the text there are 145 pages of bibliography and notes.

I found the brief preface particularly interesting. It provides an account of the author's experience in the development process over 35 years, a career which led to the writing of this book. The account raises questions foremost in the minds of most of us who have been concerned with the various aspects of foreign aid. What has been the ethical, political, and economic rationale for U.S. foreign economic assistance? To what degree has the aid agenda been driven by national self-interest as opposed to altruistic concerns about poverty, hunger, and health in poor countries? What has been the impact? Why is America's commitment on the wane?

The book is divided into five parts. Part I, Interest and Passions, explains the rationale for U.S. foreign aid. The author identifies two conflicting doctrines about the appropriate

relationships of the United States with the rest of the world. The first is the idealist or liberal doctrine—the mission of the United States is to lead the rest of the world to a more democratic and prosperous future by example, assistance, and cooperation. The second is the realist or conservative doctrine—that America must manage its affairs with other countries primarily to protect its self-interest and national security. The way in which these two conflicting doctrines have influenced U.S. assistance policy is one of the author's underlying themes.

Part II traces the evolution of policy from the Marshall Plan to the present, emphasizing the ebb and flow of the influence of the liberal and conservative doctrines described above. For example, during the Reagan administration there was first a shift away from basic human needs

and human rights toward security considerations and subsequently, following the end of the Cold War, a shift from security concerns toward a policy of greater economic cooperation. For those who question the relevance of U.S. aid, the author argues that the growth of political and economic interdependence has extended the moral basis for distributive justice from the national to the international sphere. "International interdependence has resulted in an implicit global contract between the citizens of developed and developing countries." However, facing no immediate global threats to their security, the American people are as yet unwilling to accept such a contract.

Parts III and IV deal with the emphasis on bilateral and subsequent multilateral assistance. Of particular interest to IIMI readers is the discussion of the U.S. influence on the policies of the World Bank and other multilateral development banks (MDBs). Ruttan concludes that the policies of the MDBs have generally been consistent with the broader

objectives of U.S. policy in advancing a more liberal economic order. There is little basis, however, for concluding that the United States has shaped—or has even seriously attempted to shape—the policies of MDBs to favor U.S. economic interests.

Environmental interest groups, particularly in the United States, during the past decade have caused MDBs to change their lending policies. Although not discussed in the book, in the area of irrigation development, lending for construction of large dams has come under attack, and MDB lending for large-dam projects has almost ceased. The author notes that this change is important because it is the first time that constituencies other than executive agencies or legislatures of member governments have successfully mounted a substantial challenge to MDB policies and projects. The current vision of "sustainable development" (development that meets the needs of the present without compromising the ability of future generations to meet their needs) emerged not from official

levels but was advanced by the international environmental community and later by a broad coalition of NGOs.

In Part V, Reform and Redirection, the author discusses the as-yet unsuccessful efforts in the 1990s to reform U. S. foreign economic assistance and reflects on the future of foreign aid. The continuing fatigue and disorientation of U.S. bilateral efforts will not be resolved by the reorganization or reform of US/AID. The author concludes: "it is doubtful that, in the absence of a new vision and new consensus, US/AID can survive in its present form. A new vision grounded in today's realities and tomorrow's promise, however, could lead our bilateral assistance program in a new direction—more toward development cooperation than assistance."

Might not Ruttan's conclusions also apply to the CGIAR?

Randolph Barker, Senior Advisor, IIMI

CONJECTURES AND REFUTATIONS

Irrigation and Its Environmental Impacts

Much has been written in recent years on the environmental impacts of irrigation. During two recent major world events (Stockholm Water Symposium, August 1997, and World Water Congress, Montreal, September 1997), a major topic of discussion was how to produce enough food in an increasingly water-scarce world. Associated with this discussion was how best to operationalize the concept of sustainable irrigation management, which is the main focus of this brief note.

Concern with the environmental impacts of irrigation is not new. For example, during the past 25 years several hundred environmental impact assessments (EIAs) of irrigation projects have been carried out all over the world. Irrespective of in which country these EIAs have been carried out, from Albania to the United States, the overall processes and the underlying philosophies have been mostly similar: only the depth and rigor of the analyses have varied from one place to another.

A comprehensive analysis of all the EIAs carried out indicates that

uniformly and universally the analysts have concentrated on what is NOT environmentally sound irrigation development rather than what is. The near-total emphasis has been on what are the negative environmental and social impacts of the irrigation projects: positive impacts have been almost exclusively ignored. Any large infrastructure project, including irrigation, will have both positive and negative environmental impacts. A holistic and objective approach must consider what the positive environmental impacts are and how these can be maximized, as well as what the negative environmental

impacts are and how these can be minimized. By concentrating only on one-half of the equation, that is the negative impacts, we are not obtaining optimal social, environmental, and economic benefits from the irrigation development projects. Clearly, the methodology impact assessments needs to be substantially redefined, an issue that has been basically ignored so far.

In addition, while EIA has become an essential pre-project activity to obtain the necessary approval from the governments and the aid agencies for the implementation of the irrigation projects, there is virtually no monitoring and evaluation of the actual environmental impacts (both positive and negative) during their operational phases. Unfortunately, as practiced at present, EIA has become an end by itself, rather than being a means to an end, which should be proper environmental management of the project.

One major problem that has been created by the absence of both a pre-project holistic environmental assessment process and post-project evaluation of irrigation projects is the reliability of the hypotheses that are being currently used extensively all over the world to make forecasts during the EIA process. Irrespective of the current rhetoric, the number of large irrigation projects anywhere in the world, where environmental impacts during the operational phases have been objectively evaluated and then compared with the forecasts made during the EIA phase, can be counted on the fingers of one's hands, with a few fingers left over. In the absence of properly monitored results, the hypotheses on which EIA forecasts are being made remain basically untested, and thus the existing biases and errors are being regularly perpetuated worldwide. A good example is the Aswan High Dam, whose impact evaluation clearly indicates that many ideas about

adverse environmental impacts are clearly erroneous and need to be substantially amended.

Irrigation and environmental professionals are going to face a challenge in the twenty-first century, the magnitude and complexity of which no other generation has had to face before. Environmentally sound irrigation management will not result from rhetorics. Even though our present knowledge base in this critical area is seriously flawed, there is not enough attempt to generate reliable knowledge on which sustainable irrigation management practices can be based. IIMI's current effort to improve our knowledge base on the real health impacts of irrigation is an excellent step in the right direction. However, much more remains to be done in the overall area of irrigation-environment interrelationships on a

global basis within a relatively short period of a decade or so, if we are to meet successfully the challenge of producing enough food for the world's expanding population in the twenty-first century.

● *Prof. Asit K. Biswas is Past President of International Water Resources Association, and currently chairs the Technical Programme Committee of World Water Council. His latest book is Water Resources: Environmental Planning, Management and Development (McGraw-Hill, New York, 1997, 739 p.)*

Contributions to this section are encouraged and should be sent by letter, fax, or e-mail to The Editor, IIMI News. IIMI reserves the right to select, edit, and publish letters according to its house style.

Gender and Water Management Workshop

The meeting focused on gender analysis of rights to land and water, the implications of privatization, and water markets for women's access to resources, how women—as well as men can fully participate in collective action projects. The relationships between gender and water scarcity, pollution, and multiple uses of water in irrigation systems were also considered.

This IIMI workshop, held from 15 to 19 September 1997 in Sri Lanka, brought together fifteen outstanding researchers and practitioners on gender and water to help IIMI staff clarify, and more effectively address, the major research questions of importance to IIMI's work. The event was built around the workshop's research papers that, together, provided a useful picture of the state-of-the-art for both gender research and implementation guidelines.

Several important observations were underlined by the workshop. These included the paucity of reliable quantitative and qualitative data on gender and the need for a clearer understanding of the linkages among policies, project implementation strategies, together with the diversity of social, cultural, and economic contexts of irrigation.

By the close of the meeting, the participants had constructed a useful set of research questions and issues and had identified several recommendations for improved research methodologies. The nucleus of an international research network on Gender and Water was also established. The papers, together with an interpretative essay based on the workshop discussions, will be published shortly by IIMI.