Part I

Poverty, Canals and Commonsense

Governments and aid agencies committed to reducing rural poverty have made vast investments in canal irrigation but performance has usually fallen far short of expectations. Millions of poor households, both resource-poor farmers and the landless, who should have benefited have not done so. To improve the anti-poverty performance of canal irrigation systems is now one of the great practical and intellectual challenges facing humankind.

As an approach to this challenge, Chapter 1 sets the scene by examining links between canal irrigation and the rural poor, asking who gains and who loses from canal irrigation. It considers the shortcomings of current performance, and assesses potential for improvement. Chapter 2 then suggests objectives and criteria for canal irrigation management, and outlines a commonsense mapping and naming of parts of canal irrigation systems.

CHAPTER 1

Potential for the Poor

ABSTRACT

Canal irrigation provides livelihoods for hundreds of millions of people in developing countries. In parts of South Asia, where it has been a massive thrust in rural and national development, extensive irrigation networks co-exist with the greatest concentration of rural poverty in the world.

Production and livelihoods are linked, but, for poverty alleviation in the mid-1980s, partly because of food surpluses, the generation and support of livelihoods is a higher priority than production *per se*. Key questions concern who gains and who loses from irrigation. Generally, the poor stand to gain from better managed canal irrigation—in employment and income, in security against impoverishment, in less outmigration, and in quality of life. In South Asia about 68 per cent of the irrigation is in India and 26 per cent in Pakistan, and over half the irrigation in the subcontinent is from dual managed canal systems, controlled by official irrigation staff in their upper parts and by farmers lower down. Performance in these systems has often been disappointing in areas irrigated, in waterlogging, in the multiple deprivation of tailends, and in yields. Evidence suggests that groundwater generally produces about twice as much per net irrigated hectare as canal irrigation. The potential for better livelihoods for the poor from improved management of canal irrigation systems appears high.

THE CONTEXT

Canal irrigation is a direct source of livelihood for hundreds of millions of the rural poor of the third world and it could be for tens, perhaps hundreds, of millions more. In countries as diverse as China, Egypt, Indonesia, Mexico, Philippines, Sudan and Thailand, to name but some, it is a major part of the rural and national economy; and in these and in many other countries, potential for further irrigation development has been identified. In the context of canal irrigation and rural poverty, however, South Asia stands out, combining vast canal irrigation development and potential with the greatest concentration of rural poverty in the world. There are other regions like the Sahel and the Horn of Africa which are struck by famine, violence or economic disaster and

where the plight of the poor is dramatically awful. But these are mostly areas with low irrigation potential. There is nowhere outside South Asia where so many, so close together, are so deeply deprived, in regions with such extensive canal irrigation.

The scale of rural poverty in South Asia is daunting. The 1986 population of the five largest countries of the South Asian subcontinent—Bangladesh, India, Nepal, Pakistan, and Sri Lanka—was over one billion. Of these, more than three-quarters were rural. The five countries ranked among the 28 in the world with the lowest per capita income. In those countries (Bangladesh, India and Sri Lanka) for which figures were available, the poorest two-fifths of the population were much worse off than the average, with less than one-fifth of the income (WDR 1986: 226). Poverty and deprivation in these countries are, moreover, mainly rural. Urban poverty is more visible, but in scale, rural poverty affects several times more people. In India in 1983-4, for example, some 225 million rural people were below the poverty line, compared with only 50 million urban (GOI 1985: 4). In sum, in the mid-1980s, close to half the people in the rural areas of the subcontinent had to survive in conditions and at levels of living below any reasonable definition of human decency. The challenge, was, and will remain, to generate adequate, secure and decent livelihoods both for those who already lack them, and for the much larger rural populations of the future, including the 100 million more rural inhabitants estimated by the year 2000.

To meet the challenge of rural poverty, the Governments of South Asia have launched many programmes. Without these, things might have been much worse. India, in particular, has mounted a succession of bold and large-scale attempts to help poor people directly, including the Integrated Rural Development Programme (IRDP). But the sums spent on irrigation development have been and remain higher than those on direct poverty alleviation programmes of this sort. Even in the Indian Seventh Plan, with its strong anti-poverty and rural development thrust, more was

Table 1.1. GNP per caput and population—five South Asian countries

	1 GNP Per capita 1984 US$	2 Rank position among 128 countries (1=low)	3 Population mid-1984 (millions)	4 Population estimated in 2,000 (millions)	5 % Population rural 1984	6 (3×5) Rural popu- lation mid 1984 (millions)
Bangladesh	130	2	98.1	141	82	80.4
India	260	15	749.2	994	75	561.9
Nepal	160	6	16.1	24	93	14.6
Pakistan	380	28	92.4	138	71	65.6
Sri Lanka	360	26	15.9	21	79	12.6
Totals/ average	—	—	971.7	1313	76	735.1

Source: WDR 1986: 180, 228, 240.

allocated for major and medium canal irrigation (Rs 11, 556 crores or about $11.6 billion) than for all rural development programmes together (Rs 9,074 crores or about $9.1 billion of which the IRDP was Rs 3,473 crores or about $3.5 billion). The IRDP has been evaluated for the numbers of households it enables to rise above the poverty line (e.g. PEO 1985; Rath 1985). But despite its historically and currently higher levels of investment, the same criterion has not normally been applied to canal irrigation.

This then is the starting point for this book: to examine canal irrigation from an anti-poverty point of view. In doing this, and throughout, most of the evidence comes from South Asia, especially India and Sri Lanka, but much of the analysis and many of the lessons apply more widely.

Production and Livelihoods

A first step is to examine some of the anti-poverty effects of irrigation. Two complementary views are possible here, one based on production, and one on livelihoods. There are also two major levels of analysis: the national or regional economy, and the household.

The part played by irrigation in agricultural production in South Asia needs no emphasis. It is responsible for 55 per cent of food production in India and some 80 per cent in Pakistan (Rangeley 1985). Moreover, irrigation is normally seen as the major source of future increases in production. A widely quoted study by the International Food Policy Research Institute (Oram *et al.* 1979) calculated future production and demand for food. From a baseline of production in 1974-6, the study made projections to 1990. Of the increased food production during the 15-year period for the five largest South Asian countries, 81 per cent was anticipated from irrigation (compare sub-Saharan Africa with only 4.5 per cent), with the highest proportions in Pakistan (89 per cent) and India (83 per cent). In the event, national policies have indeed given high priority to extending and intensifying irrigation and irrigation has been largely responsible for the achievement by the mid-1980s of near or complete self-sufficiency or surpluses of food in Pakistan, India and Sri Lanka.

In several ways, increased agricultural production can diminish rural poverty. At the level of the national economy, it can be part of the engine of growth; it can substitute for imports and generate exports, whether of food or of non-food agricultural produce; and it can reduce the costs of foodgrain procurement. At the level of the poor household, it usually reduces food prices and makes it easier especially for the urban poor to obtain food. It also usually generates additional employment and incomes for the poor, both directly through employment in agriculture, and related activities like input supply, processing and marketing, and indirectly through multiplier effects as incomes are spent, generating more employment and incomes. Studies, especially those of IFPRI (the International Food Policy Research Institute) have sought to measure

these indirect effects (e.g. IFPRI 1984, 1985) and, while there are methodological debates over detail, they confirm that increased production generates substantial indirect benefits.

The strength of these points makes it easy to accept production as the objective of irrigation, and to assume that more production is the best criterion of achievement in combatting poverty. Production is also attractive for other reasons. It is a simple concept. It is relatively easy to measure. Production statistics are available and accessible to academic analysts and planners. Those who prefer a physical view of development,[1] explaining poverty in terms of population, environment and other physical factors, find the mathematics of food and population a convenient and straightforward mode of analysis. Production, moreover, is a technical matter demanding technical innovations and actions. In evaluating performance of any agricultural project, and of many agricultural experiments, it is the natural unit of output and benefit. It is also a single idea, meeting the common desire for one objective rather than several.

There are, however, three qualifications to be made to assumptions that increased production is of automatic benefit to the poor.

The first concerns food surpluses. While world food surpluses persist, domestic surpluses can be a liability, either deteriorating in stores at high cost, or having to be dumped on the world market, also at high cost for the subsidies required, and with adverse effects on the national economy and so on the poor.

The second qualification concerns technology and direct benefits. Shifts to more capital-intensive and less labour-intensive farming through mechanisation and the like, tend to be found with larger and better-off farmers, who thereby gain, more than with smaller and less well-off farmers, who thereby do not gain, or lose, if prices drop for the food they sell. Those shifts also reduce the ratio of employment generated to additional production, a ratio which appears to be in long-term decline.

The third qualification follows from these two. A common view has been that hunger occurs because of shortage of food: producing more food so that more is available is essential to stave off hunger. Thus, for example, the first heading of a paper on comprehensive evaluation of the impact of irrigation on development is 'The role of irrigation in meeting world food needs', and the paper starts 'World food production is rising steadily. To improve nutritional standards among the world's poor and to feed the world's rapidly growing population, food production must continue to expand' (USAID 1980:1). Now obviously food supplies have to match or exceed demand if people are not to go hungry. But this line of thinking can mislead at both national and household levels.

At the national level, in South Asia, food is available and likely to remain so. India, Pakistan and Sri Lanka are, in the mid-1980s, either self-sufficient or in surplus for foodgrains, and total production continues to increase. Even Bangladesh, which is in deficit, has achieved substantial national food security: food aid, buffer stocks, and timely

interventions ensured that the disaster conditions of 1984, so similar to those of 1974, did not lead to a similar famine (Clay 1985). In India, effective administration, a free press and an open political system are a guarantee against any major regional food shortages. For all countries, the glut of grain on the world market in the mid-1980s has made it easier than before to buy food to make up any deficit. Short of unforeseen calamities, national food security seems assured, even without self-sufficiency.

At the household level, the question is much less food availability than entitlements (the ability to command food by growing, buying, or otherwise obtaining it). Even with national self-sufficiency in food and national food security, poverty and underconsumption of food, to use a euphemism, persist on a vast scale in South Asia. As Amartya Sen (1981, 1983) has demonstrated, it is often not decline in food availability which causes people to starve, but loss of entitlements. The millions of deaths of the Great Bengal Famine of 1943-4 resulted less from lack of food—food was there—than from the inability of many suddenly impoverished people to obtain it. Whatever may have been the case in the past, the problem of poverty in South Asia at least is not now a problem of production, or of food availability: it is a problem of who produces the food and of who has power to obtain it.

In this connection, production-thinking, which sees production as a sufficient end in itself, contrasts with livelihood-thinking, which sees production as a means of enhancing the well-being and livelihoods especially of the poorer people (Table 1.2). With livelihood-thinking, irrigation is assessed in terms of the adequate and secure livelihoods it generates and sustains, putting antipoverty effects, and people, before production *per se*. An adequate and secure livelihood can be defined here as a level of assets and stocks and flows of food and cash which provide for year-round physical and social well-being for the household and protec-

Table 1.2. Production-thinking and livelihood-thinking contrasted

	Production-thinking	Livelihood-thinking
Starts with	Production	Poor people
Problem seen as	Increasing production	Increasing entitlements, especially incomes and purchasing power, or ability to grow and retain food
Objective for irrigation	Increasing amount and stability of foodgrain production	Increasing amount and stability of days worked, wages, and food grown by the poor
Key analytical concept	Productivity of scarce resources (water, land . . .)	Livelihood—intensity of scarce resources (water, land . . .)
Benefits assessed as	Higher production especially for procurement and the market	More and better livelihoods with more food and income commanded by the poor

tion against impoverishment. This applies to all members of a household and especially to those, usually women, who are most deprived.

In contrast with production-thinking, livelihood-thinking has been little applied to irrigation. Arguments for improving the performance of canal irrigation systems are couched in production terms. Conventional cost-benefit analysis, in its simpler forms, is concerned with the value of production rather than employment or income distribution. Of 24 papers contributed to the *Indian Journal of Agricultural Economics* issue on the socio-economic impact of irrigation projects (IJAE 1984), few dealt with employment. Appraisals for irrigation projects also estimate production rather than employment or livelihoods to be generated. Production-thinking has been dominant and widely accepted, and until recently there has been little need to find other justifications for irrigation investment or improving irrigation performance. Yet, while food surpluses persist, the general economic case for additional production is weakened. Moreover, in India a major shift has already taken place in rural development from programmes which stressed community development and agricultural production to programmes targeted to the poor. Livelihood-thinking is close to the mainstream of large-scale administered programmes designed to provide direct benefits to target groups of the under-privileged—small and marginal farmers, landless labourers, members of the weaker and vulnerable sections, women, the seasonally unemployed, and poor people generally. Applied to irrigation, livelihood-thinking raises a new set of questions.

Some of these concern secondary benefits from better livelihoods. These are easy to underestimate. First, poor households spend high proportions of their additional income on goods produced locally, whether food, consumer goods, or assets like furniture, thereby generating additional employment and livelihoods for others. Secondly, new livelihoods which withdraw labour from the casual labour market help other poor people: the balance of demand and supply shifts in the labour market and wages are higher than they would have been. Third, adequate and secure livelihoods in rural areas reduce migration to other rural areas and to towns. This restrains the pressure on urban slums where otherwise new entrants would add to the overload on housing, services and jobs.

It is, however, with the direct benefits of irrigation in terms of better livelihoods, which in turn generate these secondary benefits, that we are most concerned. Livelihood-thinking leads logically to the aim of enabling the rural environment, economy and society to provide niches for and to sustain more households at acceptable levels of living. As the case for irrigation becomes less based on arguments for production *per se*, and more on livelihoods generated and sustained, questions are raised about how irrigation can enable the poor to lose less and gain more.

Who Gains, Who Loses?

Priority to livelihoods directs attention to the key questions of who gains and who loses from irrigation, setting the answers against the

Table 1.3. Indirect gains and losses to the land-poor from irrigation

	Type of gain	Who gains	Under what conditions
1.	Increase in employment in construction of irrigation projects	Male and female agricultural labourers	Labour-intensive construction
2.	Increase in number of days of employment, and levelling off of peaks in agricultural employment	Male and female agricultural labourers	Irrigation-induced agricultural intensification
3.	Increase in wage rates for agricultural labour	Male and female agricultural labourers	Irrigation-induced agricultural intensification; no surplus labour to restrain wage rises
4.	Growth in non-farm employment	Male and female agricultural labourers	Irrigation-induced agricultural intensification
5.	Return migration	Male and female agricultural labourers	Irrigation-induced agricultural intensification
6.	Lower food prices	All sections of rural society but particularly the poor (who spend a disproportionate percentage of their income on food)	Payment in cash rather than kind
7.	Non-agricultural uses of water, including uses that improve health	Those located close to major canals and distributaries	Year-round irrigation, with access by villagers to canals or groundwater

	Type of loss	Who loses	Under what conditions
1.	Increase in land prices	Marginal farmers bought out. Landless tenants displaced	Actual or anticipated irrigation-induced agricultural intensification
2.	Market competition between irrigated and rainfed farmers	Marginal rainfed farmers	Irrigation-induced agricultural intensification
3.	Displacement due to irrigation construction	Those displaced from reservoir sites, etc.	Inadequate compensation
4.	Increased unpaid work-loads for women	Women	
5.	Increase in water-borne diseases	Particularly agricultural workers	Presence of endemic water-borne diseases; lack of preventative health measures
6.	Labour displacement	Agricultural workers displaced by mechanical threshing, herbicides, etc.	Adverse effects of irrigation-induced mechanisation outweigh benefits of productivity
7.	Waterlogging and salinity	Small farmers, share-croppers displaced by induced waterlogging and salinity	Irrigation-induced waterlogging and salinity

Source: Adapted from Silliman and Lenton 1985 : 8.

counter-factual—what would have happened without irrigation. Much of the literature on the impact of irrigation on poor people has been reviewed by Silliman and Lenton (1985). They concern themselves with the 'land-poor' whom they define to include those who own no land, those who operate no land, and those whose major source of income is from agricultural wage employment. This includes many marginal and small farmers whose holdings are too meagre to produce enough food and income and who periodically join the labour force. The land-poor could also be described as households whose access to land and water does not assure them an adequate and secure livelihood.

Irrigation generally has different impacts on different people in different conditions, with both gains and losses. Small and marginal farmers can gain from irrigation in obvious direct ways. Some of the indirect gains and losses of the land-poor are less obvious and are summarised in Table 1.3.

For any irrigation project, however large or small, a balance sheet of gains and losses might come out positive or negative.[2] Losers are easy to overlook. Often they shift out of sight, migrate, or even die. Losses can take many forms. Marginal farmers can be pushed off land or bought out at low prices by speculators, and so lose the direct benefits of irrigation. Women can be burdened with increased unpaid work as happened with increased livestock responsibilities on the Bhima Project in Maharashtra (IFAD 1984). Water-borne diseases can increase, especially malaria. Sometimes labour is displaced by mechanical threshing or herbicides which are introduced and adopted along with irrigation. If irrigation fails, through waterlogging, salinity or flooding, then small farmers and labourers suffer along with others. Most seriously of all are likely to be the indirect effects of surpluses of foodgrains and other crops produced under irrigation on rainfed farmers who depend on selling the same crops for cash. For countries with sustained food surpluses and downward pressures on foodgrain prices, this may be a major hidden disbenefit of increased production from irrigation, though offset by gains to poor consumers.

Many of the losers are those displaced by reservoirs, canals, or other construction associated with canal irrigation projects (CSE 1985). After reservoirs have been constructed oustees are easy to overlook. Evaluations of canal irrigation projects concentrate geographically in command areas rather than in dam catchments where some of those displaced may remain; and often oustees disperse and are hard to find. They may, though, be numerous. An example is the Bhima Project. The Mid-Term Evaluation Report on Bhima reads favourably on many counts but it notes that

> Some people have also been hurt by the project. The Bhima Reservoir inundated 29,000 ha and some 57,000 people from fifty-one villages had to be relocated due to the submergence. The relocation programme has been a very bitter experience for some people. It is a sad commentary that . . . four years after completion, thirteen more vil-

lages where people are to be resettled are still not ready for occupation. (IFAD 1984: 23)

As here, any evaluation has to be concerned with a balance sheet of net livelihood and well-being effects, offsetting losses of livelihood and well-being against gains. With canal irrigation, the hidden losses can be so large that livelihood analysis might indicate that many projects should not have been undertaken in the past or should not be undertaken in the future.

Gains in Livelihoods

The main livelihood gains for the rural poor from irrigation can be summarised under four headings: employment and income; security against impoverishment; migration; and quality of life.

employment and income

Empirical studies again and again confirm that reliable and adequate irrigation directly raises employment: for example, increases in days worked per hectare with irrigation compared with rainfed conditions, are reported to have been 61 per cent on the Dantiwada Canal Irrigation Project in Gujarat (Patel and Patel 1984), more than 100 per cent under Kakatiya Canal of Sriramasagar Project in Andhra Pradesh (Adinarayana 1984), 135 per cent in a village under the Damodar Valley Canals in West Bengal (Ghosh 1984), and 150 per cent in Ferozepur, Punjab (Mehra 1976). Silliman and Lenton (1985), reviewing empirical evidence from 45 micro studies, 25 of them from India, found that, with few exceptions, they confirmed a positive relationship between irrigation and employment, while indicating that much of irrigation's potential to increase yields and cropping intensities had not been realised. Most studies reviewed concluded that cropping intensity had the greatest employment impact. One study (Mehra 1976) which, exceptionally, disaggregated the employment effects of irrigation and of HYVs, found the contribution of irrigation to employment to be greater than that of HYVs.

Irrigation, increased irrigation, higher cropping intensities, and associated changes in cropping patterns, all affect different groups in different ways. For small and marginal farmers, irrigation means more productive work on their land, and increased intensities mean productive work on more days of the year. Some who went out to work for others before irrigation came, or before cropping intensity increased, cease to do so, and may hire in labour at peak times. Production and income are generally higher and more stable.

For landless labourers, irrigation means work on more days of the year especially where there is a second or third irrigation season. A comparison of an irrigated village and a largely unirrigated village in West Bengal by M.G. Ghosh (1984, n.d.) shows how sharp the contrast can be for labourers. Ghosh notes that in the irrigated area there was virtually no dead season, and also that a large number of migrant labourers came in for the peak periods. The implied differences in livelihood for labourers in these two villages are stark, and the value of irrigation can be surmised as