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978-0-521-34788-4 - Managing Canal Irrigation: Practical Analysis from South Asia

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# MANAGING CANAL IRRIGATION

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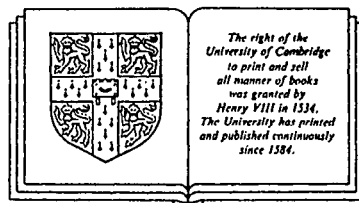
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# MANAGING CANAL IRRIGATION

Practical Analysis from South Asia

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For Jenny

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## Preface

This book is the outcome of a dozen or so years of fascination and puzzlement with canal irrigation in South Asia and with its management. I hope readers will share the excitement of the subject and be as intrigued as I have been in exploring gaps in knowledge and understanding. Other aspects of rural development are difficult, but none seems at the same time so many-sided and so diverse, and none seems so strikingly to combine potential for reducing poverty with scope for professional change. Canal irrigation management must now present some of the greatest practical and intellectual challenges facing humankind. This book, however modestly, tries to identify and explore some of those challenges and to point towards ways of meeting them. Whether it has been worth writing depends on whether it succeeds in stimulating and encouraging others to use and go beyond what is written here, to improve analysis and action, and above all to manage systems better to serve the poor.

When I first tried to understand irrigation in Sri Lanka and Tamil Nadu in 1973, I expected to find well-developed professional traditions with tested and understood methods for managing canal irrigation systems, and well accepted criteria and techniques for the allocation and distribution of water. I also supposed that 'management' when used in the phrase 'water management' included the management of whole canal irrigation systems, and of irrigation staff as well as water. Gradually it became clear that this was not so, and that there were gaps in professional knowledge and methods. At first this was difficult to believe, and it was hard to muster the courage to assert the existence of these gaps. But it became more and more obvious with time that the main preoccupations of each profession were narrow. Whatever the rhetoric and appearances, no profession, not even irrigation engineering, had the actual management of canal irrigation systems as the core of its professional training and concerns.

So the subtitle of this book might have been 'in search of reality' or 'exploring gaps'. For much of it is about knowing and not knowing, and about what the literature and normal professional training have left out. Exploring gaps and blind spots has been difficult, but rewarded by a sense of discovery. Analysis, writing and rewriting have taken longer than planned. As with irrigation projects themselves, so with this book, there have been completion delays and cost overruns. Modernisation and

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rehabilitation were also needed before construction was complete. Partly this resulted from the rapid growth in published and unpublished literature which had some relevance, even if this was often tangential. What began as a drizzle of papers became a downpour, and it has been a struggle not to drown in the resulting flood of documentation.

The five gaps or blind spots I examine are of practical concern: main system management; canal irrigation at night; farmers' activities above the outlet; managers and motivation; and diagnostic analysis. They are gaps because they are difficult. The experience that is relevant is poorly recorded; good methods are not well known; and there are still no relevant textbooks.

In choosing these five topics I have deliberately treated other subjects lightly. Two deserve mention. The first is farmer participation below the outlet (but see parts of Chapter 5, and Chapter 8 for participation above the outlet). Farmers' participation is being developed and studied in many countries, not least the Philippines, Sri Lanka, Nepal and India, and is the subject of Norman Uphoff's analysis and state of the art review *Improving International Irrigation Management with Farmers' Participation: Getting the Process Right* (Westview Press, Boulder, Colorado, 1986).

The second is financial aspects. Large irrigation projects in South Asia are heavily subsidised, both in their capital costs, which are borne by the State, and in their recurrent costs. Typically, irrigation fees paid by cultivators cover only a small fraction of recurrent costs. The question is whether more of these costs can be transferred to cultivators.

It is now fashionable to try to combine these two aspects, participation with payment. As earlier in other domains of rural development, cooperatives are to be created to undertake tasks which are too difficult for officials and too unpopular for politicians. Water is to be wholesaled to groups of farmers who will distribute the water and its costs among themselves, collect the payments due, and hand them over to an irrigation agency which becomes self-financing. South Asian countries may have much to learn from new practices in the Philippines where fee-collection and maintenance have been devolved to farmers over extensive areas, and performance incentives devised for staff. Similar changes will be a bigger challenge in the more hierarchical conditions of India. Courage and caution will be needed, avoiding new big standardised programmes and guarding against new myths.

In order to concentrate on certain major gaps, I have also consciously not emphasised some other dimensions or bodies of evidence. Most of the material drawn on is from India, Sri Lanka, and the Philippines. Within India, I have not stressed regional variations nor the differences between paddy and wheat irrigation, nor the vast subject of drainage. I have also avoided the heartlands of the major disciplines. The book is not about the normal concerns of any profession or discipline except as a means of showing why gaps and blind spots exist. It is thus not primarily about the design, construction and maintenance of the irrigation

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engineering profession, nor the on-farm development of agricultural engineers, nor the crop water requirements and irrigation scheduling of agronomists, not the cost-benefit and financial analyses of economists, nor the farmer participation at field level of sociologists, nor the coordination of administrators. It is about what all these miss. And it argues that what they miss is central for improving canal irrigation management. For these reasons, the book is addressed to a wide audience, to all those concerned with understanding canal irrigation and improving its performance, regardless of their profession or discipline. It is written for civil engineers, agricultural engineers, agronomists, hydrologists, sociologists and economists; for administrators, planners, politicians and policy-makers; for staff in government departments and in aid agencies; for academics, teachers and trainers; and above all for those tens of thousands of professionals in South Asia and many other parts of the world, who manage canal irrigation systems.

The text is organised into four parts. Part I sets the scene. Chapters 1 and 2 give background context and rationale, the scale of canal irrigation in South Asia, the potential for benefiting the rural poor, and analysis of the purposes and nature of canal irrigation systems. In Part II, Chapters 3, 4 and 5 are concerned with learning and mislearning, and prescription and misprescription. Part III analyses four gaps or blind spots with a chapter on each. Finally, Part IV gets to grips with what to do. To enable the reader to move quickly and easily through the book the table of contents includes all the main sub-headings, and there is a summary at the start of each chapter. By reading these summaries, the main thrusts of the book can be grasped in a matter of minutes.

The reader may wonder what an Englishman is doing writing about canal irrigation in South Asia. I have wondered myself. At one level I share with some irrigation engineers and hydrologists a fascination with the control of flowing water on the origins of which psychologists are welcome to speculate. As a more obvious level, I first stumbled on canal irrigation in South Asia while working on a joint research project of Cambridge University, Madras University and the Agrarian Research and Training Institute, Colombo on agrarian change in Tamil Nadu and Sri Lanka. The Wirawila tank and its irrigation system in Hambantota District in Sri Lanka were a first love. Later three and a half years with the Ford Foundation in Delhi provided an opportunity to learn more about canal irrigation in India, stimulated by visits, conferences and workshops and the shared enthusiasm of colleagues in institutions in India. Finally, grants from the Ford and Rockefeller Foundations to the Institute of Development Studies at the University of Sussex have given me the time to read, analyse, correspond, and write this book. These two grants have also subsidised publication to make the book available at a low price which I hope will make it accessible to those for whom it is written. As ever, and grateful though I am for the support of all concerned, the responsibility for errors of fact and judgement is mine alone, and the views expressed are mine and not necessarily those of others or of any organisation.

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That said, this book is really a collective effort. The many whom I thank for their contributions through support, collaboration, criticism, information and insight include:

Charles Abernethy, P.K. Aiyaswamy, Syed Hashim Ali, J. Alwis, V. Asopa, Charles Bailey, C.M. Madduma Bandara, Jeremy Berkoff, Sadiqul Bhuiyan, Anthony Bottrall, V. Branscheid, Martin Burton, Don Campbell, Ian Carruthers, Michael Cernea, Graham Chapman, Usha, Chatrath, J.C. Collins, Norman Collins, G.L. Corey, Walter Coward, H.V. Dhamdhare, K. William Easter, Antony Ellman, G. Elumalai, Gilbert Etienne, Mike Faber, H.G. Farbrother, B.H. Farmer, Harald D. Frederiksen, David Freeman, P.R. Gandhi, Sena Ganewatte, C. Gopinath, David Groenfeldt, John Harriss, Syed Turabul Hassan, L. Horst, Jayantha Jayewardene, Upendra Nath Kamalpuri, K.G. Kandharmuthu, G.N. Kathpalia, Jack Keller, Phillip Kirpich, Shashi Kolavalli, Frances Korten, S.N. Lele, Roberto Lenton, Gilbert Levine, M.T. Long, Max Lowdermilk, Arthur Maass, S.P. Malhotra, Ed Martin, Douglas Merrey, A.M. Michael, Mick Moore, Hammond Murray-Rust, James Nickum, M.G. Padhye, A.A. Pai, K. Palanisami, Niranjana Pant, R.K. Patil, W. Pemberton, Christopher Perry, Dean Peterson, V. Rajagopalan, Vengama Raju, Priti Ramamurthy, P.S. Rao, Richard Reidinger, David M. Robinson, Ernst Schulze, David Seckler, S. Senthinathan, I. Sharma, Bharat Singh, K.K. Singh, N.P. Singh, R.K. Sivanappan, A. Sundar, Mark Svendsen, Nenita Tapay, Gabriel Tibor, Mary Tiffen, D. Tyagi, Norman Uphoff, Edward Vander Velde, C.V.J. Varma, S.L. Varudkar, M.N. Venkatesan, Robert Wade, Tom Wickham, James M. Wolf, and Robert Yoder.

To anyone inadvertently omitted, I apologise.

I owe special thanks to the women, landless labourers and small farmers at the tailends of canal irrigation systems for their outspoken comments, which have given impetus and justification for this book. To them let me add all those unnamed farmers, officials, researchers and colleagues who have also helped. For the inspiration of his life and work, and showing what can be done, I owe a very special debt to Syed Hashim Ali, who also first pointed out to me the importance of canal irrigation at night. For encouragement and giving me time and freedom to work on canal irrigation, I thank B.H. Farmer for his part in the 1970s, Norman Collins for his in the 1980s, and colleagues in the Cambridge University Project on Agrarian Change in South Asia, the Ford Foundation, Delhi, and the Institute of Development Studies at the University of Sussex. For the time and care they gave to commenting on the draft as a whole, or on substantial sections, I am most grateful to Anthony Bottrall, Max Lowdermilk, Douglas Merrey, Mick Moore, Niranjana Pant, R.K. Patil, Mary Sanders, Bharat Singh, K.K. Singh, and Mary Tiffen. For generously sharing their unpublished research results, I thank Upendra Nath Kamalpuri, Shashi Kolavalli, and Priti Ramamurthy. My greatest debt is to Roberto Lenton as colleague and friend, for many discussions, for joint field visits, for much encouragement, and for seeing that gaps and blind spots should be the core of the book.



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Permission is acknowledged with thanks for the use of material which has appeared earlier. Parts of Chapter 1 were the basis for a paper 'Irrigation against Rural Poverty' to the Seminar on Water Management—the Key to Development of Agriculture, organised by the Indian National Science Academy, New Delhi, on 28-30 April 1986; much of Chapter 7 appeared as 'Canal Irrigation at Night', in *Irrigation and Drainage Systems*, I(1986), pp 45-74; much of Chapter 8 was published as 'Farmers above the Outlet: Irrigators and Canal Management in South Asia', *Journal of Indian Water Resources Society*, Vol 6 Nos 3 and 4, 1986; and finally Chapter 10 draws on parts of 'Rapid Appraisal for Improving Existing Canal Irrigation Systems', *Discussion Paper Series* No. 8, Ford Foundation, Delhi, August 1983, and on a paper written jointly with Ian Carruthers 'Rapid Appraisal to Improve Canal Irrigation Performance: Experience and Options', *HMI Research Paper* No. 3, October 1986, published by the International Irrigation Management Institute.

Last, but not least, let me thank those who have borne the brunt of typing and retyping the text. They include Julia Cross, Jane Deakin, Beverley Harries, Danielle Hodges, Marion Huxley, Susan Kent, I.D. Khurana, Helen McLaren, Susan Saunders and Ann Watson.

This book is only one very small part of a larger movement. On a wide scale, professionals are searching for more cost-effective, productive, equitable and stable ways to manage canal irrigation systems. We do not know how successful the search will be. Let us hope that by the twenty-first century, methods and practices will have so developed and changed that any historian finding a dusty and faded copy of this book will wonder at what in the mid 1980s we still did not know, and at the methodologies and textbooks we still did not have. But such a person, looking back, will only wonder at our ignorance if there has been much change in the meantime; and that may or may not occur. It depends on practical exploration of the gaps. It depends on extending the boundaries of normal professionalism. It depends on the writing of textbooks. It depends on decisions and actions by people.

Let me end then with the hope that what is written here will so provoke, encourage and support others that they will take action. For this book tries to indicate what needs to be done and can be done. The gaps belong to no one, and yet to everyone. By making them centres more of the huge potential of canal irrigation for reducing poverty can be realised. Perhaps the book's conclusion bears repeating. All can do something. And there is no need to wait.

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# Glossary and Conventions

Most references in the text give year of publication followed by page number(s), e.g. Early 1981: 14. Where there is no page number, the reference is normally to a major theme of the work in question which is not limited to one or a few pages.

The senses in which terms are used in this book include the following:

allocation	the assignment of rights or allotments of water to water users, either individually or grouped
anicut	a dam or weir to divert river water into a channel
appropriation	the act of acquisition of water
ayacut	the irrigable command of an irrigation work
chak	the irrigable area below an outlet, normally under the control of cultivators, and consisting of watercourses, field channels where they exist, fields, field drains, and chak drains. The chak is sometimes known as the unit command area
communal system	an irrigation system managed by the irrigators
convenient	(of a water supply) manageable, hassle-free, timely, cheap and profitable. In this book convenient means convenient for irrigators
crore	ten million
Culturable Commanded Area (CCA)	the area of culturable land in a command area. (For this and related definitions in more detail see Bharat Singh 1979: 38-39 and Michael 1978: 36)
cusecs	cubic feet per second
delivery	distribution through the controlled movement of water from a point of origin (such as a diversion weir or reservoir) to a point or points of handover

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distributary	channel taking off from a main or branch canal, usually supplying water to minors and also directly to chaks through outlets.
dual managed canal systems	usually larger river diversion or reservoir-based gravity irrigation systems with a dual or split management, with the upper parts managed mainly by a staff recruited, paid and disciplined by an external organisation and the lower parts managed mainly by irrigators. Sometimes also known as bureaucratic-communal or jointly managed systems
efficiency	(of water delivery) the ratio of water delivered at one point to water released from another point
farmer joint management (FJM)	recurrent officially recognised management activities above the outlet on canal irrigation systems, involving both farmers and irrigation staff
field channel	channel carrying water from a watercourse to individual fields. (Field channels are often absent with paddy field-to-field irrigation)
field level	the area below the outlet on a canal irrigation system. Also known as the chak level
gross irrigated area	area of land irrigated in a year (two irrigation seasons counting as two)
improving performance	enhancing wellbeing by increasing benefits from canal irrigation, including those from productivity, equity and stability, in relation to costs, including financial costs and adverse social, health, environmental and other effects
intensity of irrigation	in North India, this means the proportion of Culturable Commanded Area proposed to be annually irrigated. In this book it is used as a percentage to describe the ratio of irrigated to irrigable area (two irrigation seasons on the same land counting as two)
kharif	the summer southwest monsoon season in India with onset of rain mainly in May and June, and withdrawal of rain mainly in September
lakh	one hundred thousand
lift irrigation	irrigation where water is pumped up before distribution. Groundwater is the most common source, but water is also lifted from reservoirs, canals, drains and other sources

maha	great, the northeast monsoon cultivation season in Sri Lanka
main system	the canal irrigation system above the outlet, including diversion works, reservoirs, dams, main canals, branch canals, distributaries and minors, and drainage works below the chak level
minor	the lowest level of channel on a main system, below a distributary, and with outlets giving onto chaks. Also known as a 'minor distributary'. In India minors usually carry discharges of less than 10 cusecs (0.283 cubic metres/second). Minors take off from distributaries and branch canals and rarely from the main canal
net irrigated area	area of land surface that receives irrigation water in a year (two irrigation seasons counting as one)
night	the period of darkness from 20 minutes after sunset to 20 minutes before dawn, regardless of whether there is a moon
on-farm development	development below the outlet, in the chak
outlet	the structure on a distributary or minor through which water passes to watercourses and field channels. The outlet (mogha in Pakistan) is normally the official point at which water passes from the control of irrigation staff to farmers, separating the main system from the chak level.
performance	see 'improving performance'
predictable	(of a water supply) assured, known to be assured, and known about in advance as to timing, flow rate(s) and quantity. A water supply is more, or less, predictable to the extent that these conditions are met. In this book, predictable means predictable to irrigators
rabi	the 'winter' cropping season
scheduling	planning the distribution of water including specifying allocations, preparing timetables for amounts of water and locations, and making adjustments to these
seepage	the infiltration of water downwards or laterally into soil or substrata from a source of supply such as reservoir or irrigation canal or channel

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shramadana	communal labour
watercourse	channel leading from an outlet and supplying field channels or fields directly
warabandi	(a) northwest Indian warabandi: the system of water distribution and rights found in northwest India (Punjab, Haryana, Rajasthan, and parts of western Uttar Pradesh) where canal design and regulation permit near-constant flow of water through ungated outlets, the flow being allocated to cultivators at fixed times with duration of turn proportional to land-holding area (b) new warabandi: warabandi introduced, or attempted to be introduced, elsewhere in India
yala	little, the southwest monsoon cultivation season in Sri Lanka

## Abbreviations

AE	Assistant Engineer (junior to an Executive Engineer)
CADA(s)	Command Area Development Authority(ies)
CAD	Command Area Development and the Command Area Development Programme
CCA	Culturable Commanded Area
CE	Chief Engineer (senior to a Superintending Engineer)
CWC	Central Water Commission (India)
DIY	Do It Yourself
EE	Executive Engineer (junior to a Superintending Engineer, senior to an Assistant Engineer)
ET	Evapotranspiration
FJM	Farmer Joint Management
GOI	Government of India
HBP	Hasdeo Bango Project, Madhya Pradesh
IAS	Indian Administrative Service
ICID	International Commission on Irrigation and Drainage
ID	Irrigated Dry, meaning zoned for irrigation for non-paddy crops, (as opposed to Irrigated Wet) (South India)
IFAD	International Fund for Agricultural Development
IIMI	The International Irrigation Management Institute, with its headquarters at Digana, near Kandy, Sri Lanka
IRDP	Integrated Rural Development Programme (India)
IRRI	International Rice Research Institute, Philippines
IW	Irrigated Wet, meaning zoned for paddy (as opposed to Irrigated Dry) (South India)
IWM	Integrated Water Management, a programme in Andhra Pradesh integrating water management above and below the outlet
LTRIS	Lower Talavera River Irrigation System (Philippines)
M and E	Monitoring and Evaluation
MLA	Member of Legislative Assembly
MRB	Mahi Right Bank, a command area in Gujarat
MRP	Mahanadi River Project, Madhya Pradesh
MSM	Main system management
NIA	National Irrigation Administration, Philippines
NWMP	National Water Management Project (India)

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O and M	Operation and Maintenance (occasionally also Organisation and Management)
OFD	on-farm development
PENRIS	Penaranda River Irrigation System (Philippines)
PWD	Public Works Department
RWS	Rotational water supply (similar to warabandi)
SCO	Systematic canal operation (India)
SE	Superintending Engineer (junior to a Chief Engineer and senior to an Executive Engineer)
t/ha	Tonnes per hectare
USAID	United States Agency for International Development
WAPCOS	Water and Power Consultancy Services (Delhi)
WAPDA	Water and Power Development Authority (Pakistan)
WDR	World Development Report, published annually by the World Bank
WMSP	Water Management Synthesis Project, funded by USAID
WTC	The Water Technology Centre at the Indian Agricultural Research Institute, Delhi
WUA	Water Users' Association (especially in Taiwan)