A MANAGEMENT PERSPECTIVE ON THE PERFORMANCE OF THE IRRIGATION SUBSECTOR

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Cover photograph by M.G. Bos: An Egyptian irrigation canal

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Glossary

assolement	Moroccan type of zoning
bethma	sharing of certain irrigated areas during dry seasons
chak	irrigable area under control of farmers, comparable to tertiary system
golongan	Indonesian scheduling system
kharif	the "summer" cultivation season
paddy	rice
pasten	Indonesian scheduling system
rabi	the "winter" cultivation season
subak	Balinese water users' and community group
tank	reservoir

Abbreviations

ADB	Asian Development Bank
AHT/SCG	Agrar- und Hydrotechnik Gmbh/Salzgitter Consult Gmbh.
ANAFID	Association Nationale des Ameliorations Fonciers, de l'Irrigation et du Drainage
CADA	Command Area Development Authority
CGIAR	Consultative Group for International Agricultural Research
DFC	Development Finance Consultants S.A.
DAC	Development Assistance Committee
EEC	European Economic Commission
EIRR	economic internal rate of return
FAO	Food and Agricultural Organization of the United Nations
FSD	full supply depth
FMIS	farmer-management irrigation systems
HRM	human resources management
IAC	International Agricultural Center
IBRD	International Bank for Reconstruction and Development (World Bank)
ICB	International Competitive Bidding
ICID	International Commission for Irrigation and Drainage
IFDP	Institute for Food and Development Policy
IIMI	International Irrigation Management Institute
ILRI	International Institute for Land Reclamation and Improvement
IMD	Irrigation Management Division
IMF	International Monetary Fund
IRR	internal rate of return
LDC	less developed countries
MIS	management information systems
MMP	Sir M. Mac Donald & Partners Ltd.
NEDECO	Netherlands Development Consultants
NIA	National Irrigation Administration
NIC	newly industrializing countries
NPV	net present value
O&M	operation and maintenance
ODI	Overseas Development Institute
OECD	Organization for Economic Cooperation and Development
OED	Operations Evaluation Division
ORMVA	Office Regional de Mise en Valeur Agricole
PPAR	Project Performance Audit Report

PRC	Planning Research Corporation
TAC	Technical Advisory Committee
USAID	United States Agency for International Development
WUG	water users' group

Note on the Author

Charles Nijman worked with IIMI as a management specialist from November 1987 to March 1992. He has a professional background in irrigation engineering and in management science. His main activity at IIMI was the amalgation of these two disciplines into an integral analytical framework for irrigation management. He has been involved in management research in Indonesia, irrigation research in Indonesia and Burkina Faso, and irrigation management research in the Philippines, Malaysia, Sudan, Morocco, Sri Lanka, India and Pakistan. In September 1992 he joined GITP International/Management Consultants B.V. in Nijmegen, The Netherlands.

"So how is the "Crisis of Irrigation Management" to be avoided? Here the international development community has a vital role to play. This community has been an active part of the problem through the policy of moving enormous funds into irrigation programs with virtually no attention paid to the results. Indeed there can be little doubt that the policy of benign ignorance --however well intentioned through reluctance to "interfere in internal affairs" of local governments--has been a principal cause of poor management and corruption in irrigation systems. The time is now long past due for this policy to be reversed and for the international development community to play an active role in helping the many talented, honest and dedicated people in the LDCs to resist politicization and corruption of their management systems. A "hands off" policy, confined only to financial disbursements, simply helps the "bad guys" against the "good guys". Insistence of effective management, on results, reverses the balance between the two. Here is the keystone for international irrigation development policy."

Seckler 1982:14.

to Inge and Thijs

Preface

THE MANAGEMENT PERSPECTIVE on the irrigated subsector presented herein is the outcome of four years of related efforts that were initiated in 1987 by the then management of the International Irrigation Management Institute (IIMI), Dr. T. Wickham and Ir. F.E. Schulze. They requested the Dutch Ministry of Foreign Affairs to second a staff member with a background in both management science and irrigation engineering. The Ministry reacted kindly by sending the undersigned.

Developing a management perspective on the irrigated subsector required inputs from practitioners, researchers and specialists of the most important involved disciplines such as engineering, sociology, agronomy and economics. The development of this management perspective was therefore initially done through case studies in Sri Lanka, the Philippines, Morocco and Sudan. Apart from available data in reports, files, and studies in different systems, irrigation agencies and donor organizations, the generalizing picture presented here is based to a large extent on interviews with a wide range of actors involved. It is an attempt to integrate the following multitude of perspectives:

> of farmers and field staff, their superiors, system managers, engineers, design and other support staff of irrigation agencies, as well as most top managers in the involved countries, agricultural agency staff, and individuals of the national planning agencies, several secretaries and undersecretaries of irrigation ministries, external consultants, many staff members of the World Bank and Asian Development Bank, a former Executive Director of the latter, a former Member of Parliament, a Minister of Irrigation as well as a former President of the World Bank. In addition, interaction with many other irrigation and development professionals has contributed to this management perspective.

Many agency documents, files, reports, management control and information systems, as well as loan documents, audit reports and impact evaluation studies were reviewed. The presented management perspective was further validated with an extensive survey of the irrigation management and development literature.

The analysis here is based on this multitude of opinions from interviewees and available written data. Although supported by an analytical framework, and its "unbiased" management perspective, the story represents the author's distillation of the "true" picture of the performance of investments in the irrigated subsector. Thus, only the author is responsible for the analyses and evolving conclusions and recommendations. The views expressed are his own.

It is not the objective of this analysis to blame any individual or any specific agency, government, consultant firm or funding agency regarding the nature of their involvement in irrigation investment. Instead, it is pursued to provide a picture of systematic constraints in

irrigation management. Most reviewers of the two initial Sri Lankan case studies have explicitly referred to the much wider validity of this systematic pattern. Many findings and recommendations are likely to apply to a certain degree to other government agencies and other funding agencies involved in investment in irrigation, and in development in general, also in other developing countries. As far as individuals can be identified at all here, they should not be criticized as this analysis is about the performance of the "system" of irrigation development and management in developing countries, and definitely not about individual performance.

The development of the analytical framework, and its application on case studies to obtain a generalized management perspective on the irrigation subsector would not have been possible without the extensive and thoughtful professional guidance of Prof. Drs. A.A. Kampfraath in our frequent encounters during the past four years. I am extremely grateful to him and to IIMI for making possible this type of "overseas" professional guidance. Also, I would like to thank Dr. P.S. Rao for the support and technical supervision provided in an early stage of this study, and Mr. Charles Abernethy and Mr. Khalid Mohtadullah for support and supervision at later stages of my assignment with IIMI.

The majority of data collection and interviews for the two Sri Lankan case studies occurred during 1988 and 1989. The comparative studies in the Philippines, Morocco, and Sudan, as well as the extensive literature survey were done during 1990 and 1991.

Given this study's dependence on the interaction with irrigation practitioners and researchers, I am very grateful to the many people who allowed me time for interviews, often iteratively. I hope that most of these interviewees can find themselves in the presented analysis and recommendations. Moreover, I am very grateful for the cooperation and assistance I received from the staff of the Sri Lankan Mahaweli Economic Agency, Irrigation Department and Ministry of Irrigation, Lands and Land Development, the Moroccan irrigation authorities of Gharb and Moulouya, the Philippine National Irrigation Administration, and the Sudanese Rahad Corporation and Ministry of Irrigation. I am also grateful to involved staff members of several consultant companies, research institutes, the World Bank and Asian Development Bank for their cooperation with this research.

Interaction with IIMI colleagues and some of its visitors was crucial for this study. Indeed this study would not have been possible without it. In particular, I would like to thank the following for the discussions we had on irrigation management:

Dr. P.S. Rao, Dr. Hammond Murray-Rust, Dr. Zenete Franca, Dr. Masao Kikuchi, Mr. K. Jinapala, Mr. P.G. Somaratne, Dr. Douglas J. Merrey, Dr. D. Vermillion, Mr. J. Verdier, Dr. C.M. Wijayaratne, Mr. D. Berthery, Dr. H. Sally, Mr. Charles Abernethy, Ir. F.E. Schulze, Mr. Khalid Mohtadullah, Dr. R. Saktivadivel, Dr. M.S. Shafique, Prof. Khin Maung Kyi, Dr. E. VanderVelde, Dr. Jacob Kijne, Dr. Chris Panabokke, Dr. D. Seckler, Dr. D. Constable, Dr. Gil Levine, Dr. M. Svendsen, Dr. Fred Valera, Mr. Jacques Rey, Mr. Ranjith Rathnayake, and Ms. Inge Jungeling

In addition, Prof. Lucas Horst and Dr. Peter Zuurbier of Wageningen University provided thoughtful comments on the paper's final draft version. Though I do not want to implicate any of them in the author's responsibility for the presented analysis and findings.

The research was supported by the Research and Technology Department (DPO/OT) of

the Ministry of Foreign Affairs of the Netherlands, through my secondment to IIMI for more than four years. Additional research and publication costs were funded out of IIMI's unrestricted core funds, for which I am very grateful as well. In addition, I am grateful to the Department of Management Studies of the Wageningen Agricultural University for the support given to this research, especially during the last months of finalizing this text.

Special thanks are due to Ms. Charlene Ludowyke for the preparation of parts of this text, and to Ms. Mala Ranawake for assisting in the preparation of most of the figures.

Reading Advice

Readers with very limited time who want to grasp the main messages of this management perspective, are advised to read the Executive Summary and chapter six, that contains the conclusions and recommendations.

Charles Nijman
Bennekom, August 1992

Executive Summary

INVESTMENT IN IRRIGATION has been immense in the past. Estimated average annual investments of US$ 15 billion makes irrigation the largest subsector of the agricultural sector, that is itself by far the largest sector of development investment. Since the mid-1960s the awareness spread that the performance of irrigation investments was far below its potential. The size of this underperformance is well represented by Seckler's alarming conclusion that the average irrigation investment costs twice as much, and delivers no more than half the benefits specified in the plans.

THE PROBLEM DEFINITION

Simultaneously with the increased awareness about underutilization, the awareness increased that the level of management of the systems was backward compared to the construction efforts and expertise. The underutilization was considered not only a technical, but also a managerial problem. Essentially three pilot studies in the late 1970s in the Philippines, Sri Lanka and India have provided the few available data to proof such potential for performance improvement through improved management. Yet, this potential for a sustainable "water revolution" remains to date largely as it was, because the evidence of these three experiments was not repeated nor sustained.

From the perspective of many engineers, the management issue in irrigation has remained therefore, to a large extent, imaginary. There has remained thus a serious disjuncture in the perspectives of many irrigation professionals. Many of them have argued for the need for a more objective perspective on irrigation's performance to reunite the different professional perspectives, and as a prerequisite for the identification of relevant improvements. The topic of this study is such an improved insight in the management of irrigation, and ways to improve its performance.

THE OBJECTIVES

In addressing these issues, this study adopts the following two objectives: 1) the identification of generalized directions of management change for performance improvement in the irrigation subsector; and 2) the testing of an analytical framework for irrigation management.

Addressing these objectives requires firstly an effort to fill the fore mentioned gap toward the concept of irrigation management. Therefore, the concepts of management and control processes and conditions of an existing analytical management framework are translated for irrigation. Together they form this paper's so-called management perspective. Subsequently, this analytical framework is applied to irrigation.

EXISTING IRRIGATION MANAGEMENT CONCEPTS

Few explicit efforts to develop irrigation management concepts appear to exist. Most concepts focus on the formal appearance of the organization, its structure. Of the reviewed concepts, only Diemer's approach was a process-oriented approach. All concepts remained vague about the relation between process and structure. None of them tried to take a management perspective, i.e., to consider all relevant factors for irrigation managers. This study's potential contribution is to fill these gaps by taking an explicit management perspective, and by systematically analyzing the relation between process and structure. Besides, other management conditions than structure only are considered such as financial control systems, human resources, and the provision of information and knowledge.

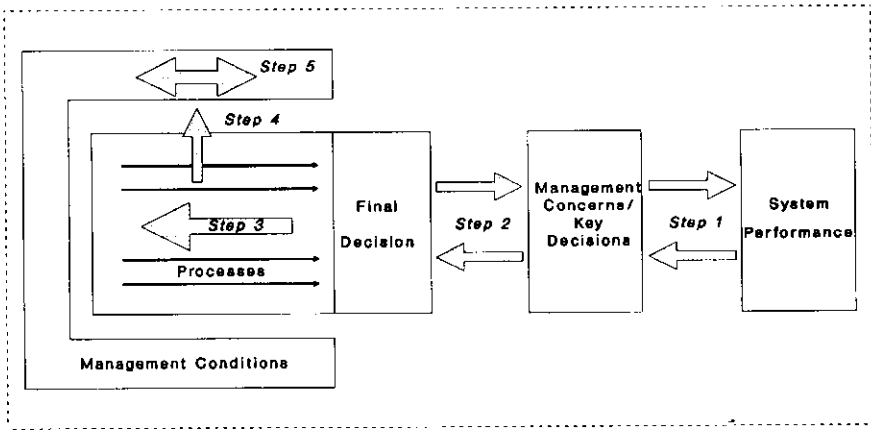
AN INTEGRAL MANAGEMENT PERSPECTIVE

This study's management perspective is based on an integral management framework developed by Kampfraath and his colleagues of the Department of Management Studies of the Wageningen Agricultural University, The Netherlands.

The Figure below is a graphic representation of the different steps of this process-based management analysis. The identification of key decisions in regard to water delivery is the first step in the development of this management perspective on irrigation (step 1 of the Figure below). For irrigation agencies, the management of *water* is considered the primary irrigation activity and measure of performance evaluation. Therefore, to evaluate the internal management processes in any irrigation system, the relevant key decisions for irrigation have to relate to the water delivery.

During the *capacity utilization*, the seasonal allocation plan, in-seasonal allocation, and the flow regulation are considered to be such key decisions. For the *capacity creation*, the desired investment objectives, feasible investment objectives, and the functional requirements for the investment were taken as the most relevant key decisions.

Performance-based management analysis



After the definition of the relevant key decisions, the contribution to the overall performance must be established for each of them (step 2). If this contribution is deemed unsatisfactory, the processes leading to the final decisions are analyzed, and the bottlenecks in these processes are identified. The establishment of the so-called levels of sophistication of the key decisions is part of this analysis (step 3). Based on an analysis of the interaction between the processes and the management conditions, those changes in the management conditions are derived that are likely to lead to improved processes. Apart from the organizational structure and rules, this framework also considers such other management conditions as the human resources, their motivation and incentives, the provision of information and knowledge, and the financial control systems. This leads to an identification of the changes needed in management conditions that are likely to result in improved processes, improved decisions, and improved performance (step 4). The last step is then the identification of the required management-control processes to achieve these required improvements in processes and management conditions (step 5).

This analytical framework thus links performance, physical processes, decision-making processes, management conditions and management control in an analytical sequence. Thus providing an integral "management perspective" on irrigation performance.

DATA COLLECTION

This study's data collection occured during in-depth organizational analyses of two Sri Lankan irrigation organizations, and during comparative studies in Morocco, Sudan, and the Philippines. Besides, less intensive observations were done in India, Malaysia and Pakistan.

The data collection on decision-making processes consisted of the interviewing of decision makers in irrigation and other line agencies, ministries, funding agencies and consultant companies. Also reports, files, records and other documentation were reviewed. In addition, a literature survey was done to shape and compare the findings.

The following sections give short summaries of the most significant findings and recommendations for the management of the capacity utilization and the capacity creation of irrigation in LDCs.

RESULTS: CAPACITY UTILIZATION

The assessment of the available water supply in the observed irrigation systems tended to occur in an approximate rather than a precise way. They tended to be on the "safe" side --preferably at a 100 per cent probability, i.e., at no risk--to minimize cultivation risks, and to minimize the related conflicts with the farmers and politicians. This practice pre-emped the inclusion of the trade-offs between lower risks for the few lucky farmers, and higher risks for more farmers. Other interested parties than the irrigation agency or officer were usually not aware of the exact probabilities of the availability of the water supply. Thus, they did not share the responsibility for any related risks.

Contrary to common belief, the assessment of the demand, the allocation of water, and the regulation tended to be demand-driven in all case studies. This decision making was left almost completely to the field level staff. Higher level agency staff made water

schedules based on theoretical calculations. These excluded important aspects such as the scarcity of water and the required management inputs by agency staff and farmers to achieve high water efficiencies. These schedules seldom had any value for the actual implementation of water allocation and regulation.

Higher level staff thereby tried to minimize their management inputs. Only when complaints occured did staff get involved. To minimize complaints they tended to allow field staff to satisfy the demand for water, and allowed a related superfluous water discharge in all canals (if the supply was available). The main canals thus often transported the maximum discharge. Systematic monitoring and evaluation was not done in any of the case studies, as the extra water in the canals and the "delegation" to field staff did not need any.

This minimal management approach of the agencies favored the farmers at head-end reaches along the canals. So the tail enders often had problems in obtaining sufficient water as the design and actual discharge capacities of the canals were insufficient for this type of surplus water allocation.

The flow regulation along the main canals appeared an "adhocracy". The individual operators had no contingency instructions on procedures for gate settings relative to the timing and size of flow fluctuations. They operated therefore often by trial-and-error and tended to favor thereby the distribution to the service area under their responsibility. This was done again to satisfy farmers and to minimize complaints, at the expense of the conveyance to downstrean canal reaches. Also gate operators that were responsible for tail-end reaches could not correct systematically such favoring by upstream reaches. The easiest way out for them was to request an increase of the total discharge in the main canal.

Getting more water to the end of the canal was then only possible by the allocation of more discharge to the overall system, or, if that were impossible, by rotation or staggering. Introduction of the latter measures required increased management inputs by higher level staff, and occurred only if (a portion of the) farmers, superiors or politicians complained.

The above processes were mainly caused by the low motivation of agency staff involved in the capacity utilization. The incentives to be involved appeared to be mainly the following "negative" ones: farmers were never satisfied, a lack of performance-related financial or career incentives, the continuous risk of political interference, and professional and financial incentives for construction and maintenance rather than for the capacity utilization. Similarly, irrigation agencies as a whole had no performance-related incentives, other than the fore mentioned negative ones.

The above practices, motivation and incentive constraints were more true in some countries than in others. In Morrocco, the management practices were at a more elevated level compared to the other case studies and some of the above generalizations did not apply to Morocco. Performance-related motivation and incentives were observed to be somewhat higher because of a more sophisticated management, with individual billing, and a volumetric water delivery to farmers. Yet, also in Morocco, the agencies appeared to have no financial incentives to manage the allocation and regulation along the main system, in order to prevent obvious and known water losses.

Main recommendations. In all case studies, improvement of the capacity utilization would require increased inputs by higher level agency staff. This would require that they, as well as field staff, become more motivated for this type of work. This seemed

unlikely to occur if the agencies themselves would not become more interested in and accountable for the water-delivery performance.

The overall recommended directions for institutional reform to improve the capacity utilization were the following:

1. A decentralization of the irrigation agencies. This would allow greater information exchanges at lower levels between farmers and agency, and between different agency levels;

2. More financial dependence of the irrigation agency on the water-delivery performance. This would introduce some accountability for the water-delivery performance. For example through an increased dependence on service payments by farmers. More financial independence of the irrigation agencies means also a decreased dependence on the judiciary budgetary allocation by the government;

3. A more performance-oriented human resources management, such as performance-based incentive systems and career development, especially for higher level staff. This would require a decentralization of the related authority to the agency;

4. A more explicit and specific mission statement;

5. External public monitoring for more systematic accountability (if no financial or other accountability to the clients exists);

6. More transparency of and thus accountability for the performance of the regulation through a separate, central "regulation unit";

7. If WUGs are to be functional, they need a more powerful position in the water-related decision-making processes than currently observed in all case studies. This could be achieved either through more administrative authority, or through financial accountability to the WUGs. An ultimate step as the transfer of the ownership of (part of) the system (and possibly the agency) would provide the collectivity of farmers with even stronger powers to make the managing agency accountable for the performance during the capacity utilization;

8. More appropriate government regulations and related enforcement to reduce the observed adverse incentives in some more independent irrigation agencies.

Given the involved interests of agencies, their staff and the farmers, the above changes can only be realized if they get serious support from political and donor levels.

RESULTS: CAPACITY CREATION

The desired investment objectives. Decision taking on the desirable investment objectives was often observed to be done single-handedly by national politicians. Usually, donor staff in consultation with consultants and agency staff prepared such decisions. This preparation usually left little time and room for participatory interactions with other interest groups.

Politicians often determined such politically relevant objectives as the site identification and the selection of beneficiaries. The political pressure thereby caused the professional guidance to become sometimes ineffective.

The acquisition of external funding was observed to be the prevalent political and agency priority. It dominated the other desired objectives, other than those of political importance. Because of this priority for external funding, the funding agency had, in principle, and in practice, a large influence on the determination of the desirability of the investment objectives. Thus, the desirability of such investment objectives as the project size and the performance of the water delivery and agricultural production was in all case studies largely at the discretion of the donor staff or consultants.

As a result, also the interests of farmers and other local interests were unlikely, and were observed not, to be adequately represented in the decision making on the desirable investment objectives. Often the desirability from the farmers' perspective was considered equal to the maximum funding level as the funds were perceived as "handouts" to localized voters.

In combination with an observed supply-driven availability of financial resources for irrigation investment, such politically dominated processes and the related attitudes worked against choices for less capital-intensive, more effective investments in, for example, water management and conservation. This applied to all case studies.

Yet, the major gap in this decision making seemed the observed absence of an explicit definition of the desired performance levels for the new investments. The widespread and long-established experiences with ineffective capacity utilization in irrigation made this absence all the more striking. Even if donors, governments or consultants were aware of the unlikeliness of achieving the assumed performance improvements in specific systems or projects, they were observed to ignore such considerations in the investment selection and design process. Assumed performance targets of irrigation investments were kept implicit in all case studies.

The likely commitment of such stakeholders as the national politicians, governments and agencies to the implicitly defined performance targets was almost nil (except for the few who were internally motivated). The more so given the lack of incentives to achieve them, while ample incentives were observed to relate to the acquisition of new investments (in an environment with abundant availability of financial resources for irrigation investment). In all case studies, the commitment of staff of the national planning agency, the irrigation ministry and the irrigation agency toward performance improvements was observed to be almost absent. The widespread underutilization of irrigation capacities in the past did not seem to have led to a stronger conditionality toward the quality of subsequent investment decisions. The underlying reason seemed the conflict of the quality of investment decisions with the fund-channeling function of the donor agencies, i.e., with the quantity of the investments.

The feasible investment objectives. Financial resources for irrigation seemed abundant mainly because of the nature of the feasibility and appraisal assessments. In all

case studies, the feasibility and appraisal assessments were observed to occur after the political decision to undertake the project. The different steps and methodologies served merely to justify the decision. Consideration of the feasibility of alternative types of projects, project sites, or a more phased development to achieve the same objectives, were ignored in all case studies.

The preparation of the decision about what was feasible and what not, was observed to be mainly the task of donor staff and consultants. Sometimes because they were considered more "independent" than staff of the recipient country or agency, in other cases because they would prevent likely delays in loan disbursements. Yet, it was observed to be very difficult, if not impossible, for them to determine the true feasibility, especially of the assumed performance improvement. Recipient agency and government staff tended to represent vested interests to realize the funding, and were unlikely to provide any information counteracting these interests. Even in the few observed cases where they were willing to do so, they were usually not asked to. Also the assessment experts and donor staff, who were driven by their organization's targets, were not interested in an absolutely neutral feasibility assessment.

The assumed performance improvements and other optimistic assumptions were thus typically not justified. They were kept implicit. Cost-benefit and sensitivity analyses were not allowed in any of the case studies to classify a project as unfeasible. They seemed therefore to have lost their functionality for an objective assessment of investment feasibility and appraisal. Instead, they were used to facilitate subsidies for irrigation investments.

The observed funding agencies were observed to have undertaken remarkably little to minimize or counterbalance some of the tendency to be overly optimistic in feasibility assessments. Rather than demanding explicit evidence of assumed performance improvements, virtually the only check and balance mechanism within the development banks was observed to be the mild "peer reviews". These meetings tended to be chaired by persons who were primarily responsible for the quantity of loans, rather than for their quality.

Performance targets for investments were implicitly set during feasibility decision making, and tended to be mainly donor-driven. Commitment to, or awareness of, these targets by staff of national governments and agencies was very low to zero.

Justifications for why an investment would not become another failure were mostly conceptual, rather than related to real-life. The different conceptual approaches developed to overcome the "management gap" (such as parallel field canals, on-farm water management, O&M manuals, water-management consultants, farmer participation and monitoring and evaluation) did not increase the commitment of the agency and government as they did not touch upon the performance and accountability issues. In fact, these solutions increased the donors' influence in actual investment planning and design, whereby the agencies felt increasingly less responsible, resulting in a diminishing commitment from their side. Sequential conceptual solutions established in a donor-driven mode, seemed to have produced progressively less and less commitment to their actual feasibility by the national agency staff.

A logical and related effect of the observed manipulation of the assumptions pertaining to the economic internal rate of return (EIRR) was the increased lack of any control over capital expenditures from the national point of view. Limits on expenditures per resource unit were observed to be non-existent in all case studies. For example, the maximum investment per settler, per unit of increased agricultural production, per unit of volume stored or regulated, per job created, per area commanded were seldom deter-

mined and were thus de-facto based only on political considerations. This led to investment maximization attitudes by irrigation agencies and politicians--at great economic loss for the overall country in current and future generations.

The functional requirements for the investment. As for feasibility and appraisal assessments also the decision-making processes about the functional requirements for the design were observed to occur in all case studies at conceptual levels only. Engineers of donors, consultants and irrigation agencies together seemed to determine these concepts and to adjust them regularly. Yet, no interaction with local system managers and farmers was observed for the determination of an explicit "program of requirements" in any of the case studies.

The resulting rigid application of the different design "blueprints" with insufficient localized information was observed to be widespread. It led to almost random turnout sizes, often arbitrary placement of structures, the planning for unsuitable soils and cropping patterns in the design and the suboptimal use of existing reservoirs and drainage lines. Also during design, the misuse of the theoretical formulae for crop water requirements was found. Sequential assessments were allowed to be inconsistent without related justification. Thus designs were adjusted to fit with the preceding overoptimistic appraisal assessments. In addition, political interference was observed to occur frequently in the design process.

Although substantial opposition against these design blueprints can be found in the irrigation management literature, all the observed funding institutions had accepted them. From their perspective, the advantage of the conceptual design seemed that issues such as the performance of the service delivery and the agency's related management control could be circumvented, while still having a "solution".

To a certain extent, awareness about the non-functionality of the designs was observed in the case studies. Still, the preferences tended to go for short-term investment at the expense of long-term performance. Construction and political priorities in the agencies together tended to resist performance arguments, and to impede changes to a more realistic professionalism. Considerable political maturity seemed required to reverse such processes. Over time, the design seemed to have become a routinized, uncreative exercise.

Awareness of how present design concepts have evolved over time was thereby observed to fade away gradually with the younger generation of engineers. Scientific design concepts have become internalized and the question of functionality did often not even arise.

Yet, the influence of donor staff and external consultants on the formulation of design concepts appeared tremendous. Although the supervision by donor staff was observed to be intermittent and minimal--their staff visited a project typically only once a year--, they appeared more responsible for project justification and success, and thus for the project's design concepts, than were the local executing agencies and government staff. To justify either new loans or loan continuation, the donor staff or consultants had to come up with solutions. These were necessarily conceptual due to their unfamiliarity with the actual local situation in terms of the institutions, farmers, and physical conditions. The observed local parties, from their side, were tempted to easily agree to almost any solution proposed as long as they themselves did not become responsible or accountable. The actual functionality of the design seemed often a minor concern to governments, agencies, consultants, and donor. Accountability for it was a non-issue in the observed irrigation bureaucracies.

The visibility of capital-intensive irrigation investments is likely to remain politically attractive. This impetus was probably an important reason for the observed donor efforts to develop ever-changing blueprints that were less dogmatic than the earlier design concepts. These provided the new solutions as justifications for new investments. The tragedy of these donor-driven, conceptual solutions was that, however appropriate these design concepts could have been, the donor was observed to become more and more co-responsible for the performance of the new design concepts as they became more and more their intellectual property. Especially because the irrigation agencies were not really responsible or accountable for either the functionality of designs, or for the water-delivery performance.

From "classical times" the technical irrigation profession was developed entirely by trial-and-error. Despite the more conceptual approaches that were developed over time, the actual development of command areas still seems to occur by trial-and-error. The early pioneers experimented on a small scale before applying their concepts on a larger scale. Yet, nowadays the abundant resource availability seems to allow for large-scale trial-and-error, and thus also for large-scale errors.

No lessons were learned from irrigation's large-scale errors, since the assumptions about the system's functions tended to remain implicit. Ideally, design should start from an agency-wide assessment of the affordable and feasible "programs of requirements" and levels of service for their investments. Such decisions were currently non-existent in the observed irrigation agencies.

Main recommendations. In all case studies, improvement of the capacity creation would require increased management inputs by higher level agency staff. This would require that they, as well as field staff, become more motivated for this quality. This seemed unlikely to occur if the agencies themselves would not become more interested in and accountable for the quality of its investment decisions and the resulting water-delivery performance.

The overall recommended directions for institutional reform to improve the capacity creation were the following:

1. A direct link between an agency's finance and the quality of its capacity creation decisions, and the ultimate water-delivery performance. For example, through cost-sharing by the agency and the clients, or through more tight funding through the reduction of the hidden (i.e., in the cost-benefit analysis) and other unconditional subsidies. The latter could be achieved through, for example, a reduction of the misuse of the cost-benefit analysis through checks and balances on all performance and other assumptions underlying the feasibility assessment (e.g., through the remedial principle). Also an explicit commitment to performance improvements could be introduced through, for example, the consistent use of a "performance and accountability balance sheet" by all major funding agencies;

2. A decentralization of the decision making to the agency or project level. This would allow for an increased capacity to process information on experiences, preferences and requirements both quantitatively and qualitatively. Currently, the staff and consultants of the funding agencies were observed to take many

of the planning and design decisions. (By such a decentralization less reliance on conceptual approaches becomes necessary as well.);

3. A more performance-oriented human resources management, such as performance-based incentive systems and career development, especially for higher level staff. This would require a decentralization of the related authority to the agency;

4. A more independent status of the irrigation agencies, also financially, seems the best way to ensure cost effectiveness and efficiency of irrigation investments.

RESULTS: PRIORITIES FOR PERFORMANCE IMPROVEMENT

Make performance an internal concern for the agency. An improved performance of an irrigation agency's service delivery can only be achieved by its managers, i.e., the staff of the managing agency. Short-term inputs by external actors cannot ensure such improved performance. Prerequisite for any of the observed managing agencies to improve its performance was that the agency made it a concern for its staff to improve their performance. The above described main recommendations were all examples of measures to make performance a concern of the staff of irrigation agencies.

Make performance a local concern, rather than an external only. Yet, such measures seemed unlikely to be initiated by the observed agencies as long as performance improvement was not their concern. Therefore, either the central government, politicians or the funding agencies should make it a concern for the agency to do so.

Possible measures to make performance a concern of irrigation agencies are, for example, the linkage of their finance to performance; the use of subsidies that do not reinforce biases of agencies toward the quantity of capacity creation (e.g., cost-sharing, fixed lump sums, proportional subsidies); the reduction of hidden subsidies; high quality investment appraisal decisions; more neutrality of donor staff toward the quantity of investment; the development of investment proposals by agencies only; and an external "water-delivery performance audit" in those situations where no financial or other accountability to clients exists. Accountability and performance issues should also become a serious issue in the so-called policy dialogues;

Let the funding agencies become prudent financiers, financially at risk for performance. Prerequisite for a managing agency to improve its performance is that the central government, politicians or donors make it a concern for the agency to do so. Yet, even the observed funding agencies appeared mainly accountable for investment quantity, and not to the quality of the investment appraisal decisions.

Possible measures to make the quality of investment appraisal decisions a concern for the funding agencies and its staff are, for example, more financial transparency and risk taking by donors. This can be achieved through, for example, direct lending to irrigation agencies rather than to governments. Irrigation agencies appeared never accountable for the (partial) repayment of the loans. Also, the funding agency could be made accountable to its board of governors for the quality of its investment appraisal decisions in terms of the match between appraised and achieved performance of its investments (rather than for the perceived professionalism and quantity). And the funding

agencies agency as a whole could be made accountable for their success in facilitating performance improvement, and in "getting the performance-related processes started". Overall, making recipients more performance-oriented requires the funding agencies to "Stick to the Knitting" (i.e., to banking) and to put "Quality First" (i.e., of investment appraisals).

Manage and control towards a satisfactory water-delivery performance. Still, if an accountability would be introduced as described above, higher levels of sophistication of the decision-making processes may not evolve automatically. The recommendations of this study therefore include many specific management control decisions that aim to develop, introduce and control performance-related requirements into the decision making about the capacity utilization and the capacity creation.

EVALUATION

The application of the analytical framework had the following advantages. Any framework facilitates a more focused data collection and analysis. Further contributions to the above analysis of the used framework were: its facilitation of a consistency in analyzing processes; its enforcement of an objective analysis of the functionality of disciplinary approaches in the decision-making processes; its enforcement to consider the full scope of irrigation management concerns; its facilitation to consider the interaction and consistency between other issues than only the usually researched upon design-utilization interaction; and its integrated perspective on performance, decision-making processes, management conditions and the related management-control decisions.

Disadvantages of working with the framework were the initial difficulty to be consistent in separating processes and conditions, and the repetitions in presentation and analysis of a systematic application of the framework on all important decision-making processes and management conditions. These disadvantages do not seem major impediments for the framework's application by others. These others could be a researcher or management specialist to do a management analysis. Though also an irrigation manager could use the framework's simple interrelations (as represented in the above Figure) to take a different perspective of his work.

Prospects for future application of the framework as a check list of relevant irrigation management concerns are either the following: a systematic awareness creation about the managerial aspects of irrigation; a systematic development of research questions or manuals about the capacity utilization; and a professionalization of ex-post evaluations and impact studies of irrigation (and other development) investments. Also the framework's concept of the levels of sophistication could be used as a performance indicator for management in the following ways: to identify systematically opportunities for improvement; to assess management improvements quantitatively before and after management innovations; or, to develop normative indicators for irrigation management performance for different socio-economic and physical environments through comparative research.

Recommendations about priorities for future research on the underperformance in the irrigation subsector that evolved from this study almost all related to measures to introduce accountability for the water-delivery performance. These were the following:

1. research on specific management-control methods and techniques that are *likely* to bring accountability for performance into the financing of irrigation;

2. the establishment of the probable potential for performance improvement in different countries or regions (these estimates could then be used for realistic investment norms per unit area that may not only prevent hidden subsidies in future irrigation investments, but may also attribute a more realistic economic and financial value to performance);

3. the cost effectiveness and efficiency of the collection of service fees in smallholder systems; and

4. appropriate structures for volumetric measuring of water in smallholder systems.

Yet, much research seems to have been done on irrigation management already. Therefore, performance improvements in the irrigation subsector seem to need much more the application of the available knowledge to change the present management and control, rather than more research.

CHAPTER 1

Introduction

"What do the three blind mice have in common with 40% of distributary canals in the Punjab? .....They all lost their tails."[1]

IRRIGATION INVESTMENT TRENDS

PAST AND PRESENT investments in irrigation worldwide are immense. Estimates by the World Bank of the total accrued investments in irrigation and drainage to date amount to US$ 800 billion.[2] The century before the mid-1950s knew only a moderate development. From the mid-1950s, the growth of irrigation worldwide was extremely rapid. In less developed countries (LDCs) alone, expenditures during this period totalled more than US$ 250 billion. Annual investments in the late 1970s to mid-1980s stood close to $15 billion.[3] Anticipated additional investment in the period from 1985 to the end of century amounts to $150 billion.[4]

Irrigation traditionally absorbed a large slice of the total investment aid in LDCs. A strong example of this favored status of irrigation is the World Bank. Irrigation investments represented more than 75 percent of total World Bank disbursements in the agricultural sector till the mid-1960s. Since then, it has varied between 25 and 40 percent, remaining the largest single sub-sector in the agricultural sector. The latter was by itself, with 30 percent of total lending by the mid 1970s, "by far the largest single component in the Bank's portfolio."[5] Throughout the World Bank's history, about 75 per cent of its agricultural lending has gone to irrigation and the directly related rural credit and area development projects.[6] In general, irrigation investments absorbed between 16 and 22 per cent of total official bilateral and multilateral aid to agriculture in the period 1976-1980.[7]

A variety of reasons underlie the investment boom in irrigation since the 1950s in the Third World. Important reasons were the intermittent food scarcities and high food prices, and (geo-)political interests. Also, irrigation "biases" in donor organizations seem to have been important, especially because of the ample resource availability through the credit lines for development investments.[8]

THE PERFORMANCE GAP

Since the mid-1960s the awareness spread that the performance of irrigation investments was far below its potential[9], both in low-income and high-income countries. The most obvious signs of this underperformance were the underutilized or even dry tail-reaches of irrigation canals and command areas in underutilized systems.

Undoubtedly, irrigation has contributed significantly to the growth in agricultural production of many LDCs, if not only for its facilitating role for the success of the "green revolution". Irrigation is often considered a critical component of the package of inputs that produced the green revolution. Seckler and Sampath, for example, have stated this for India as follows:

> "Except in rare and limited areas, there has been no green revolution in India on unirrigated land . . .The analysis indicates that irrigation accounts for one-half to two-thirds of the increase in food grain production in India over the past three decades; and without the indirect effect of irrigation development enabling the use of [high yielding varieties] and [fertilizer], most of the remainder would not have occurred. Irrigation is a Sine-Qua Non of India food grain production."[10]

Yet, despite this success for food production, the performance was much less than expected at the time of the investments. Apart from documenting this yield impact of irrigation, Seckler is also an irrigation professional who has documented irrigation's spectacular underperformance. Despite the reputed unreliability of statistics in LDCs, he has ventured to present the following embarrassing image: "A reasonable rule of thumb for irrigation projects in the LDCs is that they cost at least twice as much and deliver no more than half the effective irrigation benefits specified in the plans."[11]

The exact size of the underperformance is difficult to estimate. Only few and very rough approximations have been made. Seckler estimated in 1981 that while India created a potential of 30 million ha, it actually utilized only some 11 million ha. He estimated that this could be increased to about 21 million ha through improved management and improvements in the physical facilities. Similarly, in 1983 Chambers estimated the utilized area in India somewhat higher at 14 to 15 million ha. Also, according to both of them, the poor average yields in India could to an important extent be due to yields being not much higher than in rainfed agriculture in half the officially irrigated area.[12]

Seckler has also estimated the impact on food security of the above rough underperformance estimates. Such estimates depend to a large extent on the expected demand, i.e., the predicted population growth rates. Expecting a duplication of the population of LDCs in the period 1980-2010, a doubling of their agricultural output over the same time would be needed, according to Seckler. He has argued that given the described performance gap, the investment needs for food security between 1980-2000 in the non-Communist LDCs are in fact four times more than the generally perceived requirement of US$150 billion, i.e., a total of US$600 billion. For India alone this would amount to $12 billion per year. Else, even with the envisaged expenditures on irrigation of over $3 billion a year in India there may be a *decrease* in net irrigation output, due to the neglected maintenance of the existing irrigation capacity.

These estimates of the underperformance and their consequences are "admittedly highly subjective and impressionistic" according to Seckler, but he added that "there are innumerable

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