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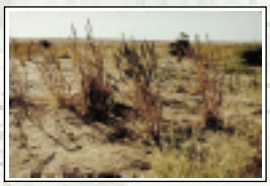
Irrigation against Rural Poverty

An Overview of Issues and Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia

Proceedings of
National Workshops on
Pro-Poor Intervention Strategies
in Irrigated Agriculture in Asia

Bangladesh, China, India, Indonesia
Pakistan and Vietnam

Intizar Hussain and
Eric Biltonen, editors



PROCEEDINGS

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and
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August 2001

International Water Management Institute,
Colombo, Sri Lanka

IWMI receives its principal funding from 58 governments, private foundations, and international and regional organizations known as the Consultative Group on International Agricultural Research (CGIAR). Support is also given by the Governments of Pakistan, South Africa and Sri Lanka.

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IWMI gratefully acknowledges the financial support from the ADB for the study "Pro-poor intervention strategies in irrigated agriculture in Asia."

Intizar Hussain; and Eric Biltonen (Eds.). 2001. *Proccedings of National Workshops on Pro-Poor intervention Strategies in Irrigated Agriculture in Asia*. Colombo: International Water Management Institute.

/ irrigation management / water resources / poverty / sustainability / rural development / irrigated farming / performance evaluation / case studies / large scale systems / surface irrigation / water use efficiency / water scarcity / water policy / productivity / Asia / Bangladesh / China / India / Indonesia / Pakistan / Vietnam /

ISBN 92-9090-450-X

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About the Project

The project on "Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia" is being undertaken by the International Water Management Institute (IWMI), with financial support from the Asian Development Bank (ADB) under its program on Agriculture and Natural Resources Research at CGIAR Centers. It is a multi-country project with case studies in six developing member countries (DMCs) of ADB: Bangladesh, China, India, Indonesia, Pakistan and Vietnam. The main objective of this project is to determine realistic options for increasing returns to poor farmers through improving the overall performance of established medium and large-scale surface irrigation systems (canals). Case studies under the project will be carried out in collaboration with national research and development organizations and agencies in the participating countries. The project will be implemented over a period of 30 months starting from January 2001.

In early 2000, IWMI submitted a draft grant proposal under ADB's Regional Technical Assistance (RETA) program to undertake a study on pro-poor intervention strategies in irrigated agriculture in Asia on the basis of expressions of interest from the Bank as well as IWMI's collaborating research institutions and agencies. Initially, the idea was to focus on small/micro scale irrigation covering assessments of mainly small-scale technical interventions in about ten countries. However, after discussions and deliberations, ADB and IWMI jointly decided that the project should focus mainly on non-technical interventions in medium and large-scale irrigation systems covering the above six countries. On the basis of an agreed version of the proposal, the ADB prepared a Technical Assistance (TA) agreement between ADB and IWMI, identified as "RETA 5945 – Fifth Agriculture and Natural Resources Research at CGIAR Centers: Study on Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia" dated 8 February 2001. The TA agreement was finally authorized in mid February 2001.

This 30 month-project is budgeted at a total of US$1.96 million, out of which ADB will provide US$1 million, while IWMI and the six participating countries will contribute the remaining sum in equal share, mostly through complementary activities and in the form of logistical support for field work. The national research activities to be carried out by the partner institutions and agencies, including development of country study work plans, will be through specifically arranged research contracts.

IWMI initiated the inception activities soon after the TA agreement was authorized in February 2001. The project leader assigned by IWMI for this study visited participating countries to meet with representatives of national research institutions and implementing agencies to discuss study implementation arrangements including forming study teams, identifying study sites and developing study work plans.

IWMI developed an overall work plan for the project and outlined the broad study approach to be followed for country case studies, which was discussed with ADB in early April 2001. While there was general agreement on the overall project approach, ADB provided useful suggestions on the draft work plan. In the meantime, IWMI requested country partners to develop country-specific work plans. The draft country work plans were completed by late May/early June 2001.

In addition, both IWMI and ADB jointly decided to hold national workshops in each of the participating country with a view to obtaining input into the project from stakeholders at the inception stage.

On National Workshops

The main objectives of the country level workshops were to: (1) disseminate information about the project; (2) involve stakeholders in the project right from the planning phase and obtain their input in the project; and (3) identify and discuss country-specific issues related to irrigation management and poverty, discuss the overall project approach, and identify suitable sites for case studies in each of the participating countries. The workshops were held during the period between 12 March and 25 June 2001 as given below

Bangladesh - Bangladesh Unayan Parishad (BUP), Dhaka, 23 June.
China - Center for Chines Agricultural Policy (CCAP), Beijing , 14 May, 2001.
India - Administrative Staff College (ASC) , Hyderabad, 25 June 2001.
Indonesia - Hotel Jakarta, Yogyakarta, 23 May 2001.
Pakistan - IWMI Regional Office for Pakistan and Central Asia,Lahore, 12 March 2001.
Vietnam - Vietnam Institute of Water Resources Research (VIWRR), Hanoi, 14 June 2001.

The workshops were lead by country study teams and IWMI representatives. Participants represented a range of disciplines/areas including academics, researchers, water policy makers, and water managers (complete list of workshop participant for each country is provided in the appendix). Representatives from ADB resident missions in China, Indonesia and Bangladesh also participated in the workshop.

This report is divided into a number of sections. The first section provides an overview of issues and pro-poor interventions in irrigated agriculture in Asia. This is followed by country sections providing selected papers presented in the country workshops. The detailed summary on workshop discussions is included at the end of each section. List of workshop participants is given in the appendix of this repot. The key points and issues raised in the country workshops are summarized in the respective sections.

Irrigation against Rural Poverty: An Overview of Issues and Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia

Intizar Hussain, Kenichi Yokoyama and Izhar Hunzai

Summary

As the largest user of water, irrigated agriculture is under intense pressure to concede water to other, rapidly growing sectors. Subsidies for infrastructure are shrinking, the most accessible and cheapest water resources have been developed, and in an increasing number of river basins, all or most of the water resources have been committed. Demand for water for higher value uses—domestic, industrial and hydropower—is rising and there is growing pressure to allocate adequate water to environmental needs. A natural consequence of scarcity is conflict over water allocation, rights and entitlements among the various claimants. In the face of these problems, the irrigation sector must produce more food with less water. Achieving sustainable increases in the productivity of irrigated agriculture requires increased water use efficiency at farm and system levels, and integrated management of water resources in water basins. Aware of these issues, many Asian developing countries are preparing to reform their policies and institutional systems. ADB's emerging water policy is helping this process. There is an urgent need for policy research and science-based solutions to improve the productivity and sustainability of irrigated agriculture, to ensure water-food security for poor men and women, a critical step in poverty eradication.

Introduction

Despite the remarkable expansion of irrigated agriculture in Asia that brought dramatic increases in aggregate food production in the past three decades, there remain vast areas in the established irrigation systems where productivity and incomes of farmers remain generally low and highly variable. This is attributed to a number of factors, including inequitable access to water, poor management, and a range of other physical, sociocultural, and economic constraints. The efforts of developing country governments to address poverty reduction in these specific areas have been limited and ineffective due to lack of proactive policies and actions, and knowledge of how alternative economic, institutional, governance, and technical interventions can address poverty related constraints. However, in the face of increasing water scarcity and ever-increasing demand for food, many developing countries in the Asian region are gearing up for major policy

and institutional reforms to optimize the management of their water resources. Enhancing the productivity of poor farmers in these areas is a priority, as they are most vulnerable to the impacts of water scarcity. Poverty eradication is now the shared goal of donors including the Asian Development Bank (ADB), developing country governments, the CGIAR, and other major research and development institutions. Since the bulk of the poor in Asia still live in rural areas and are largely dependent on agriculture for food, income and livelihoods, and since irrigation is a major contributor to agricultural production, it is logical to focus on how the performance of this sector can be improved, so that it can become an effective instrument to fight rural poverty in the region.

Irrigation has played a major role in poverty reduction in the past, even though the benefits were not always equitable. Irrigated agriculture will continue to be the main source of food supplies and employment for the poor in Asia. But the vitality of this sector is declining with growing scarcity and competition for water and increasing overexploitation and degradation of groundwater. Three conditions must be met to restore the pro-poor economic potential of irrigated agriculture: productivity, equity and sustainability. The productivity of irrigated agriculture is substantially below its potential in the region, with significant variation within and across countries. Low productivity in irrigated agriculture is largely a consequence of inappropriate policies and weak management institutions, which were designed for very different conditions in the past. Moreover, the extent to which irrigation contributes directly to improving the lives of poor rural people is a function of proactive policies and effective support mechanisms aimed at promoting equity and people-centered development. More will be said on what these policies might be during the workshop deliberations. Sustainable irrigation systems imply balancing economic, social, and environmental benefits through implementation of development policies, programs, and projects that will not enhance one type of benefit at the cost of others.

This paper highlights major issues related to irrigation management and suggests approaches that can help make this important sector more productive, equitable and sustainable, with the ultimate aim to reducing widespread poverty in the region.

Background

Agriculture in developing Asia as a whole has made remarkable progress over the past three decades. Between 1970 and 1995, cereal production more than doubled from over 300 million metric tons to 650 million tons, while the population increase during the same period was 60 percent. This remarkable growth in food production was largely attributed to the growth in irrigated agriculture, coupled with the use of high-yielding varieties of crops and the application of fertilizers and pesticides. At present about 40 percent of the cropland in Asia is irrigated and accounts for about 70 percent of total cereal production. Irrigation has greatly improved the incomes of farmers with access to fertile and well-drained lands, reliable water supplies, yield-enhancing inputs, and credit as well as other supporting services. It has also benefited the overall population by providing more food at reduced prices.

Although benefits are generally considered to be skewed in favor of those having access to fertile, well-drained lands, reliable water supplies, and yield-enhancing inputs, poor people have also benefited in terms of enhanced food security and incomes (marginal and small farmers), lower food prices (mostly urban poor) and employment (both rural and urban poor). In the period between 1965 and 1984, the net irrigated area grew at a compound rate of 1.6 percent, while food production was increasing at 3 percent per year. Between the 1960s and the 1990s real food grain prices fell by nearly 50 percent (ADB 2000). For landless laborers, tenants and share-croppers, increased cropping intensities through irrigation has meant more work over more days of the year.

Despite these achievements, the productivity of a large part of irrigation systems remains severely constrained by insufficiency of some or all of these inputs. Such low-productivity areas are characterized by persistent rural poverty. The distribution of benefits from irrigation development is thus largely skewed and unequal. Furthermore, the agriculture sector in the Asian and Pacific region is now facing the challenge of meeting increasing food demand, while conceding more water to other, 'high-value' uses. To add to this the many environmental negatives associated with irrigation were underestimated when large irrigation systems were originally designed. This raises the question of sustainability. The population of the Asian region is expected to grow from the current 3.0 billion people to over 4.5 billion by 2025. The per capita availability of water in 2025 is estimated between 15 and 35 percent of levels in 1950. ADB's 1999 rural Asia study showed that the cost of investing in new irrigation schemes has also increased substantially.[1] Moreover, the demand for water for other economic uses is rising fast in association with the rapid economic growth and urbanization in the region, along with the growing pressure to protect the environment.

During the past two decades, the rate of expansion in irrigated area has declined to be nearly stagnant throughout Asia. Much of the past expansion in agriculture came through development of large and medium-scale irrigation systems. However, this option is no longer available to the majority of Asian developing countries. It is becoming increasingly difficult to expand irrigated areas, as most accessible water resources have already been developed to capacity in a growing number of river basins and the areas having good land and water resources are diminishing— thus closing land frontiers and basins. Perhaps even more important reasons for lack of expansion are, escalating financial costs, lower economic returns, and increasing concerns about environmental and social impacts of large scale irrigation systems (Rosegrant and Ringler 1998).

From a food security perspective, there has been very slow growth in yields and in the total output of the main cereals (ADB 2000). As the single most dominant user of available water resources, irrigated agriculture is facing increasing pressure to produce more food with less water through significant improvements in water use efficiency at the farm and system levels. Low-productivity irrigated areas are in a particular stress, as

[1]The real cost of new irrigation schemes increased by 150% in South and Southeast Asia between 1966 and 1988, thus weakening the justification for investing in new irrigation.

resource-poor farmers in those areas are most vulnerable to water shortages, while there is also a significant need to enhance food production there to ensure food security for the growing population.

Causes of Rural Poverty

Low productivity and low incomes

A number of factors contributing to poverty relate to low-productivity in irrigated systems. These include:

i. Poor performance of irrigation systems caused by in stitutional and managerial factors;

ii. Physical factors (poor design, unsuitable topography, poor drainage, poor soil conditions);

iii. Economic constraints (smaller landholdings, lack of financial resources and credit, lack of key inputs and marketing outlets); and

iv. Sociocultural problems (tenure arrangements such as insecure rights and large landholdings leased to in dividual farmers, caste-related inequities, gender bias).

While the determinants of low productivity are numerous and complex, they are to a large extent associated with poor performance of many of the established irrigation systems, which causes low, inequitable, and unreliable water supplies in those areas.[2] It has been widely acknowledged that actual irrigated areas in many of the irrigation systems are much smaller than planned. Large areas within the irrigation systems suffer from chronic and severe water shortages, especially the tail-end reaches. Large-scale waterlogging has also been reported. It is now widely known that these problems are

[2]Examples of low-productivity irrigated areas in Asian developing countries include parts of both upper and lower Indus basin (in Punjab and Sindh Provinces Pakistan); tail-end areas of large government-managed systems in several Indian states including the states of Bihar, Uttar Pradesh, and Andhra Pradesh; northern and northeastern Bangladesh; northern uplands, north-central and central highland regions in Vietnam; irrigation systems in Central Java and in some some of the outer islands in Indonesia; and northwestern part of the People's Republic of China including the provinces of Shaanxi, Gansu, Qinghai, Ningxia, and Xingjiang.

largely caused by institutional and managerial factors, poor governance, and lack of funds for maintenance, rather than technical constraints, which could be addressed without large physical interventions but with greater cost-effectiveness benefiting the poor.

Most of the past investments in irrigation were not targeted specifically to poor people. Also, women's needs and environmental concerns were rarely assessed in most of the earlier projects (ADB 1995). These were largely concerned with increasing the overall food production to achieve national food security and broad economic growth. In projects lacking a specific poverty focus, benefits to the poor have often been insufficient to significantly improve their living standards. The efforts of governments and other agencies to improve the livelihoods of poor irrigation farmers have not been uniformly successful, and a better understanding of the reasons of this phenomenon is needed, particularly as competition for available water resources increases throughout the region.

Inequities in access to water resources and skewed benefits in irrigated agriculture

In the past, agricultural policies in Asia, driven by the notions of self-sufficiency, were largely focused on aggregate food production. Investments in irrigation were determined on crude economic indicators, such as return on investment and the internal rate of return; social returns and environmental impacts received cursory consideration in the early investment decisions. The politically powerless smallholder farmers, women and the landless were unable to have their economic interests articulated in national policies. This meant that poverty and environmental (crucial for poor) considerations were either not included, or were left to the 'invisible hand.' New knowledge available over the last decade suggests that strategies exclusively focused on growth do not deliver, unless they are accompanied by deliberate measures that ensure a good degree of equity in access to, and control over, resources. What are some of the main equity issues in large irrigation systems in Asia, and how can they be addressed? More importantly, what are the best practices in the region in this area, and how they can be up-scaled and replicated?

Inequities exist in many forms: some social categories get access to water, whereas others do not, or do so on less favorable terms. Inclusion and exclusion processes in decisions regarding investment in allocation and governance of water resources typically take place along class, caste and ethnic as well as gender lines. Poverty, a state of multidimensional deprivation, is very often correlated to deprivation from water in sufficient quantity and quality. Deprivation from access to water for productive uses is a strong bottleneck preventing poor people from fulfilling their basic income needs and escaping income poverty. Under growing water scarcity it is very probable that the social categories with the stronger water rights will secure their access to water first. Thus, the limited water rights that a number of poor people gained in the past risk being weakened and those poor people who were already excluded in the past risk being excluded forever. Growing water scarcity risks to aggravate rural poverty.

These and other inequity issues are an important focus of the current project and constitute a challenging topic for the workshop. For instance, in the classical case of head-tail inequities found in an irrigation system, an important discovery may be a higher concentration of the poor at the tail end of the system, which will have implications on water allocation strategies. Similarly, well-defined water rights and guaranteed provision of specified irrigation services may have a positive poverty impact. Quantification and comparison of water productivity on small and large farms together with labor absorption capacity at different levels of farm size will provide important clues to allocating water resources that meet both the productivity and equity criteria.

Environmental Issues in irrigation

Irrigation is the largest user—some say abuser—of fresh water resources, especially in the Asian region. The inescapable conclusion is that irrigation has to produce more food with less water. What are the options for water savings, for mitigating the negative environmental impacts of irrigation, and for maintaining the regenerative capacity of agro-ecological systems in Asia? Before we can address these questions, we need to assess, quantify and put an economic value on the environmental consequences of irrigation and compare those with its benefits. This will enable governments, communities and individual farmers to make informed choices about the sustainable use and management of their water and indeed other natural resources.

What can be done to increase productivity, equity and sustainability in irrigated agriculture?

Attempts made by most Asian developing countries to improve the productivity of irrigated areas have been minimal and largely ineffective. Irrigation-related research has largely been focused on general agricultural productivity increases under the overall goal of increasing food production and enhancing food self-sufficiency. While international research organizations, including IWMI, have pursued the improvement of irrigation systems performance, the research efforts have not gone much beyond technical and physical interventions and general irrigation management transfer to farmer organizations at large. Little scientific knowledge exists on how a range of non-technical interventions such as economic, financial, institutional, and governance measures can most effectively contribute to reducing poverty in these low-productivity areas.

With few opportunities to expand irrigated areas in most Asian countries, attention is now shifting to increasing the productivity of irrigated agriculture, with a particular focus on “poverty stricken irrigated areas.” These areas are characterized by substantially lower agricultural productivity than the national averages and their potential, acute water shortages, water and land degradation, and competition for, and inequity in access to, water. The low-productivity irrigated areas in Asia are home to a large number of poor

people. Typically, poor people in these areas have smallholdings, or are landless or otherwise asset-less. They lack financial resources to invest in productivity enhancing technologie, often have no access to credit, and are more prone to risks associated with higher investment and failing water delivery. Also, many sociocultural factors and political influences limit their access to and participation in the decision-making processes. As users of small quantities of water, poor people play minor roles in causing water scarcity and pollution, but are affected most adversely by their consequences. For them, access to small quantities of good quality water is the difference between having a crop or no crop at all.

Under the circumstances, attention should now be focused on improving the productivity of these less productive irrigated areas, while addressing the range of specific poverty related problems therein. This should be pursued in the context of improving the overall water use efficiency, equity, and sustainability of the concerned irrigation systems. Emerging water policies of countries and donors encourage the transfer of management to autonomous and accountable service delivery agencies with appropriate user representation. Reducing poverty by ensuring equitable distribution of water in this process is also emphasized. ADB draft water policy and its poverty reduction strategies are examples of this. Some developing countries in Asia have already initiated programs toward this direction, adopting certain levels of management transfer of irrigation facilities to water user associations and installing financial autonomy and accountability measures. However, there is little evidence that these measures have resulted in more efficient water use. Even less available is the evidence that they have contributed to poverty reduction.

To enhance the overall performance of irrigation schemes, in terms of productivity, equity and sustainability, a more elaborate set of appropriate interventions and their sequencing, need to be defined. The interventions should be able to provide necessary incentives and mechanisms for improved equity and reliability of water supply to those areas, ensuring the participation of poor farmers in the decision-making processes of water management. Necessary measures to ensure the sustainability of operation and maintenance (O&M) should also be put in place adopting the user-pay principle while taking into account affordability to the poor. Furthermore, specific interventions should be identified and designed to address other types of location-specific constraints to poor farmers. This objective can only be pursued through a rigorous assessment of the determinants of poverty in the low-productivity areas, and analysis of the poverty impacts of a range of alternative pro-poor economic, financial, institutional, governance, and technical interventions that are available or emerging within the region. Necessary changes in the overall policy and institutional framework should also be assessed to ensure an enabling environment. Given that the managerial and institutional weaknesses largely contribute to the persistent poverty in these areas, due attention should be paid to a range of non-technical interventions. These include managerial reforms in water user organizations, administration of water rights and water pricing, regulatory and supervisory measures, and other incentives and mechanisms to improve equity while improving system performance.

As mentioned earlier, much of the irrigation-related research to date has been limited to analyzing the general agricultural productivity increases resulting from technical and

management interventions. Little empirical knowledge exists on the specific poverty and productivity impact pathways of policy and institutional interventions. Consequently, attempts to target the poor have met with limited success. Rigorous analysis of poverty, water scarcity and low productivity in low performing irrigation systems and their relationship with the policy and institutional environment is therefore needed to develop effective poverty reduction strategies.

Attention must be paid to broader analysis of irrigation performance in the context of scarcity and competing uses of water basins and to finding ways to increase the productivity of water used in agriculture. Other broader issues such as institutional reforms at the system and river basin levels and the understanding the water-poverty nexus must be addressed urgently. Poverty and gender in irrigated areas is currently a subject of special research. This work is rooted in the current understanding on poverty and its causes, especially those offered by Amartya Sen and others. IWMI's research shows that poor people are essentially *water deprived*, and the policy interventions to combat this situation have to be based on the idea of *entitlement.* This means that policies and interventions need to address not just low productivity, but also inequities in access to water and decision-making forums.

IWMI has documented several cases where policy changes have led to positive outcomes for the poor. For example, an ADB supported study in Bangladesh confirmed that, the pro-poor impact of freeing the market in small pumps reduced the vulnerability of smallholders to "water lords" and the emergence of a competitive water market with excellent water service even to the poorest farmers. Institutional research in Pakistan led to establishing joint management of irrigation systems by water users and agency staff, and reduced head-tail inequities, and eventually induced pro-poor legislation and primary and provincial level institutions (IWMI 1999). Preliminary findings from studies in South Africa on *water reserves* for the poor, show promising prospects to ensure poor people's entitlement to water to meet their basic social and economic needs (Van Koppen 2000). Research in India, Sri Lanka and elsewhere show that targeted irrigation development and improvement of existing systems can be a significant tool for poverty reduction.

Irrigation Management Transfer (IMT) policies can also have a strong poverty reduction impact by actively stimulating conjunctive water use and by organizing tail enders to contest water use at the head. There is considerable evidence that IMT is only viable if larger farmers see an opportunity to improve water delivery considerably through own management, and if extra labor and monetary costs still remain a minor portion of their total production costs (Shah forthcoming). This implies that poor farmers in the same command area would be passive followers, taking advantage of the trickle-down effects. This contradicts the often-implicit belief that IMT will stimulate democratic decision making through brand-new inclusive and horizontally organized member-organizations. A better understanding of equity effects and functional differentiation in water user organizations will allow identifying critical measures to ensure both effectiveness and equity, and better targeting of those measures. Better understanding of gender relations in irrigated agriculture and removing specific bottlenecks for women farmers to become more productive will also be an effective strategy. These approaches have not yet been consistently applied to the irrigation sector.

A study on 'Pro-poor intervention strategies in irrigated agriculture in Asia' has been proposed that will undertake a rigorous analysis of poverty, assessments of performance of irrigation systems and its impacts on poverty in low productivity irrigated areas and determine their relationship with the policy and institutional environment, in order to develop effective poverty reduction strategies.

The Proposed Study

Objectives

The overall goal of the proposed study is to promote and catalyze equitable economic growth in rural areas through pro-poor irrigation interventions in the participating Developing Member Countries (DMCs) of ADB [Bangladesh, People's Republic of China [PRC], India, Indonesia, Pakistan, and Viet Nam]. The immediate objective is to determine what can realistically be done to improve the returns to poor farmers in the low-productivity irrigated areas, the context of improving the overall performance and sustainability of the established irrigation schemes.

Scope

The study will focus on selected representative low-productivity irrigated areas and their peripheries with a large number of people under persistent poverty in the participating DMCs. The emphasis is on identifying and assessing a set of appropriate economic, financial, institutional, governance, and technical interventions at field and system levels, and changes in the overall policy and institutional framework as far as they affect the poor people's access to water resources. The scope is as follows:

i. Analysis and field research on the impacts of the current policy and institutional framework, and the impacts of underlying physical, economic, and sociocultural conditions on the selected areas in particular and on the overall irrigation systems at large, including the assessment of opportunities for and constraints on improving productivity in these less- productive areas through improved access to irrigation water;

ii. Identification and in-depth evaluation of a range of potential pro-poor economic, financial, institutional, governance, and technical interventions at field and system levels against a set of criteria including cost of implementation and potential to reduce poverty, and assessment of necessary changes in the overall policy and institutional framework under which such interventions could most effectively address poverty reduction in the study areas; and

iii. Formulation of a set of appropriate interventions and the policy and institutional frameworks,including adequate support systems, required to ensure large-scale uptake, replicability, and higher impacts within and between Asian countries, to culminate into (a) the guidelines for identifying and evaluating appropriate pro-poor interventions and enabling policy and institutional framework for irrigated agriculture in Asia,and (b) country-specific action agendas for the selected low-productivity areas of the participating DMCs.

The participating DMCs are Bangladesh, China, India, Indonesia, Pakistan, and Vietnam. These countries have responded positively to IWMI's inquiries about their interest in participating in this study, and all have vast poverty-stricken low-productivity irrigated areas in their established irrigation schemes and the peripheries. They therefore have a strong interest in reducing poverty in these areas, with sound research-based advice and assistance in planning and implementing necessary pro-poor interventions.

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BANGLADESH

Country Workshop

23 June 2001

Poverty Alleviation through Improved Irrigation Practices: Bangladesh Perspectives

Mustafa K. Mujeri and Intizar Hussain

INTRODUCTION

For addressing the problems of poverty, Bangladesh needs to adopt a multi-strategy solution within which economic growth matters for reducing both income and non-income poverty. In particular, a 'pro-poor' growth strategy is necessary so that increasing benefits for the poor are generated. In terms of structure and sectoral composition of economic growth, agriculture has several advantages, which can accelerate growth and create a growth structure that has high capacity to reduce poverty in Bangladesh.[1] A high agricultural growth creates synergies for diversification of the rural economy and development of the rural non-farm sector with greater poverty reduction impact. It is important, therefore, to accelerate growth of agriculture and non-farm sectors, improve coverage and quality of social services, ensure well-functioning rural institutions and expand rural infrastructure.

In Bangladesh, accelerated agricultural growth and increased production is also necessary to ensure physical and economic access to basic food to the population, particularly the poor. In order to ensure household food security, two related concerns need emphasis: first, physical availability of food either through domestic production or imports; and second, adequate command over resources by the households to attain food security. To improve household food insecurity, specific efforts are needed to increase the capacity of the resource-poor households to access food and other basic necessities.

Over the years, poverty reduction efforts in Bangladesh emphasized raising productivity and incomes of the rural population. In these efforts, rapid improvements in agricultural production—food grain production in particular— through the expansion of irrigated farming systems have played the pioneering role. The adoption of green revolution technology in cereal production increased production and returns to land in irrigated and favorable rainfed areas with adequate water control where the technology was largely concentrated. The investments in agricultural research and technological innovations also focused on high

[1]The impact of agricultural growth on rural wages is an important element in the process since, for the rural poor households, a major share of income originates from wage labor in agricultural and nonagricultural activities. The estimated values of net elasticity of poverty with respect to per capita consumption growth in agriculture, industry and services also indicate that the head count index, as well as depth and severity of poverty, decline more with growth in agriculture than in other two sectors. See World Bank 1998.

potential and irrigated areas yielding large returns. While adaptation of new technologies and expansion of irrigation will continue to play a dominant role in agricultural development strategy in the future, a major constraint that needs to be addressed is the skewed and unequal distribution of benefits from irrigation development. The productivity of a large part of the irrigation systems, particularly under surface water irrigation, remains severely constrained. The low productivity areas are also characterized by persistent rural poverty. While the determinants of low productivity are numerous and complex covering a wide range of physical, economic and sociocultural constraints, an important factor is the poor management of established irrigation systems that results in low, inequitable, and unreliable water supplies for irrigation. An important concern for pro-poor irrigation interventions in Bangladesh, therefore, is to identify actions that can enhance the productivity of poor farmers in disadvantaged irrigated areas and suggest proactive policies and measures to ensure efficient management of water resources for irrigation.

AGRICULTURAL PERFORMANCE AND IRRIGATION DEVELOPMENT: REVIEW OF PAST ACHIEVEMENTS

Since the 1970s, agriculture in Bangladesh experienced a modest growth and a slow transition: with wide fluctuations, agricultural growth averaged around 2.5 percent per year. A significant acceleration of agricultural growth, however, took place during the second half of the 1990s primarily led by the growth in production of food grains, particularly rice.

Recent Agricultural Growth

In the 1990s, agriculture's share in GDP declined: 25 percent in 1999–00 compared with 30 percent in 1989/90 (table 1). Agricultural growth accelerated in the late 1990s with the annual growth exceeding 5 percent in 1997–2000 compared to 2 percent during 1991–1996. While all subsectors experienced higher growth, the growth of crop and horticulture was rapid 4.2 percent per year which was higher compared to any period in the past.

Since the 1970s, Bangladesh made significant progress in cereal production. The production of rice and wheat increased from around 10 million tons in early 1970s to nearly 25 million tons by late 1990s. The increase in output resulted from two major factors: first, substitution of local varieties by High Yielding Varieties (HYVs) during the three seasons—*aus*, *aman*, and *boro*; and second, increase in area under *boro* rice which has relatively higher yield compared to other two varieties. This occurred through seasonal shifts in rice production although total rice area remained stable. The area under *boro* in total rice area increased from 24 percent in 1989/90 to around 35 percent in 1998/99 while the share in production increased from 35 percent to 53 percent during the same period. Similarly, nearly 53 percent of total rice area was cultivated with HYVs during 1994-1998 which contributed nearly 70 percent of the total rice production (Mujeri 2000).

Table 1. Structure of production and composition of agricultural output (percent at constant 1995/96 prices).

	1989/90	1994/95	1999/00
	Shares in GDP		
Agriculture	29.5	26.0	25.1
Industry[a]	20.8	24.3	25.8
Services[b]	49.7	49.7	49.1
Total	100	100	100
	Composition of agricultural value added		
Crop and horticulture	65.5	59.3	55.7
Animal farming	12.6	13.2	12.2
Forest and related activities	7.1	7.5	7.6
Fishing	14.8	20.0	24.5
Total	100	100	100

[a]Includes mining and quarrying, manufacturing, electricity gas and water supply, construction; [b]Includes all other sectors.
Source: BBS 2000.

Irrigation Development

Over the years, irrigated agriculture expanded rapidly in Bangladesh. The past achievements in crop production rested on irrigation development that enabled wider adoption of improved varieties, modern inputs and better cultural practices. It is estimated that, out of 9.03 million ha of total cultivable area, 7.56 million ha (84 percent) are suitable for irrigation (Shahabuddin and Rahman 1998). In 1999/00, a total area of about 4 million ha was under irrigation that is 53 percent of the total land suitable for irrigation. Significant potential, therefore, exists for future expansion of irrigation that depends on available technological options and their economic and social viability in exploiting surface water and groundwater.

During the 1985–2000 period, total area under irrigation more than doubled: from 1.77 million ha in 1984/85 to 4.03 million ha in 1999/00 (table 2). Two major trends in irrigation expansion may, however, be noted. During 1984/85, the contribution of groundwater and surface water irrigation was almost similar: about 0.9 million ha each in the total irrigated area of 1.77 million ha. Total irrigated area increased to 4.03 million ha in 1999/00 largely due to more than three-fold expansion of groundwater irrigation to 2.8 million ha compared to only 44 percent increase in surface water irrigation to 1.3 million ha. The share of groundwater irrigation in total irrigated area rose to 69 percent in 1999/00 from 50 percent in 1984/85. Second, the annual growth rate of irrigated area declined in recent years. Compared to around 8 percent in the 1980s, the annual growth rate was 5 percent until the mid-1990s that declined to 4 percent afterwards. The deceleration is more pronounced for shallow and deep tube well irrigation. Since expansion of irrigation is an essential prerequisite for future agricultural growth, Bangladesh needs to adopt appropriate measures to accelerate irrigation development.

Table 2. Area under irrigation in Bangladesh (thousand ha).

	1984/85	1989/90	1994/95	1999/00
A. Groundwater				
Shallow tube well (STW)	586	1,037	1,638	2,252
Deep tube well (DTW)	287	384	502	465
Manual	16	16	25	65
Subtotal	889	1,437	2,165	2,782
B. Surface water				
Low lift pump (LLP)	351	484	538	624
Canals	147	176	352	424
Traditional	384	478	250	201
Subtotal	882	1,138	1,140	1,250
Total irrigation	1,771	2,576	3,305	4,032

Source: MOF 2000.

In the case of groundwater, measures to accelerate the pace of irrigation development need actions in several areas. While hydrological considerations and limits to groundwater extraction are important considerations, increasing economic returns from groundwater irrigation are of major interest. This requires optimal utilization of irrigation equipment, effective operation and maintenance(O&M), increasing command area to lower water cost per unit of land, provision of support services, extension of appropriate on-farm water management technology, and alternative measures to ensure farmers' profitability e.g., promotion of high value crops.

Several major concerns for irrigation development in Bangladesh, however, are related to surface water development. In the past, public sector investments in large surface water irrigation projects claimed a large share (around 40-50 percent) of development expenditure in agriculture. The performance of these projects is unsatisfactory as can be seen from their contribution to expansion of irrigated area in the country. More importantly, private sector tube well irrigation (which has been the major source of groundwater irrigation expansion) operates without subsidy while public sector surface water irrigation systems entail high subsidy. Not only are water charges for public irrigation modest, even these modest charges are not realized.[2] As a result, public investment in the water sector continues to remain as an enormous burden on the government budget.

[2]The 1983 Government Ordinance fixed water charges for irrigation at Tk. 100–Tk. 300 per acre depending on the location of public irrigation projects. These rates are subsidized. For the Ganges—Kobadak project, for instance, charges were fixed at Tk. 250 and Tk. 100 per acre for the dry and wet season, respectively, whereas, the O&M costs of the project was estimated at Tk. 466 per acre at 1983/84 prices. The rates were much lower than water charges for small-scale irrigation equipment e.g., Tk. 1135 for LLP, Tk. 1680 for DTW and Tk. 1640 for STW. The actual collection of water charges for public irrigation projects is, however, very low. During 1984-1991, realized water charges of public irrigation projects was Tk. 7.8 million against the assessed amount of Tk. 137.6 million – only 5.7%. The situation has not improved in recent years. During 1997/98, less than 17% of the assessed amount of Tk. 45 million was collected. Upto May 1999, the collection was only 3% for 1998/99. See Planning Commission 2000, Shahabuddin and Rahman 1998.

With limited potential for further expansion of groundwater irrigation, future irrigation development in the country has to depend progressively more on exploitation of surface water resources. In view of the unsatisfactory performance and persistence of less productive irrigated areas, the overall water use efficiency and sustainability of existing surface water irrigation systems need to be substantially improved so that these can emerge as role models in future efforts in the area. Such efforts need to address the fundamental problems in the water sector to promote efficient and socially responsive water use, delineate public and private responsibilities, and decentralize planning and management functions. In particular, the productivity of large- scale surface water irrigation systems needs to be improved through improving the performance of established irrigation systems. In many cases, inequitable and unreliable water supplies and underutilized capacity of these irrigation systems emerge due to institutional and managerial problems, poor governance, poor O&M, procedural complexities and lack of beneficiary participation. These problems do not require large-scale physical interventions and can be resolved through well-conceived and proactive policies and effective institutions. Well-designed interventions to improve overall efficiency of the irrigation systems will have substantial pro-poor implications as well since productivity and income of the vast majority of the farmers in less productive irrigated areas are low and they remain most vulnerable to water scarcity.

FUTURE PATTERN OF AGRICULTURAL GROWTH AND PRO-POOR IRRIGATION INTERVENTIONS

The expected pattern of agricultural growth can have significant implications on poverty and the nature of irrigation interventions that will generate pro-poor outcomes. In the past, reforms in the agricultural sector particularly in irrigation and input markets contributed to increased output and long-term decline in real rice prices became more prominent in the 1990s. It is expected that two dominant factors will shape the future structural changes and growth pattern of agriculture in Bangladesh: declining rate of population growth and higher growth in per capita income.[3] In the past, the demand for agricultural output was determined by high rate of population growth and a slow growth in per capita income. As a result, the consumption pattern did not reflect differential growth in demand for agricultural products. In contrast, income-induced pattern of demand for agricultural output will emerge as the major determinant of future consumption. With income growth, along with a declining income elasticity of demand, the demand for specific agricultural markets would be different due to varying income elasticities. This would imply a lower growth in demand for cereals and a strong market demand for non-cereals and non-crop agriculture. The above indicates that although policies focused on cereals (e.g., rice) paid large dividends in the past, it is

[3]The annual growth rate of population declined from around 2.5 per cent in the 1980s to 1.6 per cent in late 1990s and the target is to achieve NRR=1 by the year 2005. The growth rate of per capita GDP also increased: from less than 2% per year in the 1980s to around 4% in late 1990s.

unlikely to provide a sustainable engine of growth for the future. As a result, sustained growth in agriculture in the future would require actions on three broad fronts: (i) intensification of production of existing crops (e.g., rice); (ii) diversification of agriculture to high return crops having comparative advantage, and (iii) improvements in non-crop agriculture. Achieving progress in these directions requires policy support, incentive structures, and implementation of programs to address infrastructural, technological, institutional, marketing and other constraints.

Irrigation Development and Agricultural Growth

The expansion of irrigated crop land through appropriate land and water management will be a key factor in accelerating future agricultural growth along the desired directions. The intensification of agriculture requires increased yields and higher cropping intensity. This can be achieved through realizing higher productivity for the major crop, rice. A primary challenge in removing the constraints to expansion of HYVs of rice lies in developing coastal, central and northeastern regions that warrants investments in water control and salinity. The realization of large potential of converting existing local variety of *aus* and *aman* areas into irrigated HYVs requires that irrigation systems be made effective during both *rabi* and *kharif* seasons. This will also increase cropping intensity to relax the land constraint.

In general, measures to promote diversification need to change the past pattern of growth in crop production, which was characterized by the expansion of mechanized irrigation leading to wider coverage of HYV *boro* rice at the cost of most non-cereal crops grown during the dry season. Since the relative profitability of HYV *boro* rice is low on high lands where alternative non-rice crops (e.g., vegetables, spices) can be grown, the area under non-cereal crops can be increased on irrigated high lands if profitability of these crops can be ensured. This requires actions in several areas e.g., development of transport and infrastructure network and marketing linkages, investments in flood control and drainage to increase availability of areas with high land, resolution of the problems of low and variable profitability of non-rice crops, reduction of turn around times between crops, and removal of agro-ecological and technological constraints. The irrigation technologies and policies can also be used to create significant effect on crop diversification. The measures need to address the primary problems of introduction of non-rice crops into rice-dominated irrigation command areas. The minor irrigation technologies and irrigation practices, geared towards rice, are not appropriate for non-rice cultivation for several reasons e.g., size of flow (water discharge), conveyance canals, water application methods, and water adequacy. It has been observed that traditional irrigation and irrigation with hand tube wells and treadle pumps are more suitable for non-cereal crops (Mandal and Dutta 1993). This indicates the need to adopt a comprehensive approach to irrigation development with the capacity to generate, adopt and disseminate efficient technologies and farm-water management practices to ensure the desired transformation and rapid growth in agricultural production.

Poverty and Irrigation Interventions

Rapid economic growth has a major and direct effect on agricultural performance and poverty reduction. Bangladesh needs to achieve high growth over protracted periods to allow tangible improvements in agriculture and in the living standards of the population. It needs to be recognized, however, that reducing poverty is not a question of increasing growth and agricultural production alone. It is necessary to address the underlying institutional, structural, and sociocultural factors that determine access of the poor to assets and voices and regulate competing claims to limited resources. In order to ensure that irrigation interventions can generate pro-poor outcomes, these should be linked with production characteristics of agriculture and available natural resources.

Over the years, high population growth and competing claims from other sectors have generated increasing pressure on land and other resources in the country. The land area operated by rural households declined from 9.3 million ha in 1983–84 to 8.3 million ha in 1996. On the other hand, the number of farm holdings increased from 10.0 million to 11.8 million over the 1984–1996 period reducing the average size of farm holding from 0.91 ha in 1983–84 to 0.68 ha in 1996. In future, land available for agriculture will further decline with increasing population and diversion of land for nonagricultural uses. Another important feature of agriculture is the dominance of small and marginal farmers. The number of farmers who are landless and functionally landless (owning less than 0.2 ha) was 10 million in 1996 (56 percent of rural households). In 1996, small and marginal farm holdings accounted for 81 percent of the farms with 41 percent of the total operated land. This shows that 19 percent of the farms control 59 percent of operated land in agriculture. As a result of the inequitable socioeconomic dynamics in the rural society, the number of nonfarm households is increasing rapidly in rural areas: during 1984–1996, the growth of nonfarm households was nearly 4 percent per year compared to 1.4 percent for farm households. The medium and large holdings are undergoing subdivision leading to increasing number of small and marginal farms. The agricultural labor households, which constitute the majority of the poor rural households, mostly belong to nonfarm and marginal/small farmer categories.

Several characteristics of the rural poor households may be noted. The income sources of these households indicate that wage income is the largest component accounting for nearly 48 percent of total income (table 4). Crop production provides 22 percent while the share of noncrop agriculture (e.g., livestock, poultry, fisheries, and forestry) is only 6 percent. The income from unincorporated enterprises (which represent earnings of the nonfarm sector) is 13 percent. While agricultural wage is the major source of income of the poor, real wage of agricultural labor stagnated in the past.[4] As a result, although agricultural growth matters for poverty reduction, the poor could not benefit much, creating less than anticipated impact on poverty.

Given the structural characteristics and sociopolitical realities, it is important, therefore, to examine ways to maximize the poverty reducing impact of agricultural growth

[4]With 1969/70 as the base, real wage rate index in agriculture stands at 107 in 1997/98 compared to 137 in manufacturing and 114 in construction. See MOF 2000.

Table 4. Sources of income and main occupation of rural poor households.

Source of income	Percent of monthly income, 1997	Main occupation	(Percent) 1997	1999
Crop agriculture	22.2	Daily labor:	47.1	48.0
Livestock/poultry	3.6	Agriculture	41.1	33.3
Fisheries	0.3	Nonagriculture	6.0	14.7
Forestry	2.0	Self-employment:	49.5	43.5
Wages	47.5	Agriculture	26.9	24.1
Unincorporated enterprises	12.7	Nonagriculture	22.6	19.4
Others	11.7	Others	3.4	8.5
Total	100	Total	100	100

Source: BBS 1998, 2000.

in the country. The important element to stress in agricultural growth for poverty reduction relates to the fact that, in addition to the growth of the rural economy, productivity gains and falling real agricultural prices that accompany rapid agricultural growth would allow the supply of low-cost food to the people, improve their nutritional status, and enhance food security. At the present stage of development of agriculture in Bangladesh, and given the resource constraints, the priority needs to ensure yield growth of major agricultural products (e.g., rice). This is also necessary to release resources for accelerated growth of non-cereal crops and noncrop agriculture. In designing policies for increasing agriculture's ability to reduce poverty, it needs to be recognized that household income of the poor farmers will not increase much through improvements in crop technology due to small size of their holdings and unfavorable terms of trade of the major crop (rice). Improvements in crop productivity will contribute more in terms of increasing supplies and reducing the unit cost of production. This will enable access to food by the poor at affordable prices. For increasing household income, expansion of non-crop agriculture and non-farm activities needs to be targeted. In order to push agriculture in these directions, policies, incentives and programs are needed to pursue efficient production practices, remove supply-side constraints, and provide a supportive macro and trade environment. Within the broad framework, irrigation interventions are critical for increasing productivity and accelerating the pace of crop diversification. The availability of irrigation is an essential prerequisite for adopting improved technologies and expanding the production base. This will also reduce fluctuations in income and employment to support seasonal stress management of the poor farmers. In this respect, geographical targeting of irrigation interventions to disadvantaged areas needs priority since areas with good agricultural performance also have lower poverty incidence.

CONCLUSIONS AND MAJOR ISSUES

To reduce poverty, it is crucial to develop the rural areas in Bangladesh for which rapid agricultural growth is essential. Agriculture growth, food production in particular, over the

last two decades was guided by growth in irrigated agriculture which enabled the farmers to adopt new technologies and yield-raising inputs. This also resulted in increased incomes for irrigated farmers. The increased production of food grains enabled the country to supply more food at lower real prices.

With changing pattern, Bangladesh needs to produce more food grains, along with other non cereal crops, to meet the rising demand and ensure food security of the population. For increasing crop production and accelerating agricultural growth, further expansion of irrigation to potentially irrigated areas is a priority. While the expansion of groundwater irrigation played the key role in expanding irrigated areas in the past, the future efforts are needed to focus more on surface water potentials due to hydrological and other factors. The past experience of surface water irrigation projects in the country is not satisfactory. The established irrigation systems have been performing poorly. In particular, the productivity over a large part of the irrigation systems remains low resulting in skewed and unequal distribution of benefits of irrigation development. These areas within the surface water irrigation schemes suffer from chronic and severe water shortages, especially those located in tail-end reaches, resulting in low productivity and persistent poverty among the farmers caused by inequitable and unreliable water supplies. It is necessary to address these problems since the agricultural sector needs to meet the dual challenge of increasing agricultural growth and looming water scarcity. In particular, the agricultural sector needs to produce more output with less water through significant improvements in water use efficiency at the farm and system levels. This has a significant poverty reduction dimension as well, since the resource-poor farmers in low productivity irrigated areas are more vulnerable to water shortages than in favorable areas.

The challenges require major policy and institutional reforms toward integrated water resources management and improved management of water delivery services at the individual system level. At the system level, the productivity of disadvantaged irrigated areas can be substantially improved through several nontechnical measures e.g., improvements in institutional and managerial functions, better governance, and adequate funds for O&M. The knowledge on how a range of nontechnical interventions and replicable practices can improve productivity and contribute to reducing poverty in these areas is, however, scanty. While the government has initiated several measures to improve water use efficiency and sustainability of surface water irrigation schemes through transferring management functions of irrigation facilities to water user associations along with financial autonomy and accountability, there exists little evidence on success of such efforts in promoting efficiency and equity in water use.

Since irrigation will continue to play the key role in promoting agricultural and rural growth, the adoption of pro-poor irrigation interventions is critical in promoting equitable economic growth in Bangladesh. Along with an improved overall performance of irrigation schemes, this requires measures to ensure enhanced livelihood of poor farmers through addressing specific poverty related problems of resource-poor irrigated farmers, particularly in disadvantaged areas. As for irrigation, such measures need to cover a well-sequenced set of appropriate interventions covering policies, institutional arrangements and support systems. These measures should be able to provide necessary incentives and mechanisms for improved equity and reliability of water supply, ensure participation of the poor farmers in decisions regarding water management, ensure sustainability of O&M operations and address their

location-specific problems. The critical issue is to improve returns to the poor farmers along with efficient and sustained performance of irrigation facilities.

It should, however, be noted that the implementation of such a set of pro-poor irrigation interventions requires detailed assessment of the poverty situation of the targeted farmers and assessment of alternative measures in order to define pragmatic actions to bring about the desired results. Along with changes in policy and institutional framework to ensure an enabling environment, such actions need to include specific interventions e.g., managerial reforms in water user organizations, administration of water rights and water pricing, regulatory and supervisory measures, and supportive incentives/mechanisms to improve both system performance and equity.

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Irrigation Management Issues in Bangladesh: Experiences and Lessons from Ganges-Kobadak Irrigation System

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INTRODUCTION

Irrigation is a critical factor for crop production in Bangladesh. Although, the share of agriculture in Gross Domestic Production (GDP) has been declining over the years, it still remains the largest sector of the Bangladesh economy. At present, agriculture accounts for about one-third of GDP and employs about two-third of the labor force. While the contribution of agriculture to the economy is likely to decline, it will continue to be the single largest contributor to income and employment of the rural population in the foreseeable future. The country's increase in food production appears below the level necessary to meet basic food needs, while its population continues to increase at a rate of 1.8 percent a year. Virtually all of the country's cultivable land is already in use and each year, the farm sizes grow smaller and the number of landless laborers grow larger. However, on closer inspection, a more optimistic outlook for the future is possible. The country has fertile soils in the combined flood plains of the Ganges, Brahmaputra and Meghna rivers. There is more than enough water if properly managed to triple the amount of currently irrigated land and substantially increase food production. Additionally, some innovative attempts like improved management techniques, operation and cost-effective maintenance of the existing irrigation projects may also substantially increase food production. The Government has given highest priority to the development of the agricultural sector and through a series of Five Year Plans has attempted measures with the aim to increase food grain production. Under the plan, the Government has given highest priority to the maximum utilization of the existing facilities and improvement of productivity in areas already covered by irrigation facilities. Command area development, efficient water distribution, crop-water management practices, and participation of local people as beneficiaries of drainage and irrigation program are being encouraged.

Bangladesh Water Development Board (BWDB) created in 1959 is the pioneering organization entrusted with the task of planning and implementing various water resources projects in the country. This organization has already completed a large number of projects within the country. While the growth of water development projects have contributed

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significantly towards increased agricultural production, the shortfall from expected returns has also been substantial. Gradual deterioration in performance of the project has been identified as one of the main reasons of the shortfall.

The Ganges-Kobadak (G.K) Irrigation Project as conceived in the early fifties was the first major step in Bangladesh to provide supplemental irrigation to traditional rice varieties. It is the largest lift-cum-gravity irrigation system in the country. Like other irrigation projects in Bangladesh, performance of this project is much below the potential level. Inadequate funding for the proper maintenance led to gradual deterioration of the physical infrastructure. In addition, problems such as lack of practical guidelines for main system operation, lack of measuring devices for water distribution and allocation, lack of control at the main system level and excessive use of water by farmers in locations with easy access to water lead to poor performance level.

Between 1985 and 1994, the G.K Project was under rehabilitation with a loan from the Asian Development Bank(ADB) and Technical Assistance from UNDP to address the above deficiencies. The lesson learnt is that changes to the physical works (the hardware) are relatively straightforward and can be accomplished in a reasonably short time span, whereas changes to improve the management, the operation and maintenance (the software) of the system are less straightforward and difficult to accomplish in a limited time span (Burtonand Frank 1989). In this paper, the discussion is made on the aspects of software changes in rehabilitation for efficient irrigation management with sustainable operation and maintenance procedures.

DESCRIPTION OF THE G-K IRRIGATION PROJECT

The project area is located in the southwestern part of Bangladesh. The G-K Project Kushtia Unit comprising two phases was taken up for implementation in 1954. Net irrigable area is about 125,000 ha. Phase-I consisting of about 42,000 ha was implemented during 1954–70 and Phase-II covering an area of about 83,000 ha was completed during 1969–83.

A typical monsoon climate prevails in the project area. Average annual rainfall is about 1,600 mm, about 70 percent occurs during mid-June through mid-October. Rice is the dominant crop occupying about 70 percent of the total cropped area. Pulses, oil seeds, jute, sugarcane, tobacco and wheat are the other important crops.

The Ganges-Kobadak Irrigation Project derives its water from the Ganges river. The project includes two major pumping plants, flood control and drainage facilities and an irrigation distribution network comprising main, secondary and tertiary canals. Irrigation water is pumped from the Ganges river by a main pumping plant having 3 pumps of 36.8cumec capacity and also by a subsidiary pumping plant having 12 pumps of 3.54 cumec capacity each. The project's main canals are about 193 km, secondary canal about 467 km, and tertiary canal about 995 km, in length.

The area has developed because of the project. Good crop production is assured as areas are free from floods and have more or less assured water supply for irrigation. In irrigated areas mainly High Yielding Varieties (HYVs) of paddy are grown. At present, about

93,000 ha are benefiting from a supplement irrigation during Kharif-II season (mid-July – mid-November), against targeted area of 125,000 ha, while about 25,000 ha are irrigated during the Kharif-I season (March – June) due to scarcity of water. In contrast to other areas in Bangladesh no irrigation is supplied for the winter crops (November to February) at present. However, pulses, oil seeds, onion, wheat, tobacco etc. are cultivated in large areas (about 60%) under residual moisture condition during this season. Salient features of the G.K Project are provided in Appendix table 1.

PROJECT ORGANIZATION AND SYSTEM OF OPERATION

Organization

The Ganges-Kobadak Irrigation Project is operated and maintained by the Bangladesh Water Development Board (BWDB). Under BWDB, organization of the G.K. Project has a straight forward structure, where a Superintending Engineer (Project Director) is the head of the Project with Executive Engineers in charge of the Divisions. Divisions are responsible for construction and O&M in the field. For agricultural development activities, an extension unit has been established. The extension staff is primarily responsible for the agricultural extension, water management at the field channel level, and for guidance of the water management association. The extension staff works under the administrative control of the Project Director and under the technical control of the Chief Water Management of BWDB.

Nomenclature of the Project Irrigation System

Water from the river is pumped into the main canals. From the main canals water runs into secondary canals and from secondary canals into tertiary canals from where farmers get water into their land through field channels and plot channels. Command area of a tertiary canal is called a tertiary unit, which receives water from a tertiary offtake. A tertiary unit is subdivided into quaternary units called *chaks*, which vary in size from 25 to 40 ha. A chak receives water from a quaternary channel called field channel through an outlet.

PROBLEMS AFTER COMPLETION OF THE PROJECT

Although the Ganges-Kobadak Project is technically sound in concept, it could not achieve many of the expected benefits due to a number of problems including:

- Heavy sedimentation in the intake channel of the pumping plants;
- Insufficient water supply due to poor pumping plant condition;
- Inadequate and undependable power supply;
- Inadequate tertiary and field channel network;
- High operation and seepage losses from the canal system;
- Poor system management, operation and maintenance;
- Less than adequate extension services, farm inputs and agricultural credit; and
- Inadequate on -farm water management practices.

Inadequate system management and on-farm water management practices have resulted in illegal diversion of water by cutting irrigation canal embankment at the head reaches. The absence of adequate field channels and plot channels lead to the practice of plot-to-plot irrigation where a plot is flooded completely in order to reach an adjacent plot. This practice results in wastage of vast amount of water that is spilled into the drains and percolating into ground.

Originally, when the project was conceived, water requirement was based on more rainfall dependent local rice varieties. Now with the introduction of high yielding varieties of paddy, higher diversion duty is required. Moreover, there is strong pressure from the farmers on the BWDB to provide more water in both pre-monsoon (Kharif-I) as in the monsoon period (Kharif-II). The farmers wish to irrigate a larger area with HYV paddy and therefore they are in need of more water, even in the monsoon season. One of the consequences of the above attitude of the farmers is a larger area in monoculture paddy than foreseen in the original design, thus increasing the water requirement at the primary, secondary and tertiary levels of the irrigation system.

As a result of a UNDP grant for the feasibility of the Ganges-Kobadak Irrigation Rehabilitation Project conducted in 1983, the Government secured a loan from the ADB totaling 34.93 million SDR for financing the rehabilitation of the existing irrigation system.

REHABILITATION PROGRAM

First Phase of the Program

Rehabilitation of the irrigation system started in 1985 and has been directed at remedying the identified problems through:

- Improving hydraulic condition at the entrance and within the intake channel to the pumping plant;
- Improving adequacy and dependability of power supply;
- Rehabilitation of pumping plants to their original design capacity;
- Rehabilitating major existing infrastructure;
- Rehabilitation and improving tertiary and field channel network;
- Strengthening of farmer organizations and agricultural support services; and
- Improving arrangement for sustained operation and maintenance of the system.

As a supplement to the ADB loan for the rehabilitation and improvement of the existing Ganges-Kobadak Irrigation system, UNDP granted a technical assistance in 1985 to provide back stopping support for consulting services in detailed design, construction supervision; training of BWDB staff in system management, O&M and organization and training of water user groups. Joint evaluation of the technical evaluation was undertaken in April 1987. It was found that rehabilitation is more concentrated on physical rehabilitation with insufficient regard for other factors responsible for the need to rehabilitate this scheme like poor management, operation and maintenance and inadequate on-farm water management practices. In addition to the physical rehabilitation of the irrigation system, attention should be directed at strengthening the capacities of G-K project staff and farmers for the subsequent management, operation and maintenance of the rehabilitated system.

Detailed examination of the reasons for the malfunctioning of the system has been carried out and the following points have been observed with regard to the functioning of the main system and also of the system at the chak level.

Functioning of the Main System

The inability of the main system to deliver an adequate and reliable supply of water to the chak outlets is a result of number of factors like deficiencies in the physical infrastructure itself, high conveyance losses partly due to seepage and partly due to losses from defective or even missing control structures, substantial losses from the system from unauthorized cuts made in the embankment by farmers. A number of these problems are, at least in part, due to inadequate planning procedures for the operation and maintenance of the main system by project staff. It is evident, of course, that the simple inadequacy of the budget allocation is also a cause of the inadequate attention to system management. However, the scarce budget allocation could be properly utilized with the establishment of improved maintenance planning procedures.

Functioning of the System at Chak Level (On-Farm Level)

The extent of the irrigation system network below the main system is limited. Large parts of the project area are without field channel network. There is either complete absence of field channels or field channels previously constructed are in a very poor condition. Limited development by farmers of the water distribution network below the outlets has been a consequence of the inadequacy and unreliability of water supply reaching the tertiary canals. Lack of confidence in the regularity of the water supply has in turn discouraged the development of any sort of group discipline regarding water use or field channel construction and maintenance by farmers at the chak level. Any improvement in the present functioning of the system at the chaklevel must then come first from an improvement in the supply of water from the main system.

At the same time studies have also been conducted as regards tertiary unit development and on farm development. Studies recommended strengthening of farmer participation through the formation of Tertiary Water User Associations. Evidence from rehabilitated irrigation schemes around the world also suggests that farmers must be involved in planning, design and construction stages of the project. It was thus decided to develop such an integrated approach also for the G-K project. The concept as envisaged is to develop processes for this in selected model areas and after the processes are developed, to expand them gradually to other areas of the G-K project. The processes to be developed are those that eventually lead to organized farmers taking responsibility for the O&M at the tertiary level and below.

The intended functions of these Water User Associations are to:

- Locate, construct, improve and maintain field channels and plot channels with technical assistance from BWDB;
- Ensure equitable water distribution;
- Resolve conflicts in water distribution among its members;
- Ensure proper cleaning and maintenance of tertiary canals;
- Convey information about water management and communicate farmers needs to the relevant agencies; and
- Help in the collection of water charges.

The approach that was taken as ideal was to organize first small water user groups, an outlet committee in each command area of the outlet and then bind all the outlet committees of the tertiary unit into an association. While the Tertiary Water User Association was the main organization, its success depended largely on the viability of the outlet committee. Thus, it was felt necessary that the outlet committee represents the farmers from the head end, middle and tail end of the field channel and also from large, medium and small farmers in the community, those who have leadership and interest in social work to make it a strong and viable committee.

This program was taken up in 1988 in three tertiaries as model areas where encouraging progress was made which acted as the foundation of future course of tertiary unit development work under farmers' participation program in G-K project.

The terminal evaluation of the Phase-I UNDP supplemental Technical Assistance to the Asian Development Loan for the G-K Irrigation Rehabilitation Project was carried out jointly by GOB/UNDP/ADB in June 1989. The evaluation concluded that although substantial implementation progress had been achieved, the G-K project would benefit from a further technical assistance in the following fields:

- Completion of physical work on chak development through farmer participation;
- Establishment of farmer groups responsible for O&M of the tertiary level of system; and
- Strengthening of the O&M capability of G-K project organization.

Second Phase of the Rehabilitation Program

The implementation of second technical assistance started in May 1991 and was planned for a duration of 30 months. It was funded/financed through a UNDP grant and an equity of the Government of Bangladesh. The objectives of this technical assistance were:

- Development of the tertiary units and the formation of Water Users Associations, comprising groups of farmers which would be responsible for the operation and maintenance of the tertiary canals and for cost recovery;
- Training of all levels of project staff and farmer groups on operation and maintenance of various aspects of the project; and
- Direct support of water management unit (WMU) to be established within the project organization which would be responsible for water distribution, planning and operation through the introduction of a computer-based scheduling model.

The essence of the Technical Assistance design was to provide the G-K project staff with the necessary training, experience and facilities to make major changes in the project functions, transforming it from an organization with a central responsibility for operation and maintenance to a participant organization responsible for main system control and the supply of water to independent agricultural enterprises. Completion of the tertiary level physical development and improved operational control in the main system were essential for successful conclusion. The activities carried out are stated below:

Organization of Water User Associations

During the rehabilitation period that ended in June 1993, 324 Water User Associations (WUAs) were formed. These water user associations participated in the remodeling of tertiary canals. To improve water distribution below the outlet, water user associations constructed field and plot channels in locations agreed upon by G.K staff and the farmer beneficiaries. Their participation in tertiary remodeling was a unique undertaking, i.e., the WUAs had to provide the funds for remodeling the work then, later on reimbursed by the project management. The source of funding was individual contribution by beneficiaries, but in some cases for smallholders, they had to work for the equivalent amount of their contributions. Any profit from these activities formed part of the capital of the WUAs. There were, however, areas where farmer beneficiaries adopted the wait and see attitude, and it took sometime to convince them. But since they observed that farmers in the more advanced WUAs were satisfied with the water supply at the farm level, the participatory movement gained grounds.

Training of G-K Staff and Water Users

A training program ranging from the fundamental principles of water management to a more advanced water management was designed, implemented and participated by selected personnel from the field staff to the senior management. Practical training for members of the WUAs, regarding leadership and financial management to prepare them for the full management of tertiary level facilities and manage their association not only for O&M but for a more responsive production economic oriented group.

Water Management in the System

A unit called Water Management Unit responsible for main system operation was established within the G-K project organization. To help this unit, the consultant of the project developed a software to develop a central database for storage and analysis of system operation information. In addition to the storage and processing of basic operation data, the software calculates crop water requirements, determine target discharge control structures making use of feed back on actual field conditions. The software is capable of providing target discharges and reports for actions by gate keepers and system operators. Procedures for monitoring, control and assessment of the operations of the main system as well as development of operating guidelines and communication links were also developed.

EXPERIENCE OF THE CANAL ROTATION PROGRAM CONDUCTED BY IIMI-IRRI-BRRI RESEARCH GROUP

During the rehabilitation program, an experiment on canal rotation program was conducted by the IIMI-IRRI-BRRI research group with the active involvement of the farmers and G.K project officials during 1989–90.

Rotation

As the Ganges-Kobadak system is deficient in water in relation to the total needs of the farmers within its command area, a nine-day rotation (with three days on followed by six days off) among secondaries was rather loosely followed for some years. In 1990, the rotation was changed to that of ten days—with five days with water followed by five days without. The IIMI-IRRI-BRRI research group, in consultation and collaboration with the G-K project officials, undertook an experiment on one secondary canal so as to monitor the implementation of the rotation and examine its results.

The previous (nine-day) rotation system had faced a number of problems which the action research experiment attempted to resolve. These problems included: a) non-observance of rotation among tertiaries; b) deteriorated condition of canals and field channels; c) unauthorized cuts in canals; d) poor condition of hydraulic structures as well as that of some bridges and culverts; e) absence of farmer-organizations and participation; and f) a general lack of communication and interaction between farmers and the project officials. The secondary canal chosen for study (denoted as S8K) was one of those having significant problems. Project officials arranged for repairs to this canal and its control structures and devised a system so as to ensure that the 5+5 ten day rotation could be strictly observed with regard to water deliveries to the secondary. Project officials, along with the research team members made special efforts to keep the farmers along the secondary informed as well as to encourage their participation.

As a result, area irrigated under S8K in the 1990 Kharif-I season increased from 54 hectares in 1989 to 528 hectares, an increase of 877 percent. The distribution of water among different tertiaries and among the head, middle, and tail farmers along the various field channels also became much more equitable in 1990 than before.

LESSONS LEARNT FROM THE REHABILITATION OF THE SYSTEM

There were positive and negative experiences gained during rehabilitation of the system. The negative experiences were as a result of unenlightened water users, and inadequate maintenance planning. But these are not insurmountable ones as solutions to these problems developed overtime. At least with these experiences, the span of the rehabilitation, operation, deterioration and rehabilitation cycle in irrigation development could be

lengthened. Attempt was made to institutionalize the lessons learnt within the G-K Project to improve and build upon the sustainability of the system.

While organizing water users is a long and tedious process, once given the right motivation they can become willing and excellent partners in remodeling irrigation facilities, operation and maintenance, water management at the field level and in cost recovery, thereby contributing to the sustainability of irrigation system operation.

- Proper and adequate maintenance of irrigation facilities is a key to successful operations.
- Continuous training is necessary to improve the capability of both irrigation staff and water users in the management of irrigation systems.
- Regular monitoring and an efficient management information system is indispensable in the effective operation and maintenance of irrigation systems.
- Labor-intensive practice if properly managed is a sustainable approach in system rehabilitation and improvement.
- Appropriate management environment (characterized by irrigation managers and farmers interaction) can improve system performance to a large extent.

From the lessons learnt through the rehabilitation program of the G-K Irrigation Project, it could be concluded that improved efficiency of the project is very much dependent on the software of management and training. Rehabilitation tries to make the scheme technically perfect. But a technically perfect system does not automatically imply a proper functioning of the system. To function effectively, the scheme also requires proper operation and maintenance of the main system, as well as an efficient use of water by farmers. In other words, it is essential to focus on elements such as: (i) main system management, (ii) improvement of O&M procedures, (iii) strengthening and training of O&M staff, (iv) participation of the water users, (v) coordination among all parties, (vi) socioeconomic impact on the farmers and (vii) environmental aspects of the project area.

Although the future looks bright with the rehabilitation program of the G-K Project, there is no room for complacency. Improvement of the management skills are still required for sustainable operation and maintenance.

Appendix table 1. G-K. Irrigation project at a glance.

Project area	197,500 ha.
District	4 Nos (Kushtia, Chuadanga, Jhenidah, Magura)
Upazila/Thana (small administrative area)	13 (Kushtia, Kumarkhali, Khoksha, Mirpur, Bheramara, Daulatpur, Alamdanga, Chuadanga, Harinakundu, Jhenidah, Sailkupa, Magura and Sreepur)
Population	20 lac
Irrigable land	1,25,000 ha
Project implementation period	1st Phase : 1955-56 to 1969-70 2nd Phase : 1960-61 to 1982-83
Project implementation cost	Tk. 739 million
Project rehabilitation cost	Tk. 2126 million
First irrigation supply	1962
Pump house	2
Total discharge Capacity	153 cumec
Flood control embankment	39 km
Irrigation canal	
a) Main irrigation canal (3 nos)	193 km
b) Secondary canal (49 nos)	467 km
c) Tertiary canal (444 nos)	995 km
Drainage canal	971 km
Hydraulic structure	2,184 Nos
Inspection road	228 km
Project's electricity requirement	14 Mega Watt
Highest irrigation achievement	99,119 (Aman) ha 42,742 (Aus) ha
Annual operation cost	Tk. 290 million
Water user association formed	324
Total number of outlets	3,500

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Role of Irrigation towards Achieving Food Self-Sufficiency in Bangladesh

Z. Karim *

INTRODUCTION

Bangladesh is a land-scarce country with a high population growth, resulting in an adverse land-man ratio of 0.06 ha at present. Land resources are being squeezed leading to decline in the net cropped area; making it difficult to match the needs of increasing population. Attaining food self- sufficiency and its sustainability is thus a big issue for the agricultural development planners and policy makers of the country.

Of the total land area of 12.31 m ha at present, 7.85 m ha is under agriculture, and crop agriculture alone constitutes over 80 percent. Further, land degradation of various types are active and threatening the agricultural productivity in the country. In Bangladesh, the primary cereal crop, rice, is grown in three crop seasons, while wheat is grown during rabi season. Pulses and oilseed crops are also sown during rabi. Maize is cultivated both in rabi and kharif on a limited scale, while some minor small grain crops are sown in the rabi season. By crop growing season, the kharif season crops are prone to risk of early/late flood, drought and hailstorms. The rabi season is free from such risks, but needs investment in the form of irrigation development for cropping.

FACTS ON IRRIGATION

Present irrigation coverage is over 4.0 m ha and the target by the end of fifth five year plan is 4.86 m ha of which surface water irrigation is 1.338 m ha and the groundwater irrigation, 3.522 m ha. Total area that can be brought under irrigation is 7.56 m ha. However, the potential area that can be brought under irrigation through conjunctive use of surface (28%) and groundwater (72%) is 6.90 m ha. Since 1996/97, annual growth of irrigated area was 4.2 percent on average. Growth rate was higher for groundwater irrigation than for surface water irrigation. Irrigated area of the last 5 years is shown in table 1.

IRRIGATION AND FOOD PRODUCTION

Enhancement of land productivity is the only answer to meet the food and fiber requirement of the country. Currently, over 80 percent of the irrigated land is under rice cultivation with

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Table 1. Irrigated area by mode of irrigation (ha).

Method						
Year	LLP	STW	DTW	FCD/1	Others	Total
1994-95	656912	1543405	668120	159117	402227	3429781
1995-96	677804	1645571	677048	153032	400443	3553898
1996-97	695551	1769454	677974	155986	395084	3694050
1997-98	706594	1936437	674494	162664	371491	3851680
1998-99	715385	2078138	661943	167206	364211	3986883

Source: Statistical yearbook of Bangladesh, BBS 1999.

an irrigation water use efficiency of only 20–30 percent. By area, kharif-II rice (Aman) covers the highest hectarage, though the total production is not much over Boro rice production, although Boro rice area is nearly half of that of Aman. One main reason is that, Boro coverage is over 94 percent by modern varieties (MV) with primary irrigation, while for Aman (T.Aman)—which is mainly rainfed— coverage is only approximately 40 percent. Investment in MV Boro is rewarding, with a highest benefit-cost ratio of 1.47 compared to 1.30 for MV Aus. This implies that, much remains to be done to expand the irrigation facility and to go for MV Boro instead of other two seasons' rice. This statement however should not be taken as a recommendation for growing rice, this is rather to emphasize on the importance and role of irrigation for increasing rice production and thus self-sufficiency.

This is because crops other than rice have much higher benefit-cost ratio, and thus greater comparative advantage; e.g., sugarcane 2.06, mustard 1.55, pulses 1.68, maize

Table 2. Production targets of important crops during the Fifth Five Year Plan (1997-2002) (area in million hectares, production in million tons unless otherwise stated).

Crops	1996/97 (Bench mark)		Target during 2001/2002	
	Area	Production	Area	Production
Rice	10.398	18.823	10.110	23.400
Wheat	0.708	1.450	0.700	1.600
Subtotal	11.106	20.273	10.810	25.000
Other coarse grain	0.100	0.120	0.120	0.120
Total food grain	11.206	20.393	10.930	25.120
Potato	0.150	2.400	0.200	2.431
Sweet potato	0.050	0.500	0.078	0.660
Oilseeds	0.570	0.580	0.700	0.760
Pulses	0.700	0.600	0.778	0.850
Spices	0.170	0.380	0.220	0.500
Vegetables	0.232	2.320	0.300	1.815
Fruits	0.190	2.140	0.260	3.540
Jute (million bales)	0.510	4.870	0.570	7.242
Cotton (million bales)	0.042	0.090	0.105	0.260
Sugarcane	0.175	10.340	0.182	12.371
Tea (million kg)	0.048	54.00	0.050	60.00
Tobacco	0.034	0.035	0.034	0.036

Source: Fifth Five Year Plan document, GOB.

1.55, banana 4.31, onion 2.61. Modern varieties of wheat have the benefit-cost ratio of 1.20, which is lower than all MV rice crops (BRRI 2001). Vertical expansion, cultivation of low water demanding crops and higher water use efficiency would facilitate to release more lands for non-rice crops resulting in greater returns to the farmers. Production targets of major crops shown in table 2 also justify this argument.

Table 3 shows the area irrigated under different crops for the years 1994-1999.

As of 1999, the BWDB's FCD/1 projects provide irrigation coverage to 1.35 m ha, drainage to 4.22 m ha and flood protection to 3.45 m ha. These, together with the minor irrigation have helped to attain the present self -sufficiency in food grain production in Bangladesh.

Table 3: Irrigated area by crop in Bangladesh (ha).

Crop	1994-95	1995-96	1996-97	1997-98	1998-99
Rice : Aus	124,492	114,887	111,886	105,263	95,951
Aman	321,457	295,682	304,521	338,866	291,903
Boro	2,392,874	2,531,140	2,603,247	2,681,781	2,868,826
Rice total	2,838,823	2,941,709	3,019,654	3,125,911	3,256,680
Wheat	283,147	300,068	320,565	345,757	361,943
Other Cereals	3,840	3,678	4,009	2,834	3,644
Pulses	3,294	1,632	3,159	3,387	3,644
Oilseeds	17,713	18,934	22,002	24,696	29,555
Potato	95,951	100,625	108,612	113,398	121,700
Vegetables	89,117	88,380	93,209	100,034	104,453
Sugarcane	14,058	13,960	15,419	15,910	19,028
Cotton	7,719	8,936	9,215	9,281	6,883
Others	76,120	75,976	98,207	110,471	79,352
Grand total	3,429,781	3,553,898	3,694,050	3,851,680	3,986,883

Source: Statistical yearbook of Bangladesh, BBS 1999.

SUSTAINABILITY OF FOOD SELF-SUFFICIENCY

Recent estimates reveal that, approximately 220 ha of land are going out of agriculture every day. Against this backdrop, and while the yield of major crops are either stagnated or declining, it is imperative that much efforts are given on relatively low risk high yielding Boro rice (average yield of which is nearly double that of T. Aman and almost three times that of Aus rice) cultivation. T. Aman has the highest coverage and is advantageous as it is mostly rainfed and requires little supplementary irrigation. Wheat area though expanding until now occupies only approximately 7-8 percent of the total cereal production. Literally, though food means combination of cereals plus other crop products, by culture and practice, rice is the major food item and the self-sufficiency in food is related to rice.

At present, over 80 percent of the irrigated area is devoted to Boro rice, which has proven to be remunerative. To attain security in food and nutrition, crops other than cereals, animal and vegetable production should be given importance. Irrigation area development thus

shall have to be reoriented in order to harness the benefit of non-rice crops as well. For food self-sufficiency, increased rice production needs to be ensured but not at the cost of other crops. Using the available technology and land suitability information on irrigated crops, current level of production of cereals and non-cereals can be doubled. This will however require pragmatic policy interventions and their field level implementations.

Irrigation Development in Bangladesh: Socioeconomic Issues and Evidence

M.A. Sattar Mandal[*]

The earlier development of minor irrigation depended heavily on the actions and supports of the government. In the backdrop of very slow growth of irrigation under public sector domain, rice production suffered. Since late 70s, a series of policy reforms have been pursued by the government to liberalize the market for irrigation equipment and to create opportunities for the private sector to play more roles in the development of minor irrigation. The major policy reforms in irrigation included: (i) liberalization of imports and distribution of irrigation engines and spare parts; (ii) rationalization of duties and taxes on irrigation equipment import; (iii) removal of engine standardization restrictions; (iv) withdrawal of tubewell spacing and siting regulations, and (v) withdrawal of subsidies on irrigation equipment prices. Recently, financial and technical supports have also been extended to promote supplemental irrigation for Aman rice in the drought- prone areas. Adherence to these policies has been committed in the National Agriculture Policy, 1999 of the Ministry of Agriculture.

The most significant impact of the market liberalization and privatization policy has been a marked reduction in prices of engines and other irrigation equipment, which means that irrigation equipment are now much more widely available and affordable to the farmers. Local workshops have grown rapidly to manufacture spare parts and provide repair services for irrigation equipment (Mandal 2000).[1] This has led to a rapid growth of irrigated area at the rate of about 8 percent per annum since 1991/92. The growth of irrigation has been propelled by Shallow Tubewell (STW) whose number increased from 235,900 1988/89 to 757,044 in 1999/00. STW area grew from 0.94 million hectares in 1988/89 to 2.64 million hectares in 1999/00. This meant an average annual growth of around 14 percent in STW irrigation, which covered 81 percent of groundwater irrigation, 64 percent of minor irrigation and 59 percent of total irrigation in 1999/00. Growth of low-lift pump and major canal irrigation was moderate, while there has been virtually no growth in DTW irrigation. In 1999/00 total irrigated area stood at 4.48 million hectares, which accounted for around 64 percent of approximately 7 million hectares of cultivated land. Groundwater irrigation technologies as a whole (i.e., STWs, DTWs/FMTWs) covered about 73 percent of the total irrigated area.

There are inter and intra-regional variations in the extent of irrigation development. For example, NMIDP census of minor irrigation shows that while the districts of Bogra,

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[*]The views expressed here do not necessarily represent those of the Planning Commission for which the author works.

[1]Minor irrigation is currently the most dynamic private sector which involves about 1.7 million full or part owners/managers of mechanized irrigation pumps with another 0.76 million owners and operators of unmechanized and traditional irrigation devices. Added to this are about 0.16 million rural mechanics who are engaged in installation, repair and servicing of irrigation pumps and engines (Mandal 2000).

Jaipurhat, Naogaon, Dinajpur, Rangpur, Gaibandha, Chuadanga and Tangail have experienced relatively higher growth of minor irrigation there has been slower growth in other areas with high groundwater potentials. The variations are attributed to the socioeconomic conditions such as farm size and land tenure systems as well as physical conditions such as agro-ecological characteristics, groundwater aquifers, expansion of equipment market at the local level, growth of physical infrastructure and provision of electricity.

The growth of irrigation has also been influenced by the availability of institutional credit. In areas where bank loans are either insufficient or difficult to obtain, the growth of irrigation market has been generally slow. In areas with intense competition for command area plots, a new form of partnership arrangement has emerged for taking up irrigation as a business enterprise. But this should not be seen only as a credit market failure. There is a whole range of valid socioeconomic rationales behind choosing partners in irrigation business in a highly competitive environment, especially in a complex rural setting. The major reasons for choosing partners include: mobilization of enough capital for purchase and operation of irrigation machines, meeting kinship or social obligation, enlarging and protecting a viable command area with partners' land and social supports, and acquiring adequate financial and moral strengths to do water selling business without threat of encroachment from the competing pumps (see Mandal 2000).

Profitability of irrigated agriculture is the overriding factor affecting the expansion of irrigation. An earlier study by Mandal et al. (1995) showed that very low paddy price in 1993 Boro season in Faridpur discouraged many farmers from growing irrigated Boro rice in 1994. A recent NMIDP census of minor irrigation revealed that high price for Aman rice in the previous season encouraged the potential investors to respond quickly to food grain shortages (reflected in high prices) by increasing the number of irrigation units and command area per unit of equipment (NMIDP 2000). Therefore it is important to maintain a favorable price regime for food grain as well as other irrigated crops.

The growth in minor irrigation has directly contributed to an acceleration of food grain production from about 18 million tons in early 90s to over 26 million tons in 2000/01. This has been possible mainly through a rapid surge in Boro rice production.

The growth in minor irrigation has led to the emergence of a rapidly expanding irrigation water market, which has largely been competitive and more efficient than before. Irrigation privatization has also significant positive equity implications as more and more small and medium farmers gained increased access to irrigation benefits through ownership of tubewells and pumps whose prices dropped. The increased access of the small farmers, facilitated by significant reduction in prices of irrigation engines and pumps, broke away the monopolistic control by the landed rich or 'water lords' as earlier studies epitomized it referring to DTWs (for an elaborate discussion on dynamics of irrigation water market see Mandal 2000).

As irrigation coverage is expanding, more and more unfavorable and difficult lands are being put under irrigation, meaning that profitability from irrigation is likely to decline if on-farm water management is not improved or more diversification to high value crops does not take place. The added concern is the recently observed arsenic contamination with groundwater—a subject, which is much talked about but least known yet. Be that as it may, it is important for the country to develop surface water irrigation and to improve its management so that pressure on groundwater abstraction for irrigation purposes is minimized.

REPORT ON WORKSHOP DISCUSSIONS

INAUGURAL AND TECHNICAL SESSION

A National Workshop on the proposed Study "Pro-poor Intervention Strategies in Irrigated Agriculture in Asia: Bangladesh" was held at the Bangladesh Unnayan Parishad (BUP) Auditorium, Dhaka on 23 June 2001. The workshop was organized by BUP in association with the International Water Management Institute (IWMI), Sri Lanka. It was participated by about 40 experts and professionals, representing all major government and non-government organizations working in water sector, academic institutions, and donor organizations of the country (A list of participants is given in Annex).

The workshop began with a brief address of welcome by Dr. Q.K. Ahmad, Chairman of BUP. He explained the purpose of the workshop and also the overall objective of the study. He invited all the participants to contribute towards firming up the approach and the methodology of the proposed study. Following his remarks, Dr. Abdus Sattar Mandal, Member of Bangladesh Planning Commission made a presentation on "Irrigation Management in Bangladesh: Socio-Economic Issues and Evidence." He commented that minor irrigation has so far contributed the most to the overall irrigation development in the country. Dr. Mandal made a graphic presentation on agro-ecologically constrained regions with limited scope for development of irrigation. He also talked about socioeconomic constraints such as land tenancy and problems associated with share cropping, low economic return from paddy, and difficulties in marketing the produce. He commented that if the link between the issues of large-scale contamination of shallow ground water by arsenic and groundwater irrigation could be established or even if the evidence of arsenic entering into the food chain is established scientifically, then groundwater irrigation development would face a tremendous set back; but that link is yet to be established.

Dr. Intizar Hussain of IWMI made a presentation on the study. Dr. Hussain first introduced IWMI, and then presented an overview of the purpose and scope of the study. He identified the following two important factors with respect to pro-poor interventions in irrigated agriculture: (a) skewed distribution of benefits of irrigation; and (b) unsatisfactory performance of irrigation systems, involving poor management, unreliable water supplies, inefficiency and inequality in water use, poor maintenance of water infrastructure, financial dependence for running the system etc. He pointed out that there are regional and spatial differences in the types of problems. He commented that it is generally found that the poor performance in irrigation management is to a large extent due to non-technical factors and the study would probe into those issues. He then discussed the purpose and scope of the study. The following four aspects highlights the scope of the study, as described by Dr. Hussain.

- The study would analyze, through field research, the impacts of the current policy and institutional frameworks, and the impacts of underlying physical, economic,

and sociocultural conditions on the selected areas and on the overall irrigation system at large.

- The study would assess opportunities and constraints on improving productivity in these areas through improved access to irrigation water.
- The study would identify and evaluate a range of potential pro-poor interventions at the field and system levels against a set of criteria including cost of implementation and potential to reduce poverty.
- The study would formulate a set of appropriate interventions and policy and institutional frameworks, including adequate support systems, necessary for ensuring large-scale uptake, replicability, and higher impacts on poverty.

Following the two inaugural presentations, there was an open forum where the participants raised questions or asked for clarification on the two presentations. The representative of the Asian Development Bank (ADB), Dhaka mentioned that the ADB was in the process of carrying out two studies in medium and small-scale irrigation projects which might provide valuable insights that this study may find useful to draw upon. In general, the participants expressed their satisfaction that this study proposed to address relevant and topical issues. However, given that poverty is a complex and multi-faceted phenomenon, specification of the link between poverty and irrigation alone could be a very difficult task.

Participants attached high research priority to institutional issues of irrigation management. It was suggested that research on such issues should also encompass minor irrigation in addition to surface water irrigation schemes since the former happens to be the major form of irrigation in the country. In the discussion, lack of adequate marketing facilities and limited access to land were also highlighted as major issues for research.

After a brief break, the second technical session started with a presentation on the Ganges-Kobadak (G-K) Irrigation Project, the largest irrigation scheme in operation in the country. The presentation was made by Mr. M. Noajesh Ali, a BUP consultant, who was formerly the G-K project Manager. He gave a description of the project and its management programs. He explained why the project needed rehabilitation and what has been done so far. He also explained how local people and the beneficiaries were involved in the decision-making processes by the formation of Water User Associations (WUA) within the project area. Mr. Ali showed how WUAs could facilitate irrigation development through a participatory process of project management at the farm level. He also commented that there exist ample opportunities for further improvement.

Following the presentation, the participants raised questions and offered comments. Uneven elevation of land, lack of availability of water in the Ganges, lack of access to water in the tail-ends during dry season, poor management, and transformation of surface water irrigation system into groundwater irrigation during low flow conditions in major rivers were identified as major problems of the G-K project. The other relevant issues that were raised by the participants include: (a) sedimentation and volume dredging, (b) problems of land consolidation, (c) cost recovery, and (d) availability of power to run the operations.

The next presentation was made by Dr. M.K. Mujeri of BIDS, a specialist on poverty issues, on “Poverty Alleviation through Improved Irrigation Practices: Bangladesh Perspectives.” Dr. Mujeri reviewed the past achievements of agricultural performance and

irrigation development. He mentioned that groundwater irrigation accounts for about 70 percent of all irrigated lands in Bangladesh. He pointed out that surface water irrigation is currently enjoying large subsidies compared to the groundwater irrigation systems, but the realization from these schemes is poor, even though the water charges are very modest. Dr. Mujeri visualized a future pattern of agricultural growth and mentioned aspects in which pro-poor irrigation interventions could be focused. He explained that the growth in demand for cereals will decline and demand for non-cereal crops will increase in future. He put emphasis on a shift from cereal to non-cereal crop production. He also argued that non-farm activities should be facilitated in addition to diversification of crops. He suggested that issues concerning inadequate and unreliable water availability at the tail ends should be given high priority towards formulation of pro-poor irrigation intervention strategy. He commented that opportunities concerning improvement of water use efficiency at the farm and system level should be explored.

Dr. Zahurul Karim, Secretary, Ministry of Livestock and Fisheries, Government of Bangladesh and former Chairman of Agriculture Research Council (BARC) made a presentation on the "Role of Irrigation towards Achieving Food Self- Sufficiency in Bangladesh." Dr. Karim informed the workshop that almost 80 percent of irrigation involving both surface and groundwater is directed towards a single crop: Boro paddy. He called for revisiting the past irrigation policies and exploring new ways of growing more food by expanded/improved use of irrigation. He mentioned that there are many areas suitable for non-cereal crops; these potentials should be explored towards crop diversification. He said that transferring cereal growing lands to high-value non-cereals could also help reduce rural poverty. He informed the audience that the BARC established a GIS database, which could be utilized for developing a number of technology packages depending on ground realities.

Dr. Karim mentioned that increased production alone would not ensure increased income for the poor farmers. Promotion of agro-business with value addition at the grassroots level and enhancing of market facilities should be given due emphasis. He suggested that poor farmers should be empowered technologically, and that there are technological packages available in the National Agricultural Research System (NARS). He said that Farming System approach involving the homesteads, particularly of the poor households, as production centers for increasing production of various crops should be considered in order to face the challenges of the future.

The post-lunch session started with a brief presentation by Dr. Q.K. Ahmad, the Team Leader of the proposed study in Bangladesh. Dr. Ahmad explained the framework of the study, which revolves around the nexus of thematic issues: (a) poor irrigation performance, (b) low agricultural productivity, (c) low access to land, and (d) poverty. He also said, as did Dr. Hussain earlier that the study will focus on non-technical interventions, focussing on macro, meso and micro levels as appropriate. He mentioned that micro-level information will be collected through field surveys and PRAs, while meso-level information will be generated through interviews and review of available documents. He also explained that an attempt will be made to examine how macro-level policies affect the poor farmers at the micro level. The issues of coordination among different levels and the role of local government system in irrigation management will also be examined in the study.

Following the presentation by the Team Leader for the Bangladesh component of the study, the participants were invited to take part in a brainstorming session on the issues, the approach and the methodology of the study. The outcome of the brainstorming session is presented below.

BRAINSTORMING SESSION

The brainstorming session, chaired by Executive Director of BUP Mr. Khalilur Rahman, started by considering the general guidelines provided by IWMI. The participants were requested to discuss the major poverty related research issues in irrigated agriculture in Bangladesh. It was mentioned that both types of poverty prevailing in the country should be taken into account: (a) absolute poverty which may be described by using income levels as indicator; and (b) relative poverty which gives an idea about inequality.

In the case of irrigated agriculture, a question was raised as to whether poverty would be compared within the system and between systems or before and after project or with and without (control area) project. In view of non-availability of poverty related data before the project/irrigation system was implemented, a comparison between before and after project cannot be made. It was opined that a comparison of poverty situations in agricultural areas with and without irrigation systems could be done, but this would not serve the purpose at hand; and the approach also suffers from methodological complications. It was agreed that comparisons between water-surplus, water-adequate, and water-scarce areas within an irrigation system and among corresponding areas between irrigation systems would be the best option for the purpose at hand.

It was pointed out that there are three types of benefits from irrigation that may accrue to the poor families: direct, indirect, and derived; and it was suggested that consideration be given concerning the inclusion (in the study) of non-crop agriculture in addition to crop agriculture.

The workshop identified means of improving productivity of the irrigation systems as one of the key areas of research interest. In this regard the workshop identified the timing of pump operation as one of the key aspects. Questions were raised relating to access to irrigation by households located at different locations. It was suggested that the effectiveness of the design of the irrigation systems be examined. The former Director of the G-K project informed the workshop that only about 60 percent of the farming households get irrigation water during the dry period in the G-K project due to nonavailability of adequate water vis-à-vis the required water level for running of the pumps. Therefore, there were seasonal inequities in the distribution of water and some people could not derive stipulated benefits from the irrigation system.

It was suggested that the study should examine availability of inputs, including adequacy and timely availability of financial resources and other types of support and quality of inputs as barriers towards improvement of productivity in the irrigation systems. The participants made the point that pro-poor, targeted management-related interventions should be examined in the study. Possible opportunities for multiple use of irrigation systems, especially in terms of paddy-cum-fish culture, which might help improve the poverty situation within the project

areas, may also be considered. In addition, opportunities for canal bank afforestation should be examined as a means of increasing incomes of the poor families.

The workshop suggested that issues relating to increase of cropping intensity be studied including, if appropriate, conjunctive use of surface and groundwater. It was also suggested that this might be relevant for certain specific areas within the project. Whether the poor were included in the decision-making processes in managing the irrigation systems was another research area identified by the participants. The legal basis of the formation and activities of the Water User Associations (WUAs), with particular emphasis on their registration process, should be taken on board, it was suggested. Participants also suggested that cost recovery for the irrigation systems, giving due emphasis on the processes of cost recovery, be included in the study. The process of formation of WUAs was also identified as one of the research issues. The participants suggested that it would be useful to examine how the WUAs were formed, whether or not there were democratic processes involved and whether or not those were linked with the local government bodies. As a general guiding principle it was suggested that the information should be obtained by involving the local people in the process. Participants were in agreement that there were some problems related to inter-institutional coordination and for an improved management; such problems should be identified and remedies sought.

For selecting irrigation projects for the study, a number of criteria were identified which include age of the project/richness in experience, mode of water supply, water availability/ adequacy/scarcity, experience in irrigation management transfer (IMT) through WUAs, experience in Command Area Development (CAD), pricing system, cost recovery, productivity and poverty situation. Based on the deliberations, a matrix was developed, which would help cross-examine various key aspects of different irrigation projects in Bangladesh for selecting projects out of the seven named in the workshop.

The participants considered indicators for defining poverty in Bangladesh at length. The workshop was informed that the government documents usually use income levels and the size of landholdings as two indicators of poverty in the country. It was also suggested that the housing condition could be another indicator of poverty. It was pointed out that a large proportion of the poor people are ultra-poor (defined with reference to lack of access to 1805 Kcal); in terms of housing they would be in a rather precarious condition. The participants also discussed a number of indicators for measuring irrigation system performance. Following are some of the indicators discussed: (a) water distribution efficiency, (b) command area, (c) cropping intensity, (d) crop yield, (e) existence and functioning of WUAs, (f) cost recovery, and (G) degree of institutionalization of WUAs.

While discussing the probable design of the study, it was agreed that a comparison between ‘before’ and ‘after’ project(s) would not be suitable for the study. It was agreed that, with and without irrigation comparison would not also serve the purpose of the study. After long deliberations, it was agreed that comparisons between water-surplus, water-adequate, and water-scarce areas within the irrigation system and among corresponding areas between irrigation systems are the best options for the purpose at hand.

It was decided that a questionnaire survey at the grassroots, facilitated/supplemented by group discussions, as appropriate, by means of Participatory Rapid Appraisal (PRA) and interviews with knowledgeable respondents within the project area and project personnel could be parts of the general methodology. It was also suggested that the irrigation water

distribution accounting for the selected systems should be done in order to evaluate system performance.

The final discussion topic involved identification of projects for study. G-K and the Pabna Irrigation systems were selected after considering the criteria evolved during deliberations

The discussion was concluded with a vote of thanks by the IWMI representative and also by the BUP Chairman.

PRE-WORKSHOP FIELD VISIT

The workshop was preceded by a visit to the G-K project. Dr. I. Hussain of IWMI along with Mr. Khalilur Rahman, Executive Director of BUP visited the G-K Project in Kushtia district on 21 June 2001. Dr. Hussain and Mr. Rahman were received by the Project Director of the G-K Project, Mr. Hasan Zubair, at Kushtia. The Project Director briefed them about the project activities and accompanied them during the field visit. The visit was made to the pumping plants of the project, intake channel, the Ganges river, which is the source of water for the G-K project, and the canal systems.

CHINA

COUNTRY WORKSHOP

14 May 2001

Tarim River Water Allocation and Community-Based Management

Yu Suhua and Zhao Xiusheng *

BACKGROUND

The Tarim Basin is an important base for implementing the strategy of utilizing China's abundant resources in the twenty-first century, including the large petrochemical reserves, and the important cotton and other agricultural products' production area in Xinjiang. However, the ecology in this region is rather fragile. The extremely dry climate, desert ecology, excessive cultivation of land and the irrational utilization of water resources all accelerate the deterioration of the basin's environment. The river and the lake are dried up, the water quality is worse, the natural vegetation is withered over large areas, the "green corridor" along the lower reaches is disappearing, desertification is increasing, natural disasters occur more frequently with increasing destruction, and many species have disappeared while the population of other species have decreased significantly. The environment now restricts the sustainable development of the local economy.

The Tarim Basin ecology, is drawing more and more worldwide attention from experts, scholars and international aid organizations, especially the issues of preventing desertification and managing the water resources being the most important among all the current problems that await immediate solutions. IDRC funded and organized this project to make a thorough study on the Tarim Basin.

Western China Development strategy is an important strategic decision made by the Chinese government to bridge the economic gap between the western and eastern regions, to coordinate the economic, industrial and social development among the different regions and to assure sustainable and healthy growth of the national economy. The objective of the western China development plan is to improve the local environment and the local economy. The Tarim Basin plays a major role in the municipal economy and the social development of Xinjiang, which is an important autonomous region in the west. This project is thus very significant with the need for new management strategies and technical solutions. Efficient management and rational utilization of water resources, the two key issues in this project, are needed to coordinate environmental improvement and economic development.

Exacerbation of the environment problems in the Tarim River Basin has hindered local and regional economic development, threatened human existence in the region and retarded social development. In January 1999, at the second session of the ninth National People's Congress of the PRC, the Xinjiang delegation submitted a motion for funding a project to dredge the Tarim watercourse and to improve regional ecology as a national program. This

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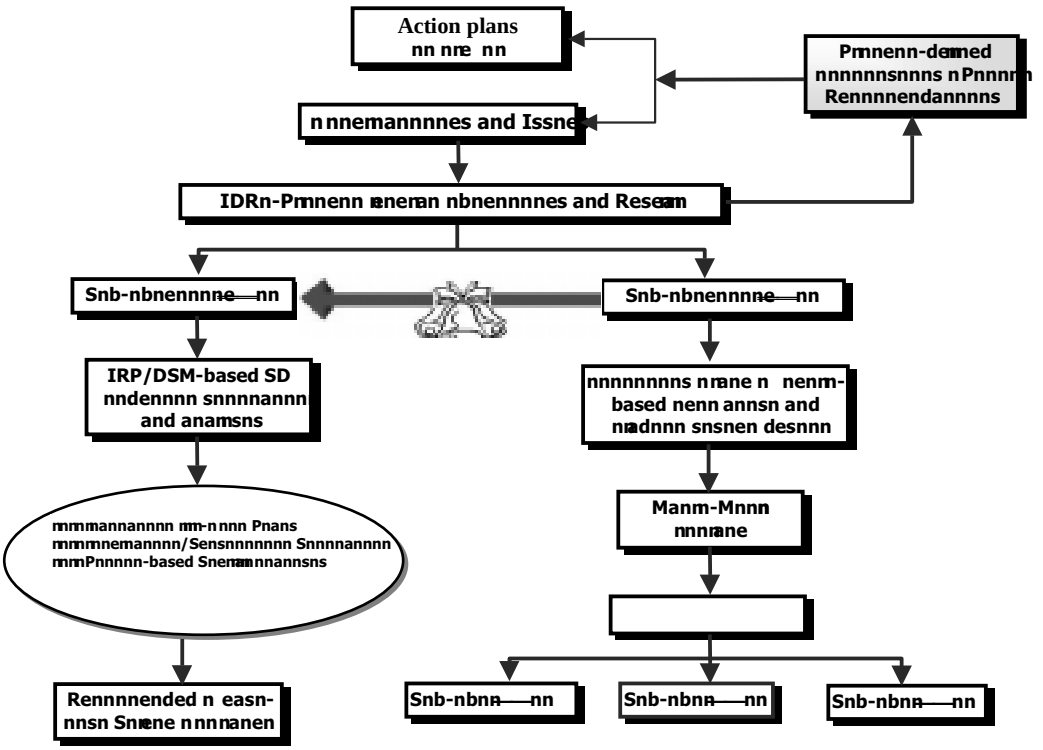
Note: Only one paper is included in the China section. The other papers could not be included as they were not available at the time of publication.

motion drew attention from the State. This project, approved by the State Council, has been listed as one of the ten national river environmental improvement projects, with the first phase of the work already begun. In accordance with these, the research group adjusted the research content to facilitate implementation of the Tarim River project. The thorough research at both the macro and micro levels has provided wide-ranging policies and suggestions to maintain sustainable economic development of the Tarim Basin, which is of practical and far-reaching significance.

Figure 1. The research framework of the project study.



RESEARCH METHODOLOGY

The socioeconomic system, the water use and the ecosystem are all interconnected through complex interactions, interdependence and interlinks. At the same time, by virtue of the internal intrinsic mechanisms and dynamic feedbacks, the whole system would display a non-linear and counterintuitive characteristic. These issues are obviously typical of complex large-scale system natures, and need to be carefully analyzed using proper system engineering approaches.

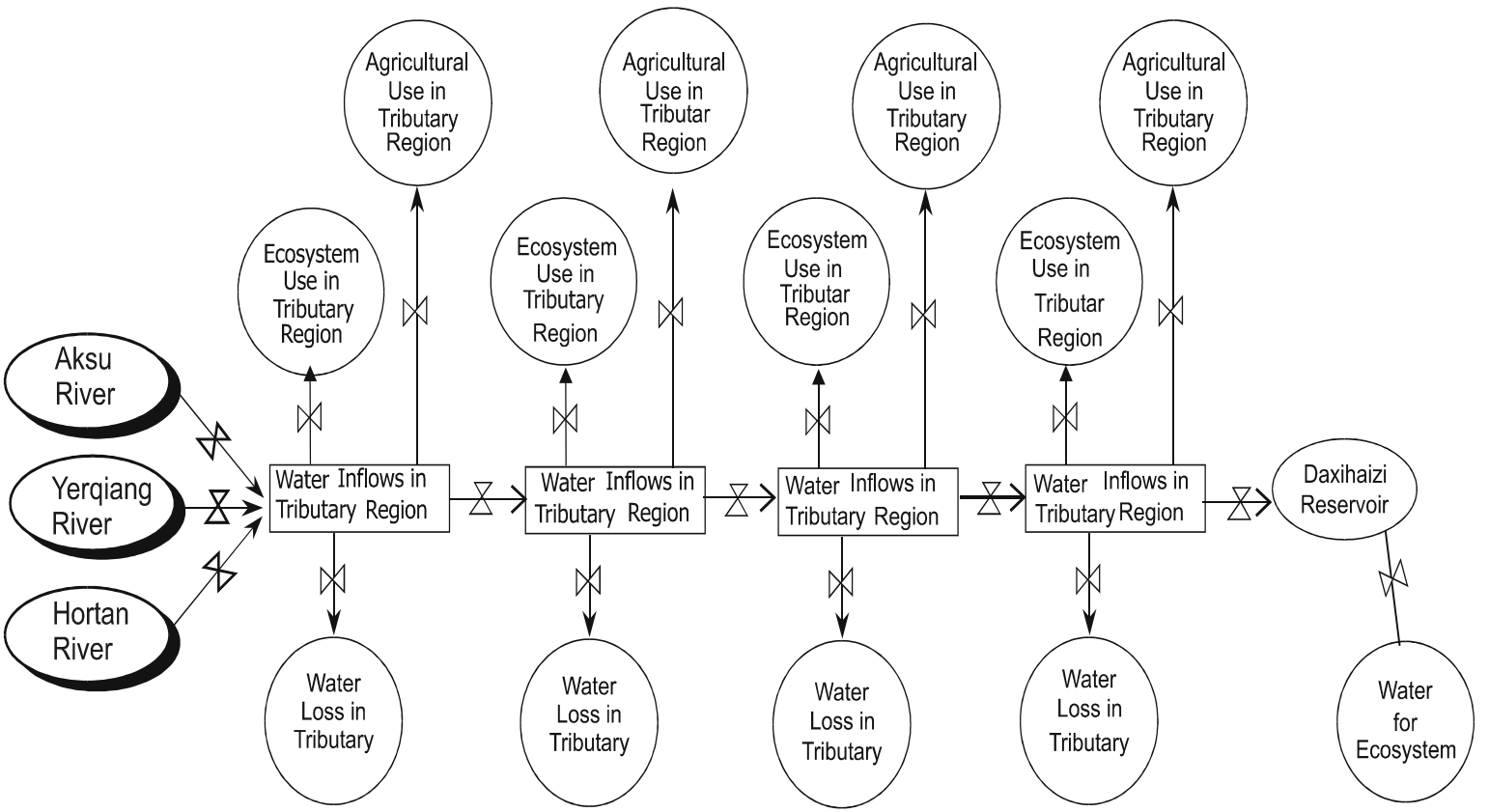
The system dynamics(SD) method which can analyze both quantitative and qualitative effects was coupled with the Integrated Resource Planning(IRP) and Demand Side Management(DSM), to systematically analyze the status of the water supply and demand throughout the Tarim River basin, as well as the impacts of socioeconomic growth on the water demand, and the effect of variable flow on the water supply and demand.

The purpose of building this SD+IRP/DSM model is to explore how to successfully implement the government-sponsored remedial program for the still-degrading Tarim ecosystem and how to achieve the planned socioeconomic growth and development. The model should simulate the possible scenarios of imbalance between water supply and demand, and then develop cost-effective response measures involving a set of the mixed water supply/ demand technologies available to meet the variable water demand.

- The model includes three functional modules described below:
- Surface water allocation module reflecting the natural interconnections in the entire Tarim River system.
- Total water demand module related to the crop structures and agricultural scales
- IRP/DSM-based water supply module driven by the gap between water supply and demand

Design framework and modeling exercises: With the annual estimates of water demand equation derived from the water demand module, the gap between water supply and demand can be mathematically expressed in the PD computer language using the variable surface water inflows given by the surface water allocation module. More importantly, the imbalance between the water supply and demand will be used as the primary motivation of the IRP/DSM-based water supply module to drive the selection process by identifying a cost-effective group of both supply-side and demand-side technologies. The selection will start from the lowest unit cost water supply technology among the available candidate options and increase in ascending order of unit cost until supply and demand are balanced. It should be noted that the SD sub-model has been coupled with the IRP/DSM sub-model to form a powerful functional modeling tool which apparently overcomes the deficiencies of the single IRP/ DSM model once employed in the first phase of the project study. The addition of the SD sub-model allows simulation of the interdependent and interactive nature of the large-scale complex system. The IRP/DSM method will determine the water supply options to satisfy the target demand for a given scenario. The successful and efficient coupling of the SD sub-model with the IRP/DSM sub-model using only the Professional Dynamics(PD) plus computer language is an important innovation in this second phase of the project study to facilitate analysis of various scenarios. Additionally, the data used for the model inputs and outputs is organized in a database, to enable efficient management and retrieval of the data. The model structure is described by the block diagrams as shown below.

Figure 2. Cause-effect relationship for Tarim River.



As described above, the dynamical selection of the mixed water supply technologies to balance the aggregate demand in the model simulation is driven by the imbalance between the water supply and demand, which is affected not only by the natural annual flows in the three tributaries, but also by the demand related to the socioeconomic growth rate at that time. For instance, with low economic growth, the water supplies may not necessarily fall short of the total demand in the event of *low flows* during dry years, and by the same token, the water supplies wouldn't necessarily exceed the overall demand in the case of *plenty flows* when it happens to be a wet year. That is to say that the balance status is at last finalized by the actual gaps between them. In reality, the surface water flows(**S**) from the three tributaries may occur as one of the following scenarios:

- Multi-year average flows
- Dry-year low flows
- Wet-year high flows
- Multi-year statistically variable flows

The water demand is primarily related to the agricultural scale, that is, total area of irrigated farmland, and the overall water use efficiencies, which include both the canal efficiency and field irrigation efficiency. The irrigation areas are more dependant on several parameters such as local population increases, agricultural productivity(crop yields per unit area), the target growth rate of the local economy, and so forth. These relationships can be described functionally as:

Water demand(i)=WD_i=F($Area_i$, Eff_i), $Area_i$ =G(Pop_i, Uyd_i, Gr_i)

Here, Eff=Efficiency, Uyd= Crop yields per unit area, and Gr=Agricultural growth rate

i={tributary, upstream, midstream, downstream}

Therefore, all these possible changes which is related to the socioeconomic development in the Tarim Basin should be properly considered in the model simulation. The following key factors and their combinations are supposed to be the most important elements affecting the overall water demand in the foreseeable future.

- ✓ $\frac{\partial \mathbf{F}}{\partial \mathbf{Eff_i}} > \mathbf{0}$, When the overall efficiencies of water use remain variable
- ✓ $\frac{\partial \mathbf{G}}{\partial \mathbf{POP_i}} = (>)\mathbf{0}$, when the local population remains constant or variable
- ✓ $\frac{\partial \mathbf{G}}{\partial \mathbf{Uyd_i}} = (>)\mathbf{0}$, when the crop yields per unit area remains constant or variable
- ✓ $\frac{\partial \mathbf{G}}{\partial \mathbf{Gr_i}} = (>)\mathbf{0}$, when the local agro-economy scale remains constant or variable

In accordance with the basic theory of the System Dynamics(SD), there always exist some sensitive parameters or critical “loops and sub-structures” in the complex systems, which affect the overall properties or performances of the whole system. So in an attempt to identify and then simulate such important and crucial elements that could impact the water supply and demand, as well as the possible gaps between them, a set of scenario combinations of water supply cases with water-demand situations have been designed to reflect all the possibilities that may occur in the time horizon of 50 years. The scenario-based analysis will reveal the possible conflicts or challenges that may arise from the future implementation of the water allocation scheme outlined in the government remedial package, and also provide the corresponding response measures to help resolve the problems in the event of imbalance. For the details about the scenario combinations, please refer to the attached table.

In reality, there only exist the following three situations of the water supply and demand in the event of imbalance:

$$S_i(\text{surface water})\text{-}D_i(\text{demand}) \begin{cases} <0, \text{ +Policies (Policies 1)} \\ =0, \text{ Business as Usual (BAU)} \\ >0, \text{ +Policies (Policies 2)} \end{cases}$$

In which, S_i represents the water supply D_i denotes the water demand{i=tributary, upstream, midstream, downstream}. When there is a gap between the water supply and demand as illustrated above, the following policies will also be taken for the water use priorities.

Policies={ Policies-1, Policies-2}

Policies-1:

Top priority is given to the use of scarce water for the ecosystem

Top priority is given to the use of scarce water for the agricultural production

Encouragement of the implementation of **IRP/DSM**

Policies-2:

Emphasis of the ecosystem

Emphasis of the agricultural production

Emphasis of both the ecosystem and the agricultural production

Continuation of the implementation of **IRP/DSM**

MODEL-BASED RECOMMENDATIONS AND CONCLUSIONS

The population increase would undoubtedly result in the growing need of the agricultural products which could be apparently satisfied by the expansion of the farmland scale,

or other means like the restructuring of the crop patterns or the improvement of productivity. The study shows that the increase of the yields per unit area could largely offset the additional requirement of the agricultural products. It is very important to both readjust the crop mixes and develop some locally advantageous economic sectors, with the aim to improve the living standard of the local ethnic groups.

The simulation also shows that the improvement of the water use efficiency could reflect the local capacity for future economic development. But the potentials from the efficiency enhancement would depend on the water flows available. When the surface water is relatively plenty, this potential would be more obvious. So the upstream regions should deliver more water flows to the middle and lower reaches.

MANAGEMENT MECHANISM FOR ENSURING THE IMPLEMENTATION OF WATER ALLOCATION SCHEME IN TARIM WATERSHED

Defects of Current Water Management Mode—Lack of Benefit Allocation and Adjustment Mechanism

Under the traditional planned economy, water resources were allocated among different users through administrative orders. The Department of Water Conservation as the administrative organization of the basin was responsible for making water allocation plans. The department relied on administrative orders to ensure water resource allocation, which often did not reach the expected target. The various mechanism concerned with water allocation in the Tarim Watershed are illustrated in figure 3.

Figure 3. Simplified relationships for water allocation in the Tarim Watershed.

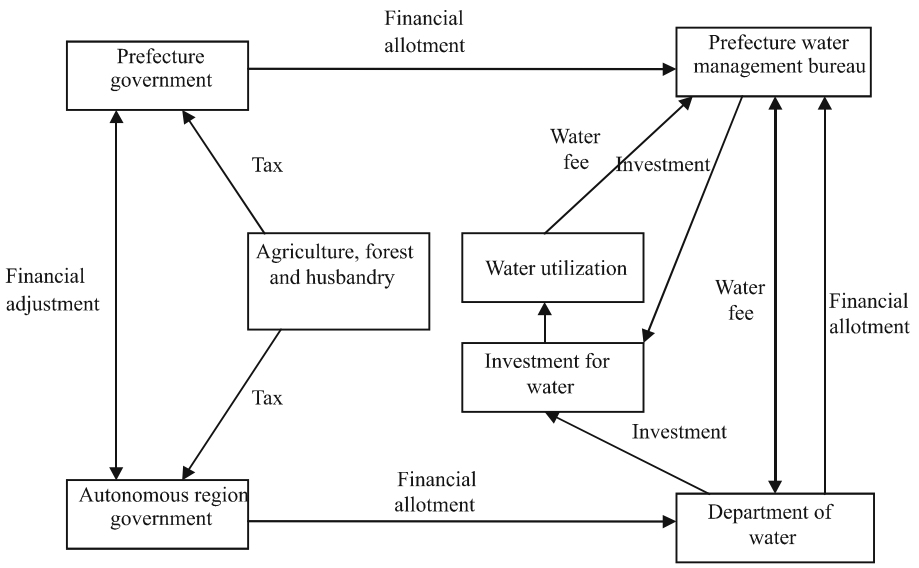


Figure 3 shows that the management organizations directly involved in water resource allocation including the Department of Water Conservation, the Autonomous Regional Government, local water management department, local governments and the Tarim River Administrative Bureau.

The decisions on water resource goals were made by the Autonomous Regional Government basically by itself after considering the central government's constraints. The main preference of the government is economic development, through a much higher rate of economic growth. The most important preference is the maximization of production for Tarim Watershed. Environmental preservation was only given minimal consideration. Therefore, when the Autonomous Regional Government established economic development goals, the constraints of water resources on agricultural production were neglected, which greatly influenced the reasonable allocation of water resource among the whole watershed. As with the Autonomous Regional Government, local governments focused on economic development of their territories, i.e., the maximization of local production, without considering the interests of the whole watershed. The main objective of the Department of Water Conservation of Autonomous Region was to ensure the investment and normal operation of the water conservation projects. Thus, the Department of Water Conservation had limited influence on the local water management departments through allocation of investment funds from the central government and the Autonomous Region, with no authority to restrict local water departments, especially those responsible for water allocation. The responsibility of the Prefecture Water Department is to ensure the allocation and utilization of water in its own territory, investment into water conservation projects and to collect and use water fees. Therefore, the local water administrative departments aim to ensure regular operation of the water system in the local prefecture and satisfy the agricultural irrigation needs, to achieve the economic goals established by the local government because the local government overseas the local water department. So, there is no administrative department with clear and definite responsibility to coordinate the reasonable allocation and utilization of water resource throughout the whole watershed. The Autonomous Regional Government and its Department of Water Conservation represent the country's ownership of the Tarim River water resource. Local prefectures only possess the right to use water. Self- interest would drive all of them to select the most favorable decisions for their own benefits. Their decisions and countermeasures, as a consequence, more or less oppose the goal of reasonable allocation and utilization of water resources throughout the river basin. This is the real reason for irrational allocation of water resources among the local prefectures. Behavior analysis of the administrative departments showed that only the Autonomous Regional Government can regard the rational allocation of water resources as one of its key goals. The allocation and management of water resources is supervised by the Department of Water Conservation, which mainly relies on the local water management departments to control the Tarim Watershed. Thus, the local water management departments directly affect the allocation of water resources. The Tarim River Administrative Bureau, as part of the Department of Water Resource Management, is just a peripheral organization. Although in 1997 it was promoted to the vice-bureau status, the Tarim water situation has not changed much with the promotion. The Tarim River Administrative Bureau lacks actual authority to control the whole watershed, so it cannot coordinate the water allocation conflicts. From the complicated administrative relationships among these management departments, it is clear that only the Autonomous

Regional Government has enough authority to coordinate the conflicts between different interest groups to make them achieve the goal of reasonable water resource allocation throughout the whole watershed.

Therefore, the Department of Water Conservation of the Autonomous Region should be responsible for management of the river resources. The Department of Water Conservation should adopt effective steps to ensure rational allocation of water resources among the five regions. However, the biggest problem is that orders from the Department of Water Conservation cannot get support from the Prefecture water management sector, so there is no effective control. The Department of Water Conservation must have more power over the water resources for the whole watershed to guarantee that its orders are executed effectively and must be able to control the water extracted by the local prefectures. To achieve the target, the government investment must be increased to set up enough control systems so that the Department of Water Conservation can completely control the river to properly allocate the water resources throughout the water conservation. At the present level of financial investment, the intervention cost is too great for the Department of Water Conservation or the Government. The current investment level can only provide some administration so the Department of Water Conservation cannot control the local prefectures.

However, other methods can be used to provoke water conservation. After several years of field surveys to study the management of the Tarim River Basin and its policy mechanisms, we think that market economics would provide better investment. From the viewpoint of economic benefit, it is better to set up an effective management mechanism based on incentives than to intervene by means of administrative orders. The best systems for the Department of Water Conservation is to reform the pattern of water resource use rights, introduce market reforms and to bring out the use of their own interests to promote reasonable utilization of the water resources among the local prefectures. Therefore, the problem of the irrational water resource management mechanism is not the water price or the government organizational structure. The problem lies in the lack of incentive mechanism throughout the whole watershed. Therefore, the water resource management regime must be improved to promote an interest allocation mechanism, which can realize reasonable allocation of water resources throughout the whole river basin at the lowest investment cost with the benefit-driven methods to encourage investment from different benefit groups. Therefore, further study on the innovative water management system is needed.

Water Rights Allocation and Transaction System

1. Water rights allocation among the five prefectures:

   The allocation of water rights firstly depends on identifying the differences between the societies, economies, environment, resources, capabilities, etc. of the prefectures; then developing a reasonable model for water rights allocation.

2. The principles of water rights allocation:

   The principles for water rights allocation differ greatly due to people’s different conditions and understanding. There are often debates and opposite viewpoints

on the principle of allocation, because every person always thinks about the questions relative to their own benefit. Generally speaking, the principle of water rights allocation between prefectures should consider the benefits of the most areas.

The goals that must be considered in the analysis are efficiency, fairness, environmental protection, sustainable development, etc.

Balance between efficiency and fairness

In the Tarim River basin, the water use efficiency is very low and conflicts over water resource allocations occur, so neither efficiency nor fairness is achieved within the present water resource management system. The government seeks efficient and fair use of water resources, so the policies must balance economic efficiency and fairness. The principle of fairness requires that every individual, interest group and region should have equal rights to obtain water resources, rather than each prefecture using water based on its abundance of water resources. For efficiency, the water resources should be allocated to maximize the output per unit water. Therefore, the water resources should be allocated between prefectures with consideration of their GNP and the influence of the water utilization on the output.

Environmental protection

Maintenance of the environment must be a fundamental aspect of the water resource allocation plan. The decrease in water flow to the lower reaches of the Tarim River, has seriously damaged the ecology of the desert and the oasis causing much worse desertification. In the past 40 years, forest area in the basin has decreased by over 500,000 ha. All of the managed artificial forests, the grasslands and the desert oasis vegetation should be allocated a certain amount of water to maintain the ecology. This ecological water should be allocated fairly and rationally, with the woodland and grassland areas chosen as the basis to allocate water for environmental protection between prefectures.

Keep sustainable development

Water resource allocation should also aim at sustainable development in the whole basin. The principle of water rights allocation between prefectures should include consideration for social improvement, economic development, environmental protection, sustainable resource exploitation and use, population increase, improvement of local residents' living standards, etc.

Balance between historical and present development

For historical reasons, the different prefectures in the Tarim River basin are in different stages of water resource exploitation and utilization with deficient factors influencing their water use such as population, resources, economy and so on. Therefore, specific initial allocation of water rights should be determined according to the actual specific conditions and considering the historical development. The main indices for water rights allocation, such as population, GDP, arable land area, etc., must be based on current data (for example, the 1995 data) with the influence of the development in each prefecture. For example, the influence of the average increase since the hydrological stations were established in 1950s would be considered.

Therefore, the water rights allocation principles can be generalized as follows: "Allocation should consider the actual condition and the historical development, promoting a combination of fair economic development, which is sustainable and protects the environment."

Allocation model for water rights

The water in the Tarim River basin is mainly used for agricultural irrigation, animal husbandry, ecological needs of the desert oases, and people's daily needs, as well as for industries, petroleum development and other sectors. The water rights of each prefecture should include the following parts: residential water consumption, water consumption, environment protection water consumption.

Water rights = residential water consumption
+ industrial and agricultural production water consumption
+ ecological protection water consumption

The allocation of water rights for industry and agriculture should first meet the requirement that every prefecture has a fair opportunity for development with consideration of the influence of economic efficiency, so as to promote increased benefit from the water resources in the whole basin. Water for agricultural irrigation should be allocated according to the gross farmland area with consideration of the agricultural output per unit water to efficiently use the water resources. The industrial water rights should be allocated according to the industrial production, for example, using the water consumption per 10000 yuan of industrial production as a weighting factor. According to the current water resource utilization in the Tarim River basin 25-30 percent of the water has been used for ecological maintenance for many years.

Data for water consumption is not normally given per capita but is correlated with income per capita. However, the population must be confident simultaneously with an influencing weight relative to the income per capita, which could be the ratio of the income per capita in the prefecture versus the average income per capita in the whole basin.

These principles were used to develop a model to allocate water rights with the aim of sustainable development The water rights allocation model was used to calculate the initial water rights allocation for the Tarim River basin.

Water Rights Transaction System

Once the allocation of basic water rights for each region and each user is fixed, there must be some imbalance between supply and demand. Consequently, a system is needed for trading water rights. The allocation of water rights by governmental orders would result in conflicts and unlawful exchanges such as “black market.” The allocation of water rights at the regional level has established a basis for the transaction system. As soon as the original water right is allocated, the transaction system and the transaction regulations (and the transaction price) must be established to offer guidelines for transactions.

1. *Trade principle for water rights among prefectures:*

The trading of water rights among prefectures should be consistent with the basic principles.

The total profit of the whole basin is to be maximized to optimize the allocation of resources. The maximum total economic efficiency, which means the efficient allocation of water resources, should be promoted.

The principle of trade compensation and shared interest states that the seller of the water right should receive compensation with the amount depending on the profit that the buyer and seller gain through the transaction. Because the water right transaction is a win-win interaction, the profits should be allocated by negotiation or an exchange price system.

The principle of maximal tradable water rights states that the water sold in each region must not exceed that stipulated by the management of the Tarim River basin. For example, water rights for the ecology cannot be sold.

The principle of progressive forfeit for surpassing quota states that a region may not exceed the quota plus any transactions. When the flow at the hydrological station exceeds its quota, the region must progressively forfeit some of its quota.

2. *Rules and implementation of water rights transactions among prefectures*

a. Water rights transaction rules

The core of the transaction system is a set of explicit rules to guide the transaction rules.

Suggested specific rules and processes are:

Each prefecture forecasts the possible necessity of transactions according to their water consumption plan in the beginning of the year and the unpredictable runoff, then applies to the water right transaction management institute for a transaction.

As the organizer of the water rights market, the management institute of the Tarim River basin publicizes the transaction request and facilitates the transaction by considering both the demands (of the buyer) and the supplies (of the seller).

The management institute of the Tarim River basin used the transaction sheets and the actual water usage to ascertain the seasonal (or annual) transaction of water rights at the end of the year.

The management institute together with the prefectures measures the water consumption, and the amount exceeding the quota, then settles the transaction accounts based on the exchange price (to be discussed later in this report).

b. Transaction of water rights among sectors

The analysis indicates two kinds of tasks that must be done by the management institute of the Tarim River basin to guarantee the transaction process:

A service institute for the water right transaction market that would supervise the water right exchanges among prefectures throughout the basin. At present, the Department of Water Conservancy could serve as the institute. Its budget should come from governmental financial allotment for administrative enterprises to avoid additional economic burdens on the users for the water rights transactions.

To ensure the balance of supply and demand, a trade fund for water rights transactions should come into existence through which the government can intervene directly into the market (like the open market function).

Unregulated transactions, i.e., trades without the permission of management institute of the Tarim River, would be permitted to allow prefectures to get enough water from other locations according to a price agreeable to both sides. But these transactions should be reported to the institute for the records. The management institute ought to examine the legitimacy of the transaction to ensure that it does not affect the environment nor a third party by permanent transfer of water rights. The institute could veto such transactions.

The permanent transfer of water rights among sectors would request the consent of a third party and the management institute of the Tarim River. The transaction must not harm downstream users or the environment.

When the water cannot be allocated proportionately, the management institute must be able to implement compulsory measures. When a prefecture has not obtained extra water through transaction and the quantity of water used exceeds its legal water right, the penalty should be levied based on the price set by the river management agency.

If a prefecture has not arranged transactions and the actual quantity of water used is less than its legal water right, it should receive compensation for the rest of the water right from the management agency at an agreed upon price.

Because the water resources are unpredictable since the runoff may be affected by the weather, the water right of each prefecture and user each year cannot be definitely guaranteed. The effect on production of the unsteady water volume can be minimized through “futures” to regulate water rights bargaining. The water right futures market bargaining may be improved through regulation of a “futures broker.”

c. Problems in the water rights transaction system

Return-flow problem

Water right transactions may sometimes affect the water rights of third parties, such as in agricultural irrigation. If a farmer transfers his whole irrigation water right to a farmer living out side the basin, then the downstream users cannot get the benefit of the return flow of

the irrigation water used by the upstream user. The downstream user should be protected from such loss. This is the so-called return flow problem. The solution is to have any changes of diversion points or else water rights transactions must apply to the basin management authority or the related water user group for their approval to protect the downstream user's benefits through supervision of the water rights market. If the water rights transaction changes the return flow, for example, transferring irrigation water to the oil sector, the basin management authority should approve only part of the actual water right (calculated by the average utilization rate of the water resources).

Groundwater problem

Though the water right allocation does not include allocation of groundwater resources, the influence of groundwater reserves in each prefecture has been considered in the allocation model. Since the cost of groundwater use is much more than that of surface water, groundwater use in the Tarim River basin has not yet resulted in obvious conflicts. However, groundwater use will be developed in the future and groundwater use affects the surface water allocation, so a license system should be established for groundwater use. The basin management authority should be in charge of issuing licenses, supervising and protecting water resources, and evaluating the influence of the water resources. Before a landowner can use groundwater, he must apply to the related water user group or groundwater management authority. The management authority should punish illegal users by reducing his/her surface water right or his/her right to directly use groundwater.

Water for the ecological system and environmental protection

Currently in the Tarim River Valley, the faction of water used for the ecology is about 25-30 percent. Therefore, the water allocation scheme assumes that 28 percent of the water in each prefecture must be used for the environment to ensure water for forestry development Gobidesert irrigation, etc. This portion of the water cannot enter into the trading market and be used in any other way. The basin management authority should supervise the use of water for ecology in coordination with the autonomous regional forestry departments, the prefecture forestry bureaus, etc.

If the total runoff is more than the total water allocated to all the water rights and no prefecture water consumption exceeds its rights, a proportion of the excess water can be used to improve the downstream ecology environment. However, when there is no excess, the water rights transactions may transfer more water to the upper reaches of the river so as to indirectly influence water for ecological use downstream. The basin management authority must properly supervise water use and transactions to ensure that sufficient water is available for environmental protection in each section and prefecture so that water rights transactions do not cause further desertification in the lower reaches of the Tarim River Basin. Therefore, when each prefecture increases its consumption, the basin management authority should invest the income by trading excess water rights to the downstream areas to improve their ecology.

Furthermore, the environmental problem caused by poor water quality such as the discharge of salty wastewater after irrigation will require water quality regulations.

Price Regulation of Water Rights Bargaining

The establishment of reasonable bargaining price regulation will determine whether the water rights bargaining is successful. The water rights bargaining system will require a water rights price a regulation system that is appropriate for the water rights bargaining.

1. Water rights price and water rights tax

2. Basic principles for water rights transaction:

- Basic water right exchange price
- Market-based water rights exchange price
- Initial water rights are free
- Combining penalties with compensation
- Progressive penalties
- Setting up seasonal prices for water right transaction

3. Inter-prefecture water rights transaction pricing system:

- Basic water rights exchange price
- Water rights exchange price determined by the market
- Water right pricing mechanism to penalize activities that are not part of the transactions
- Intra-prefecture water rights transaction pricing system

Water Price Reform

Price is one of the most important and effective incentives for allocating resources in the market economy. However, the water supply price in China is very low historically, even lower than the water supply cost, so the water price cannot correctly reflect the supply and demand of water resources, indirectly resulting in the inappropriate use of water. A reasonable pricing system will play an important role in promoting effective management of water resources in a basin.

As is well-known, all economic activities in the traditional economics are based on price and the economic relationships in the society are a kind of pure price (currency)

relationship. Price can't represent all economic relationships, and price system can't solve all economic problems in the society.

Similarly, without the support from some kind of non-price system, water property right regime can't be put into practice effectively and water right allocation will be defeated.

A representative of non-price systems is the outstanding social trend to depend on laws and regulation. In this section, non-price system related to water right transaction will be discussed. The main contents will focus on the following three fields legislation, institutions and the Government's responsibility.

(1) Legislation for keeping market in order

Before the introduction of law systems, people had to depend on customs or ethics to allocate water resources. Along with the social development, the whole system of commodity transaction became more and more complex, people realized that the tortious cost is far less than the exchange cost. However, it is very difficult to value tortious activities, so that the law system becomes the best way to keep market in order. Law is often a governmental action, and clearly regulates the cost for taking tortious activities. The implementation of property rights needs to establish a complete legislation system to make market mechanism work, and reasonable property right legislation becomes one of the most important tools to ensure market operation.

Another, the existence of risk in the transaction is also an important reason for a legislation system. If there is no legislation to keep a contract or an agreement effective, they will lose their roles. Legislation becomes the basis of contract implementation and a basic institutional guarantee to remove factitious risks.

Anyway, the legislation system has set up rules and criteria for social members to go after benefits so as to promote the progress of the whole society. The establishment of rules by legislation plays a role to normalize market.

(2) Water rights and legislation

"Property right systems" are a collective term of systems about definition of property right, management, transfer or transaction, benefit and responsibility of property right, and these systems are authorized and enforced by legislation. If our society has no property right system, the individuals will take various tortious measures to meet their desires. Just like water resource in the Tarim river basin, the whole basin currently encounters continuous conflicts on water use because of lack of clear property rights. There is no legislation to define prefectures' and users' water property right. There is also no regulation or law to clearly regulate the transfer or transaction of water property right. The inevitable result is that all prefectures will take their countermeasure to use water, even some tortious actions.

Legislation on resource allocation is the chief way to control organizational actions, and the institutional guarantee to implement water rights transaction. When we try to set up a water property right transaction system, it is also an urgent task to establish relevant laws or regulations that cover the whole system.

Institutional arrangement and function adjustment

As described above, in order to completely solve the water conflicts in the basin, water rights allocation and transaction system under the market economy should be introduced to establish effective water management mechanism. To guarantee the successful implementation of this mechanism, it should study and reform the existing water administration system and establish a suitable organizational structure for water rights transaction. Separating administrative functions of the government agencies from operational functions of enterprises is the key to ensure successful implementation of the water rights allocation and transaction system. Water rights allocation and transaction requires setting up of corresponding institutional framework that should manage water rights transaction, and making clear definition about the functions of water management agencies and water enterprises.

ENFORCEMENT OF THE MACRO-SCHEMES AND MANAGEMENT OF COMMUNITY WATER RESOURCES

Basis for the enforcement of macro-strategies and macro-schemes: Management of community water resource

The management of resources and the effect of the communities are analyzed in this section to improve the practicality of the macro-schemes and to understand the effects of the water resource management schemes and the macro-schemes for allocating water. The water resource management patterns of the Tarim Basin were studied by analyzing the effects of water prices, the influences of non-technology factors on the water conservation techniques, and the effects of farmer households on the macro decision making and the conservation techniques.

Community surveys

According to the research project objectives, the project group choose 3 testing locations for community studies, which represent the upper reaches, the middle reaches and the lower reaches of the Tarim River to analyze the effect of water prices on the water conservation and desertification techniques and on various communities. The locations are Tuoyibaoledi Township in Shaya county in the upper reaches of the Tarim River, Akesupu Township in Bazhouweili county in the middle reaches of the Tarim River, and Thirty-third Regiment of the Second Agricultural Division in the lower reaches of the Tarim River.

Influence of water price on agricultural water conservation techniques

(1) Relation between water price and agricultural water conservation techniques

According to basic economics, only when the economic benefit of a technology is larger than the cost will the technology be adopted throughout the economy. For agricultural water conservation technologies, the benefit that a technology brings must be larger than the annuity cost of the application. A larger difference between the benefit of water conservation and the annuity cost will increase the motivation to implement the technology, so the technique will be more widely accepted. The spread of agricultural water conservation technologies is directly related to the water price. So increasing the water price will increase the benefit of water conservation and facilitate the spread of he technology. Otherwise, the technologies will not be widely used. The following formula explains their relationship.

$$C_j = PQ_{ij} \qquad \text{…….. (A)}$$

Where:

C = Annuity cost for application of a water conservation technology
P = Adjusted per cubic-meter water rate
Q = Amount of water saved relative to flood irrigation
i = Crop index
j = Technique index

When $PQ_{ij} > C_j$, the application of a water conservation technology j can produce the beneficial returns. Q_{ij} is fixed, so only when P is high enough , PQ_{ij} will be lager than C_j.

$$P = C_j / Q_{ij} \qquad \text{……..(B)}$$

Only when the water price is higher than the average per cubic-meter annuity cost will the technology j satisfy the essential requirement for spreading of technology so that the use of the technology j will provide the benefit expected. Therefore, the influence of water price on the spread of water conservation technologies is based on the cost and benefit analysis of the water conservation technologies $Q_{ij.}$

2. Influence of water price on the application of the water conversation techniques

We analyzed the cost and the benefit of various water conservation techniques for water transport and field irrigation systems in the first phase of the study. The specific water conservation techniques can be used with certain crops. For example, wheat can only be irrigated with *check irrigation, small check irrigation* and *moving nozzle-line irrigation.* But cotton can use all kinds of water conservation techniques. The water price for which the

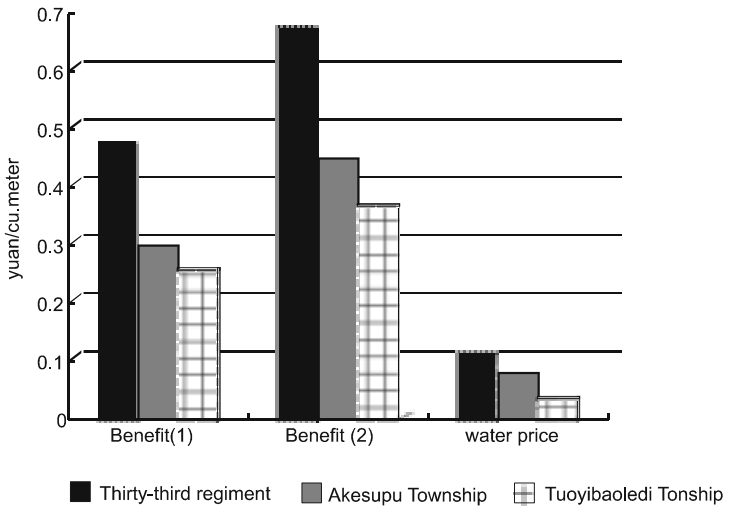
communities will apply water conservation technique for wheat and cotton is analyzed in this section. Annuity cost data do not include the plastic-sheet cost. Some data have been adjusted in the following study.

- Cotton

Table 1. Water price for application of various conservation techniques.

Technique	Furrow irrigation	Small check irrigation	Check irrigation	Irrigation above	Moving nozzle-line plastic-film	Trickle irrigation irrigation
Water price						
Yuan/ m^3	0.06	0.05	0.033	0.05	0.194	0.389

Figure 4. Comparison benefit of planting cotton and the water price.



The water price for the Thirty-third Regiment and Akesupu Township were 0.12 yuan/ m^3 and 0.08 yuan/m^3 in 1998 which satisfy the essential condition for the application of furrow irrigation, small check irrigation, and check irrigation. In fact, these water conservation techniques have been widely applied for cotton production in the two communities. However, because the water price in Tuoyibaoledi Township is only 0.038 yuan/m^3 since it has abundant water resources, flood irrigation is still the main irrigation method here.

- **Wheat**

Table 2.Water price for application of water conservation techniques.

Technique	Small check irrigation	Check irrigation	Moving nozzle-line irrigation
Water price (yuan/m^3)	0.067	0.044	0.215

The Thirty-third Regiment has never planted wheat. The Akesupu Township water price is now 0.08 yuan/m^3 that satisfies the essential condition for application of small check irrigation and check irrigation, so these water conservation techniques have been widely applied for the wheat production in this community.

The cost/benefit analysis shows that in these three communities, moving nozzle-line irrigation and trickle irrigation are still too expensive.

Maximum agricultural water price

(1) *Maximum agricultural water price*

The water price is determined not only by the cost of supplying water, but also by the demand. Economics principles show that the consumption and the desire to pay for a commodity are decided by the marginal utility provided by the final unit of the commodity. The average benefit of using water in agriculture is the practical ability of the farmers to buy water. The desire of the farmers to pay the water fee is decided by the marginal utility that the water provides. Therefore, the net income that the water provides is the upper limit that the farmers will pay. The benefit provided by per cubic-meter water used in agriculture is regarded as the maximum water price. When the water price exceeds the benefit that the per cubic meter of water provides, farmers will not buy the water.

(2) *Determination of the maximum agricultural water price*

a. *Per cubic meter of water benefit and crop value*

- Cotton

The benefit sharing and the cost discount methods were used with the data gathered in 1998 to calculate the benefit and the crop value per cubic meter of water for cotton. The results are listed in table 3.

Table 3. Benefit and crop value per cubic-meter of water for cotton

Communiy	Benefit(1) (yuan/ m^3)	Benefit (2) (yuan/ m^3)	Water price (yuan/ m^3)	Crop production (kg/m^3)	Crop value (yuan/m^3)
Thirty-third Regiment	0.48	0.67	0.12	0.36	1.52
Akesupu Township	0.30	0.45	0.08	0.23	0.84
Tuoyibaoli Township	0.26	0.37	0.038	0.22	0.80

Note: 1. Benefit(1) is calculated by the benefit sharing method.

Benefit(1) = (0.65*(net production + water fee))/ the amount of saved used,

where: 0.65 is the coefficient of the benefit sharing for irrigation as stipulated by the Water Conservancy Department of Xinjiang Autonomous Region.

2. Benefit (2) is calculated by the cost discount method.
Benefit (2) = (total output - other cost - other cost*0.07)/ the amount of water used,
where: 7% is the coefficient of other cost discount.

- Wheat

The benefit sharing and cost discount methods were used with the 1998 data to calculate the benefit and the crop value per cubic-meter of water for wheat in Akesupu Township. The results are listed in table 4.

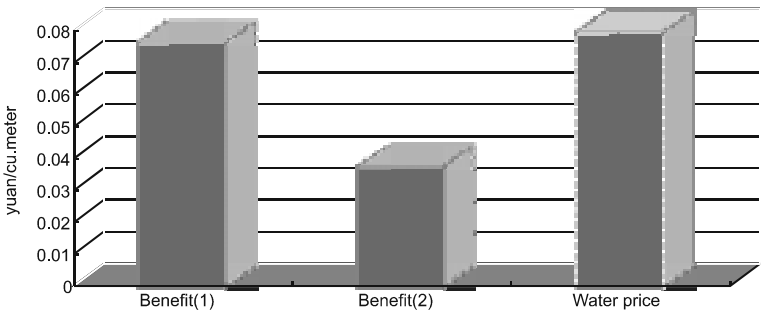
Table 4. Benefit and crop value per cubic meter of water for wheat.

Community	Benefit (yuan/ m^3)	Benefit (yuan/ m^3)	Water price (yuan/ m^3)	Production (kg/m^3)	Crop value (yuan/m^3)
Akesupu Township	0.077	0.038	0.08	0.29	0.56

b. Maximum water price

The results in tables 1 and 2 show that the benefit and the crop value per cubic meter of water for cotton are more than the water price in 1998 in each community, but the benefit per cubic meter of water for wheat is less than the water price in Akesupu Township in 1998. As a results, cotton accounted for 70 percent of the planting area in Akesupu Township and 100 percent in the Thirty-third Regiment. The maximum water price may equal the greatest benefit which was 0.48 yuan in the Thirty-third Regiment, 0.30 yuan in Akesupu Township and 0.26 yuan in Tuoyibaoledi Township.

Figure 5. Comparison of benefit of planting wheat and the water price in Akesupu Township.



The feasible management pattern of water resources in the future

In order to scientifically manage and reasonably use the water resources in the Tarim Basin, we must vigorously reform the outdated and irrational system and pattern of managing water. The community is the most basic unit of using water, which concretely puts the strategy and the measures of macro management in practice. Only the community can finally weigh the rationality of a measure of managing water. Because the peasants are the concrete users and the final beneficiaries, they should also become the genuine managers of water resources.

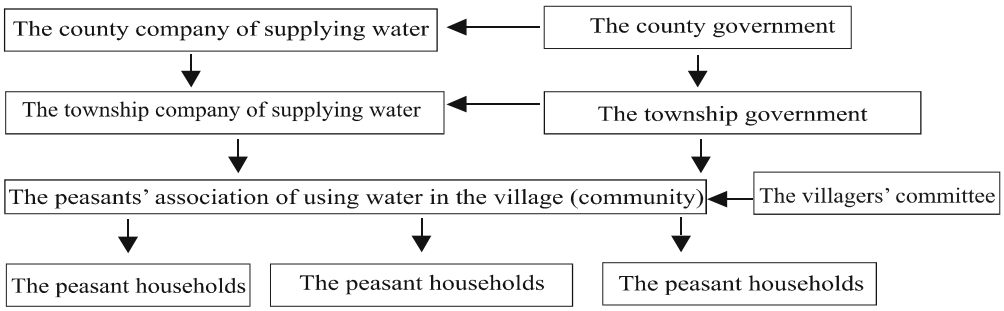
According to our investigation, on the basis of analyzing the advantages and the disadvantages of the now pattern of managing water, using the experience of other countries for reference, we propose that the following two patterns of managing water should be applied in the communities in the future.

(1) *The pattern of the administrative guidance plus the peasants' participation*

The pattern of the administrative guidance plus the peasants' participation are conceived according to the operational system of the social market economy. After the departments of managing water at all levels implement the same management methods with the private enterprises, the country or the divisional departments of managing water will be translated into the parent companies of supplying water. The township or regiment institutes of managing water will become the branches of the parent companies supplying water. Water is a necessitous and special commodity. The conditions that water is bought and sold fully according to the supply and the demand are not still mature. Therefore, in the process of the water management, the economic benefit, the social benefit and the ecological environment are equally important. In order to protect the benefit of the local masses and improve the ecological environment, it is necessary for the government departments to superintend the

water management. The companies of supplying water or their branches are managed by their own superior companies on the business, but are guided and superintended by the government departments at all levels on the policies and the rules.

Figure 6. The pattern of the administrative guidance plus the peasants' participation.



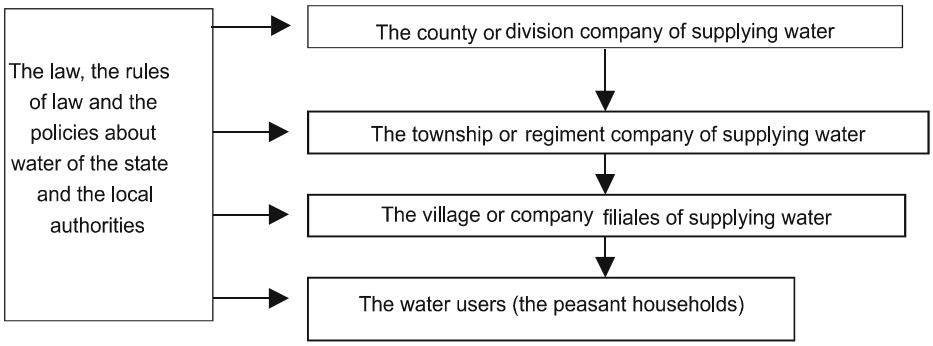
The township or regiment companies of supplying water set up the peasants' associates of using water in the villages or the companies. The peasants' associates of using water are the mass organizations of managing water in the communities, the corporate organizations. The peasants' associates of using water mainly represent the whole interests of the water users, take charge of all the work of managing water in the communities. The peasants' associates of using water take charge of working out the plans of using water in the communities and reporting the plans to the *filiales* of supplying water. The *filiales* of supplying water allocate the water resources in the whole township or the whole regiment according to the plans that every community reports. The peasants' associates of using water are in charge of allocating the water resources in the communities, charging the peasant households the water fee, building and maintaining the water conservancy facilities in the communities. A part of the funds that it needs to build and maintain the water conservancy facilities comes from the water fee charged by the peasants' associates of using water, the other from the companies of supplying water and the higher governmental financial department. The peasants' associates of using water are responsible for stipulating the community bylaw, improving the system of the rewards and the punishment to supplement the community bylaw, and advocating the peasant self-management, self-mastery and to superintend each other. The peasants' associates of using water also post up the rolls to promulgate the water amount that the peasant households use, the water fee that the peasant households should hand in, and the present water price etc. so that the peasant households can superintend.

The above management pattern integrates the enterprise behavior, the governmental behavior and the peasants' benefit. The companies, the governmental departments and the peasants are independent of each other as well as restrictive to each other under the management pattern. Undoubtedly, the management pattern strengthens the management functions of the skeleton communities by a long way, makes for the fulfillment and embodiment of macro management policies in the communities. The pattern is more suitable

for the districts that water is seriously short such as at the middle reaches and the lower reaches of the Tarim River.

The management pattern of the peasant households' superintendence under the market mechanism

Figure 7. The management pattern of the peasant households' superintendence.



The above water management pattern is the operational pattern under the market mechanism. The companies supplying water independently deal in the water resources. The local administrative departments cannot intervene in their management activities that are fully independent. But their management activities must be restricted by the law, the rules of the law and the policies about water of the state and the local administrative departments. The companies of supplying water comply with the peasant households' demand to send the water to the peasants' fields through the *filiales* of supplying water or the water managers in the communities. The peasants superintend the *filiales* of supplying water or the water managers, and report their opinions upon the *filiales* of supplying water or the water managers to the companies of supplying water in time. The *filiales* are in charge of solving the problems that the peasants lodge.

The management pattern is favorable to the scientific management of the water resources in the whole valley, the operation and the management of the companies of supplying water. But the management pattern very easily leads to the industrial monopoly. Only when the system of managing water is fully innovated, the superintendence system of the law and the rules is effectively implemented, the water conservancy establishments are very consummate, and the management pattern is feasible. Therefore, the management pattern cannot be put in practice in the local communities in the near future, and can only be regarded as reform objective. Thirsty-third Regiment may try the management pattern.

MAJOR CONCLUSIONS AND POLICY CONTRIBUTIONS

1. Water is a critical resource to maintain the watershed ecosystem, so the overall water use efficiency must be improved to make the best use of already scarce water resources by upgrading water conservation facilities and the basin-wide water management system.

2. Market-driven mechanism of water allocating and trading schemes would lead to the most efficient use of the Tarim Basin water resources and effective implementation of the planned restoration program for the Tarim watershed.

3. The Tarim Basin water resources must be managed at the micro level by introducing the ideas of CBNRM relevant to the local sociocultural conditions.

4. The pace of pricing reform must be improved and more innovation is needed in management mechanism in a bid to achieve efficient and effective use of Tarim Water resources.

5. The water conservation potential and methodology needs further research to promote wider application of water-efficient technologies.

6. Tarim water resources should be allocated in an equitable and enforceable way to ensure a reasonable balance between the economy and the ecosystem.

7. New ideas and methodologies in this project study will greatly improve the scientific and practical results.

REPORT ON WORKSHOP DISCUSSIONS

INAUGURAL AND TECHNICAL SESSION

The Chinese national workshop for project on "Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia: China" was jointly held by the Center for Chinese Agricultural Policy (CCAP), the Chinese Academy of Sciences (CAS), and the International Water Management Institute (IWMI) in Beijing on 16 May 2001. The workshop was chaired by Dr. Linxiu Zhang, professor and Deputy Director General of CCAP. The workshop was attended by approximately 30 water and poverty experts and officials from IWMI, CCAP, the Asian Development Bank (ADB), and various Chinese research academies and universities.

The first presentation was given by Dr. Intizar Hussain, introducing the overall background highlighting its background, objective and scope of the research activities. This was followed by the presentation on Chinese workplan by Dr. Jinxia Wang. She introduced the CCAP's seven research programs and the relationship between the pro-poor project and these programs. She stated that rural poverty issues are related with all programs, such as production and technology, resource and environment, household food and poverty, consumption and nutrition, and other programs.

Then she discussed the significant progress in the reduction of rural poverty in China that occurred from 1978 to 1999. Despite drastic reductions in the rate of poverty incidence and increases in rural incomes, there remain great disparities among the different regions of China. For example, for 1998 the average rural net income in Shanghai province was more than 5000 yuan, while rural net income in many provinces such as Tibet, Ningxia, and Henan remained less than 2000 Yuan. In addition, distribution of the poor in China is not even. China's eastern regions[1] share of total poor population has decreased significantly over the past several decades, while the proportion of the poor population in the western regions[2] has increased from less than 40 percent in 1989 to more than 50 percent in 1998. The share of the total poor population from the central regions[3] has also shown a declining trend from 37.4 percent in 1989 to 34.5 percent in 1998.

Previous research on poverty reduction in China indicates that the marginal contribution of irrigation to poverty reduction is less than from technological improvements, agricultural

[1]Eastern regions include Beijing, Tianjin, Hebei, Liaoning,Shanghai, Jiangsu, Zhejinag, Fujian, Shandong, Guangdong, Guangxi and Hainna Provinces.

[2]Western regions include Chongqing, Sicuan,Guizhou,Yunnan,Tibet,Shananxi,Gansu,Qinghai,Ningxia and Xinjiang Provinces.

[3]Central regions include Shanxi,Inner Mongolian, Jilin, HeilongJiang, Anhui,Jiangxi,Henan,Hubei and Hunan provinces.

institutional reforms, and other public investments, such as education and communications. This raises the question "Why is the contribution of irrigation less than other factors in China?" Currently, there is limited potential to expand irrigated areas in the future, so the expansion of irrigated areas is unlikely to play an important role in reducing poverty and promoting development of China. Alternatively, improving irrigation management, policies, and institutional arrangements do have the potential to impact further reductions in poverty.

In order to realize the research objectives, two surface water irrigation systems in Ningxia and Henan Province would be selected to carry out the surveys for the project. These two irrigation systems have the following characteristics: 1) relatively poor areas, 2) low water productivity, 3) increasing water shortages, and 4) the importance of irrigation for pro-poor interventions.

The next presentation was given by Professor Jun Xia's on "Water Issues and Characteristics in the Arid and Wet Regions of China." Professor Jun Xia pointed out that water is a source of life; water also presents hazards at both ends of the water-availability spectrum in the form of floods and droughts.

He gave the example of floods that occurred on the Yangtze River in July and August of 1998. These floods caused an estimated US$2.2 billion worth of damage. Between 2,000 and 4,000 people lost lives and the floods affected more than 223 million people. Additionally, 17 million homes were destroyed and 22 million acres of farmland flooded. Major flood events can seriously harm agriculture, socieconomic development, and property. Likewise, droughts cause serious problems including water shortages and ecosystem degradation. Impacts from drought include inadequate drinking water supplies, reduction in crop production, ecosystem degradation, and reduced or non-existent river flows in the downstream.

Dr. Jun Xia suggested that the seven challenges to achieve water security in the twenty-first century proposed by the Second World Water Forum and Ministerial Conference are also important for China. These seven challenges include: meeting basic needs, protecting ecosystems, securing the food supply, sharing water resources, dealing with hazards, valuing water and governing water wisely. In conclusion, it was pointed out that, in China, socioeconomic development is closely related with changes in the water cycle. Understanding the characteristics and regulations of the water cycle is helpful for improving the socioeconomic conditions of rural and urban populations.

The next presentation was given by Professor Suhua Yu, who presented research results from the project on "Desertification Control and Water Management of the Tarim River Basin." This project was conducted under the support of the International Development Research Center (IDRC). Major issues included: 1) water pricing reform and water management; 2) assessment of water saving technologies and analysis of water saving potential; 3) desertification control and strategies and 4) rational water allocation scenarios. Based on an analysis of water supply costs for different regions in the Tarim River Basin, various water-pricing reforms have been proposed. These are self-maintenance of operating cost, self-recovering of supplying cost, and self-development by market regulation. Currently, water management systems suffer from a lack of integrated river basin management approach, poor implementation of laws and regulations, and a mixture of political and enterprise issues. Research results suggest that water saving planning should be gradually shifted from normal technologies to technologies that are more efficient.

In China, desertification has become increasingly serious and downstream "green corridors" are disappearing. They analyzed the situation, evolution, and regeneration of desertification and two kinds of desertification control measures (engineering and biotechnology measures). Ecological benefits induced by each kind of desertification were measured through a quantitative assessment of environmental influences. They proposed desertification control measures integrating economic and ecological benefits.

Phase 2 research activities include: 1) an assessment and policy influence analysis of water allocation scenarios of the Tarim River Basin, 2) research on reform mechanisms for water management, and 3) implementation of macro scenario and community water management. They established the integrated model of IRP/DSM and SD, which is based on "Water Project and Ecological Environmental Construction Program", proposed by the Planning Commission of Xinjiang Province. Using this model, they simulated the supply and demand for water and corresponding policy alternatives for a normal year, a dry year, and a wet year.

In the study, they introduced water rights concepts, specified the original water allocation model, analyzed regulation and system of water rights transfer, determined water pricing system and non-pricing system, proposed and designed water right transfer price as a basis for a water market. They suggested conducting integrated management system comprised of government macro-control, water supply company operation, and water user participation. For community water management at the micro-level, they selected three experimentation areas to conduct PRA and household surveys. Through the surveys, they understood farmers' responses to local water management and water saving technologies. Research activities included analysis of price elasticity of demand for agriculture, capacity of farmers to bear water pricing, and the highest potential of water pricing. Additionally, they examined the influence of water price adjustments on application and extension of various water saving technologies, the degree of influence of community non-technical factors on water saving technologies, and proposed water management patterns for farmers' participation and monitoring.

According to their research, Professor Suhua Yu suggested strengthening water management and water project construction, establishing market mechanisms for water rights allocation and transfer, emphasizing water saving approaches and micro-water management, making scientific and rational water allocation scenarios for the Tarim river basin, and ensuring economic development and eco-environmental protection.

The next presentation was given by Professor Xurong Mei on "China's Water Shortage and Conservation to Promote Rural Economy Growth." He began by explaining that water scarcity in Chinese agriculture is due to the following issues: shortage of available water for agriculture, uneven spatial and temporal distribution of water resources, incapable increment of agricultural water, and low water use ratio and efficiency. He showed the picture of gross grain production and effective irrigated area of China from 1949 to 1996. Since 1949, gross grain production increased continuously while effective irrigated area declined since the 1980s. According to their forecasts, agricultural water use after 2000 would stabilize.

Professor Xurong Mei stated that the real water saving is to improve the output of water use in production. The real water conservation in agriculture is to maximize water use efficiency, it not only concerned with water use ratio. Priority objectives of water-conserving

agriculture should be to promote the rural economy and improve farmer incomes. Major executor of water-conserved agriculture is farmer, not government. The water use ratio and water use efficiency can be improved by extending suitable technologies. In order to promote water-conserved agriculture, investment mechanisms and the property rights system should be reformed.

Professor Xurong Mei showed his research on productivity and its limits of rain-fed corn in Shouyang from 1992 to 1998. He suggested that the following measures could improve the rural economic growth by water conservation: models to improve farmer incomes through water-saving technologies; adjusting economic structure to save water; reforming possession right system of water conservancy facilities already existing; investing and managing mechanism of water conservation facilities; increasing investment intensity to develop modern irrigation for profit; promoting science and technological improvements, and strengthening human capacity building measures.

BRAINSTORMING SESSIONS

In response to a general concern that there is no poverty in irrigated agriculture according to the official definition of poverty in China, it was explained that this research project will not only consider absolute poverty as defined by the national or local governments, it will also focus on relative poverty issues. In China, farmers who depend on irrigated agriculture are generally not considered as poor. Since irrigation plays an important role in increasing farmers' incomes and welfare, farmers in irrigated agriculture generally have incomes that are higher than the national or local absolute poverty lines. However, rural development is not balanced and the distribution of benefits among farmers benefits is not equal. Of all factors contributing to unequal rural development, poor water management is one of the most important reasons to be explored.

The following issues were suggested to be included in the project

- Understand the major causes of poverty in irrigated areas.
- Match irrigation supplies with demand.
- Issues related to reliability of irrigation water supply.
- Issues related to water rights, water allocation and equity in distribution of water (How to improve equity of water use?), assessment of efficiency of water use and distribution.
- Issues related to irrigation management (role of irrigation managers) and institutions, issues related to farmer participation in irrigation systems, implication of the current irrigation management practices and institutions for the poor, legal and regulatory issues.
- Performance of irrigation systems.

- Water pricing (impact on poor farmers), irrigation financing: investment, maintenance, operation-cost recovery, sharing the cost of irrigation management.
- Water saving technologies (identification of pro-poor irrigation technologies in the study areas?)
- Identifying factors that may have impact on poverty through changes in sources of income generation.
- Issues related to farmers' capacity for managing irrigation systems.

It was pointed out that water conflicts in Hei River Basin are very serious, and that Hei River Basin would be a good candidate for this research project.

The second session began with an explanation by Dr. Intizar Hussain of his idea of a framework for this research. He suggested that this research would be conducted at four levels: macro-level, meso-level, system-level, and farm-level. For macro and meso-level research, national water policies, management, and institutions would be analyzed. System-level analyses will focus on issues related to performance of irrigation systems, water use efficiency, equity of water allocation, operation and maintenance cost, water pricing, productivity and other issues. Micro-level research will focus on understanding poverty situation at the household level. Team members for China expressed concern over the implementation of the project, especially on how to integrate research among four levels and find quantitative relationships between water management and poverty. However, it was recognized that determining the relationships between water management and poverty is a key point of the project.

In order to find a relationship between water management and poverty, Prof. Jikun Huang proposed potential regression models based on field surveys. During the discussion, most team members debated about the sample selection issues. It was felt that if one or two irrigation systems were selected, water management patterns would lack sufficient variation to do quantitative analysis. Therefore, more fieldwork would need to be done regarding site selection. Suggested criteria for selecting research sites included: 1) degree of water price reform; 2) degree of water management reform; 3) development degree of water users associations; 4) degree of water scarcity; 5) regulation differences on water allocation among industry, domestic and agricultural water use; 6) differences of crop water demand.

INDIA

Country Workshop

25 June 2001

Pro-Poor Intervention Strategies in Irrigated Agriculture in India

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Poverty alleviation has been the primary objective of the development planning of the Government ever since independence of the country. However, because of the very vast geographical area of the country with widely variant climatic conditions across its length and breadth and an enormous population to sustain, the magnitude and dimensions of the poverty problems of India have been equally big. Also they are not quite comparable with the poverty attributes of other countries in Asia or Africa.

Population growth increases demand for goods and services which in crowded rural areas exerts additional direct pressure on natural resources and consequently environmental degradation as more people, produce more waste and put additional stress on earth's assimilative capacity. Alleviating poverty is both a moral imperative and a perquisite for environmental sustainability.

Prior to independence, the country had suffered time and again from droughts leading to famines and starvation. The poor suffered the most. Mainly failure of the monsoon or, inadequate rains leading to crop-failure and sometimes, excessive rains causing floods and destruction of standing crops caused these distresses. Naturally, the remedy was lying in developing the water resources of the country to provide assured irrigation to overcome the vagaries of the rains.

The Government has been a key player in the water resources development of the country since the inception of Planning in the country. There are many success stories of the role it played in the last fifty years. About 83 percent of the developed water resources of the country is presently used for irrigation that has contributed to the significant agricultural growth the country has witnessed since independence. The primary task of development is to remove poverty.

In the first half of the last century agricultural production in India grew at the rate of about 0.5 percent per annum. But, in the last fifty years the annual compound growth rate has increased to 2.5 percent. The Gross Irrigated Area of the country expanded by 224 percent from 22.6 m.ha in 1950-51 to 73.3 m.ha in 1996-97. This phenomenal expansion of irrigation along with an extension to barren and un-culturable land, culturable wasteland and fallow land has led to the increase in the gross cropped area from 131.9 m.ha in 1950-51 to 189.5 m. ha by 1996-97. Merely a 27 percent expansion of area under food production resulted in an increase in food grain production by 292 percent because of the increase in productivity witnessed during the period. The yield of food grains per hectare of land increased by over 200 percent from 522 Kg in 1950-51 to 1,637 Kg in 1999-00. Increase in coverage under irrigation from 18.1 percent in 1950-51 to 51.0 percent in 1996-97 and

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improvement in the irrigation intensity served as a major facilitator for absorbing the beneficial effects of the other inputs, particularly the high yielding varieties of seeds, chemical fertilizers, etc. Consequently, food security has been achieved in the country and we are able to stock food grains by way of food surplus. But, such food surplus ensuring security against non-availability or, shortage or, price instability is only a fragment of the fight against hunger and malnutrition that the poor of the country are exposed to. Food surpluses do co-exist here with hunger as FAO has observed:

> *"Hunger is not just a manifestation of poverty; it perpetuates poverty, and has been the major stumbling block to efforts aimed at eliminating poverty. Food security is therefore an essential factor for breaking the vicious circle of poverty and malnutrition. In order to eliminate hunger, concerted efforts are required to accelerate agriculture and rural development in countries where poverty and under-nutrition exist."*

A recent estimate indicates that more than 1,300 million people around the world are suffering from absolute poverty. Though the world is producing enough food to provide every person with more than 2,700 calories per day, there are still over 800 million people in the developing countries who suffer from chronic under-nutrition. This is because many people do not have the ability to buy the food they need. The pro-poor interventions need to address this problem in its totality.

Low public investment in irrigation coupled with poor maintenance of rural infrastructure, especially canals and roads are of serious concern for our agrarian economy base. The policy approach to agriculture particularly in the 1990s has been to secure increased production through subsidies in inputs such as power, water and fertilizers, and by increasing the minimum support price rather than through building new capital assets in irrigation, power and rural infrastructure. The subsidy stimulated boost in output is not sustainable as it is generally at the cost of infrastructural investment like roads, irrigation, maintenance of canals and roads, and power generation. This has resulted in the agricultural output showing the signs of slowing down.

Percentage cropped area covered under irrigation under the coarse cereals, which remain the crop for the difficult eco-systems with poor resource base, and of poor farmers, is the least. This is one of the major factors as to why productivity of coarse cereals is far less as compared to other major crops. While the industrial potential of maize and sorghum has been realized to a small extent, it is not so for the other coarse cereals although their nutrient composition is comparable to rice and wheat. Some coarse cereals are even nutritionally superior. Coarse cereals are, therefore, a group of dual purpose nutritive crops with low productivity, though crucial for the sustenance of resource-poor farmers whose livelihood is dependent on agricultural lands with deficit irrigation or where options are few. The water resources in drought-prone areas need to be taken up as subsistence irrigation projects.

Irrigated agriculture has been a strategy for poverty reduction. In the areas irrigated by Indira Gandhi Nahar Project of Rajasthan, higher wage employment has become available on the farms. As a result, a study showed that employment per household in these irrigated areas was 640 man-days in a year against 580 man-days in nonirrigated areas. Particularly for irrigated areas, employment rose in crop farming and farm wage sector while it declined in

other activities. Certain States such as Orissa, Madhya Pradesh and the Northeastern States are lagging behind in water resources development, and are mainly dependent on rain for agriculture and suffer from very low production/productivity. For example, Orissa contributes about 2.9 percent, Assam 1.7 percent and Madhya Pradesh 9.8 percent to the total food production (1998-99) of the country. The yield per hectare of land in these States with respect to wheat and rice as well as the whole range of food grains is much lower than the all-India average yield, not to speak about that of the agriculturally developed States. The poorer productivity in agriculture in these States has a clear bearing on the standard of living of the people, particularly in the rural areas. The percentage of rural population below poverty line in the States of Assam, Orissa and Madhya Pradesh are 40 percent, 48 percent and 37.1 respectively as per 1999-00 status against the national average of 27.1 percent. The lack of irrigation facilities is the major impediment in these States to have a year-round cultivation and employment on field. The rural poverty incidence in the agriculturally developed States is much lower. For example, it is 6.35 percent in Punjab, 11.05 percent in Andhra Pradesh and 8.27 percent in Haryana.

To meet the growing food demand in the country a growth of 4 percent per annum in agricultural produce has been envisaged in our Agriculture Policy. This demand is likely to put tremendous pressure on all our natural resources which will have to be managed with great care and protected from overuse and degradation. Two options are available to meet this challenge: to intensify the production on area already in use or to expand into new areas. If more food could be grown on the same land, it would take care of the pressure to cultivate new areas and allow preservation of natural areas. The challenge before us is to balance intensive and extensive growth of agriculture so as to avoid the environmental damage and constraints on productivity that each can cause. Thus, the demand for irrigation water will multiply with increased crop intensity in future, but the escalating competition from industrial, power and domestic use will drastically reduce the availability of good quality water for agriculture from 83 percent at present to about 72 percent in 2025 A. D. and then to about 68 percent in 2050 A.D. Since irrigation has to play a key role in enhancing agricultural production, sustainability of irrigated agriculture and maximization of benefits from this sector through efficient and environment-friendly irrigation management assumes much greater significance now than ever in the past. Also, an effective liaison between the agriculture and irrigation departments needs to be established by developing most harmonious and effective working arrangements. Since application of irrigation water primarily depends upon the soil conditions and crop water requirements, it is necessary that operation of irrigation systems and the associated drainage should be supported on scientific lines with the interface of agriculture production. Essentially, the irrigation engineers, economists, agronomists, social scientists and extension services should have a much greater role in water management including delivery of water and maintenance of the system for sustenance of land and water resources.

Disjointed planning plus disaggregated and disorganized information are assumed to have caused many problems encountered in the water resources sector. In general, gaps and inconsistencies between planning and implementation, including lack of effective institutional mechanism for coordination among multiple agencies involved in water and related activities, lack of scientific management of resources, inadequate information systems, and conflicts in sharing of water between States are some of the critical areas which have not been given

due attention in the past. It must be stressed that these aspects have greater significance in the present context in view of the fact that the financial constraints, inter-sectoral claims and competing priorities will become more severe in future. Institutional restructuring has to get highest priority for effective resource management.

Undoubtedly, water development has been a key to raising the living standards and it needs to be extended to one-fifth of the humanity who have largely missed-out on its benefits. However, in doing so for economic growth, food sufficiency and material wellbeing, we will have to respect the Mother Nature's limits. The policies, laws and practices that shape water use today rarely promote the three basic tenets of sustainable water resource use, namely, efficiency, equity and ecological integrity. Taking heed of water's limits together with land, and learning to live within them, amounts to a major transformation in our relationship to fresh water. Doing more with less is the first easiest step along the path towards sustainable water development. By using water more efficiently, we in effect create a new source of supply. Each liter conserved can help meet new water demands. With technologies and methods available today farmers could cut their water needs by 10-50 percent, industries by 40-90 percent and cities by a third with no sacrifice of economic output or quality of life. Recognizing ourselves as part of the life-support network we depend on, and learning to live within water's limits are integral aspects of creating a society that is sustainable in all respects. Measures to conserve water and use it more efficiently are now the most economically and environmentally sound water supply option available for much of the world. The full resource value of water—economic, social, cultural and environmental, should be recognized in irrigation water management. The small and marginal farmers are the worst sufferers of the ill management of water leading to scarcity and inequality. In order to address equity issues, pricing mechanism such as rebates for better and efficient water use and subsidies targeted to benefit the poor farmers are required to be adopted. If availability of irrigation water was not ensured at reasonable rates as per crop requirement, technological transformation appear to be a costly proposition and yield instability in crop production would increase. Besides, sources of irrigation water, if not planned scientifically, completed in time, managed technically and utilized effectively would generate several problems such as uneven distribution of water in the case of canals among head reaches and tail enders, waterlogging, salinity and alkalinity, cultivation of high water-consuming crops at the cost of low water-demanding crops, ecological distortion and generation of environmental imbalances. Moreover, if access to irrigation water was confined to a group of farmers due to geographical, social, economic and/or political factors, inequalities in agrarian structure would get widened.

The construction work of irrigation projects taken on hand should be completed as early as possible. There should be quantitative improvement or increase in water-use efficiency. Posting technically competent staff to supervise the overall water distribution network, effective coordination among Agricultural Department, Irrigation Department and Command Area Development. There should be good interaction between government organizations and users of water.

The objective function, therefore, should be to optimize total agricultural output per unit of irrigation water rather than per unit of land. Small irrigation works (including minor surface water irrigation) which are less expensive, quick rewarding and easier to manage should be promoted in future.

The planning strategy should be directed towards improvement in soil-water combination and moisture retention capacity of soil in different agro-climatic regions. Keeping topography, natural drainage system of surface water and other characteristics of soil in view, 'watershed' in different agro-climatic zones needs to be identified and development plan should be prepared. An integrated development plan for each, 'watershed' can promote activities of afforestation, soil conservation and land reshaping, creation of ponds and other water (land moisture) conservation works appropriate to local area. Development work can include reforestation of the catchment areas, restoring the field channels to their original capacity, restoring and improving the tank bunds and other associated structures, construction of small wells, check dams, and other improvement in the system of collection/distribution of rainwater as per the local requirement. Preparation and execution of 'watershed development plan' demands peoples' participation.

We, therefore, have to recognize a policy mix for targeting our interventions at the poor based on the following strategies:

i. Higher investment for reservoir backed irrigation projects and extending the irrigation facilities.

ii. Stepping up plan allocations for maintenance involving user groups in management and appropriate cross-subsidized pricing of water to cover O&M costs;

iii. Generation of skills among the stakeholders for maintenance of irrigation structures, watercourses and canals including pumps and tube wells for lifting groundwater;

iv. Supporting groundwater potential to augment surface water resources wherever ground water potential is abundant but comparatively less exploited;

v. Adopting employment-intensive construction, operation and maintenance practices;

vi. Equitable use and distribution of water, enabling greater access to water, particularly in the times of scarcity to the marginal and small farmers;

vii Empowering women through greater representation in Water User Associations;

viii Preservation of soil quality in agricultural areas;

ix Providing extension services in irrigated areas;

x Integrating micro water resources projects based on water sheds in areas where resourcing of water by other means is not economically viable or difficult due to topography and other constraints.

Irrigation systems that can bring workable and equitable water distribution in difficult and marginal areas, where the poorest live, are possible, but need much more attention of all concerned. The challenge will be to make the technology affordable and easy to maintain,

and ensure that irrigation systems can operate effectively and equitably under adverse hydrological regimes. Appropriate low-cost irrigation technology, including low-cost pumps, hose and drip systems and simplified drip systems, require further investigation and promotion.

Pro-Poor Intervention Strategies in Irrigated Agriculture in India: Some Issues

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The aim of this paper is to raise a few issues as examples in order to initiate discussions on irrigation and poverty in India. The issues raised here are neither exhaustive nor final. Many of the issues raised are being debated for quite some time and yet are craving for solutions.

GENERAL ISSUES

Poverty is of a serious concern in India. Though it declined during the post green-revolution period since 1970s, every third person in the country in 1993-94 was found to live in absolute poverty. National Sample Survey data vouches for only marginal decline of poverty in spite of the higher growth rates recorded in mid-1990s. This trend is partly due to statistical artifacts and also due to factors, which have accelerated poverty in some states having weak property rights and poor governance (World Bank 2000).

Concurrently, the policy agenda has significantly evolved from an initial focus on increasing food production to concerns of environment, poverty in a wider sense and stakeholder participation. The focus on poverty became more explicit and the concept has further expanded beyond earlier notions relating to supplies of food to encompass wider livelihood concerns (Carney 1998).

Currently, there is much criticism on the low performance of the irrigation sector, although it is widely accepted as vital for India's economy, and pivotal for its food security policy. Irrigation is also considered an important carrier for development of poor masses (Chambers R).

The indicators of low level performance of canal irrigation in India are:

- Low rates of utilization.
- Unreliable water supply.
- Waterlogging and salinity.

The Indian government with the assistance of the World Bank has tried to improve the situation in the 1970s through the Command Area Development (CAD) and in the 1980s through National Water Management Program. However, technical solutions were sought

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through technical measures in these massive programs. Institutional issues were not given due importance and the technical solutions alone could not bring in better performance.

In the 1990s, two institutional issues started to draw attention in wider circles. They are (1) the monopolistic role of the government in irrigation management and (2) lack of 'market' mechanisms for the allocation of water (Report of the Workshop on Alternative Approaches to Canal Irrigation Reform 1998). The participatory development 'paradigm' in irrigated agriculture like in other related development efforts (e.g., agricultural research) has certainly provided reflection on the need to devolve control of the development process to its clients. This shift has been associated with shifts in globally held perceptions concerning the role of State in society (Hall et al. 2000).

Addressing the core institutional issues and structural reforms becomes an important issue in irrigated agriculture in South Asia and especially in India. The image of irrigation sector has vastly altered from what it had been two decades ago. It is suffering from (a) financial crisis with budgets going down, low water fee and low collection rates, etc., (b) technical and managerial crisis in the light of deteriorating physical system and poor delivery of water and (c) image crisis with major dams and canal irrigation being questioned on the grounds of negative environmental impact and social displacement (Mollinga 2001).

One of the main poverty related issues in irrigated agriculture in India has been that it widened the gulf between the haves and have-nots, not only in between the project area and outside but also within. *Ceteris paribus* irrigation incrementally added wealth among all those dependant on it. But the small, marginal and 'tail-end' poor farmers are believed to have got further effected (Chambers et al. 1987). The landless poor in the labor markets got better wages but as mechanization reduced the number of man-days of work, seasonal migration became rampant. The service providers, artisans, village craftsmen etc., who are on the periphery of irrigation sector remained a further neglected lot. In such a scenario how to ensure percolation of irrigation benefits to the poor in the irrigated and peripheral areas is a major issue of concern. "Addressing questions related to water, poverty and rural development that are not yet clear and are just now emerging" calls for strategic thinking.

Integrated Water Resources Management (IWRM) approaches are of recent thinking in developing countries like India. Different meanings of 'integration' in IWRM include: s (i) integration of different uses of water (ii) integration of analytical perspectives because the organization of knowledge production tends to be along different disciplinary and sectoral lines; (iii) integration of different institutions responsible for water resources development into a broader agenda of rural transformation (Workshop on Alternative Approach to Canal Irrigation Reform 1998). Lot of thinking and experimentation need to be done on this subject.

Building partnerships in research and creation of synergy in innovation aiding uptake of productivity initiatives is yet another important general issue that calls for attention. For example, ways of building linkages between the irrigation sector and agricultural research, and other organizations and farmers including poor at different levels.

The concept of food insecurity goes further than only the absence of food. The four important interactive dimensions of food security are classified as availability, access, utilization and vulnerability. The 'psychology of plenty' of late 90s as evidenced by mounting buffer stocks might soon be seen as a transient phenomenon reflecting weather-borne fluctuations in production, unsustainable farm price support policies and a lack of effective

demand by the poor. The challenge for India that lies ahead includes both raising food output and ensuring that growth is sustainable, stable and widely shared. (World Food Program 2001).

Balanced use and appropriate management of water resources are central to achieving food and nutrition security in India for rural as well as urban poor. Efficiency, equity and sustainability are three goals essential in irrigation management for meeting future challenge (Shah 2000).

SPECIFIC ISSUES

Separate pro-poor programs are not existent in the areas of irrigated agriculture. Some of the programs that are addressed to rural development are common to irrigated areas also. In other words, the fact that water is a determinant in poverty reduction though is talked about is not fully appreciated in carving out initiatives. The CAD authorities in some states were mandated to look specifically into the problems of small and medium farmers. However, like many other laudable objectives set for CAD, this objective was also drowned in a hub of construction activities like field channels—whether water reaches the target groups or not.

The following features of irrigation systems (major and medium projects) deficiencies are commonly pointed out in several evaluation studies conducted in CAD. They are: (i) unreliable water delivery and total neglect of maintenance of systems; (ii) inadequate water distribution and deprival of water to the tail ends; (iii) inefficient and wasteful use of water; (iv) lack of incentives to economize and conserve water; (v) insensitivity of government service delivery; (vi) low water rates and recoveries; and (vii) deteriorated physical infrastructure.

Statistics on poverty is awfully lacking like other irrigation statistics in the areas commanded by major and medium irrigation projects.[1] The criteria for identification of poverty are still household level income, expenditure or consumption.

The culture of government departments working in ‘isolation’ is a general phenomenon in the Indian context. The rural development department or the panchayats raj department are both mainly responsible for poverty eradication. The irrigation or water resources department, health or education have little coordination with the rural development wing. Information sharing, among the departments is rare and ‘knowledge’ flows are always vertical and not horizontal.

Area-specific programs like DPAP, Desert Development etc., or the target group programs addressed to specific communities like tribals, backward classes, small and marginal farmers etc., do not have any focus on the poor in irrigated agriculture.

Performance measurement criteria followed by the Irrigation Department is in terms of the area irrigated and not based on the number of families. The Revenue Department is concerned with the revenue collected. The exact number and picture of poor farmers not

[1]The integrated rural development programs however maintain statistics like number of tube wells, open wells, and irrigation pump sets because of the subsidy component involved.

getting irrigation at the tail ends is not available (again related to poor performance of irrigation projects and poor quality of distribution network). In irrigation commands all farmers situated are considered as beneficiaries whether they get water or not.

Eleven states in India contribute to nearly 82 percent of the total agricultural production. They cover 78–80 percent of the irrigated area. Considering the low productivity rates, how to increase productivity and how to bring the less-endowed in the irrigated commands to make the maximum use of the irrigation potential created and how can those with surplus waters efficiently use irrigation? How to ensure conjunctive use of groundwater by farmers in irrigated areas and also the peripheries?

How the participatory mechanisms developed during the last decade be reengineered to provide enough representative voice to the less-endowed to gain advantages accruing from irrigation?

How the resource poor can be enjoined upon and trusted for providing through a collective mechanism, services in storage, processing, marketing and the like breaking the nexus with traders and the powerful (rich) in the village? In other words, how to link the market with small producers for an appropriate institutional evolution or arrangement?

The Center-State relations and political economy in the Indian context needs to be clearly understood while discussing matters related to irrigation and agriculture. Many policy ideas and some funds come from the central level, but these get incorporated and transformed at state level in very different ways.

MACRO-LEVEL ISSUES IN INDIA

Unlike the direct interventions (e.g., Land redistribution through land reforms) which are difficult and not practical, a number of indirect strategic interventions can produce positive results on the productivity and equity of water economy (Shah 2000).

Poverty reduction depends on the economic conditions that generate pro-poor growth. In South Asian Countries and Sub Saharan Africa (though not elsewhere) it is evidenced that the performance of agricultural sector is critical because poverty was lower where agricultural productivity per worker was high relative to the modern sector (Hanner et al. 2000).

The natural resource management in India should aim at ensuring that the renewable resource— water— should not be allowed to damage the non-renewable resource—soil. Considerable extent of land is going out of productive use in irrigated commands year after year. What specifically is to be done by way of strategic interventions at the policy level?

Institutional issues are believed to be central to the management in irrigation sector. These issues figure at all levels. Identification of these issues (not merely economic issues) using a wide trawl at macro level is essential to tackle them in an integrated manner.

Canal irrigation reform trajectories in India are very diverse and case-specific. They are anchored in reform ‘models’ that gained international popularity. The influence of these models have no relation to the results of the approach in situations where it was conceived and implemented. The notions of a ‘model’ is attractive to irrigation professionals (mostly civil engineers) and policy makers as well as donor agencies. The specificity of reform situations calls for strategic analysis and strategic planning that is dealing with political

(I would add also social) dimension of change and transformation, for which capacity and skills need to be created (Mollinga 2001).

The 'first wave reforms' are believed to be completed in some states implying that participatory management mechanisms are installed. For many, reforms are linked to 'farmer participation and management' for several reasons. At macro level issues like establishment of water rights; participatory policy making are still elusive. However, the assessment of the first wave reforms, its process and impact are yet to be undertaken in right earnestness.

In the political economy of water pricing the funding agency (World Bank) has an important role. The banks' approach in India seems to be evolving starting with conventional high engineering works— centered projects to efficient utilization of water (CAD) to proper management of water (NWMP) and more recently to encourage more comprehensive approach to improving the quality of water resource planning and management. But these approaches are all techno-centric and are not addressed to the whole system. However, the technical and organizational problems of improving main system management still remains neglected (Vaidyanathan 1998).

STATE-LEVEL ISSUES—ANDHRA PRADESH

Excerpts from the 'white paper' issued by the Government of Andhra Pradesh in June 1996 (Keith Oblitas et al. 99) point the decline in the net financial situation of the irrigation sector, low revenues, increased expenditure, non-involvement of farmers, deteriorated infrastructure, excessive drawl of irrigation water at the head reaches and the total non-availability of water at tail ends— the scenario that was to a great extent common for the other states in the country.

With the World Bank assistance, irrigation sector reforms were initiated by GOAP by enacting Andhra Pradesh Farmers' Management of Irrigation Systems Act 1997 with a move to proceed further with:

i. Management of irrigation systems by farmer organizations (WUAs);
ii. Cost recovery, including principle of levey of water charges;
iii. Mobilization of resources for completion of ongoing and new irrigation schemes, and
iv. Improving sector financing and funding of maintenance to ensure sustainability of irrigation schemes.

Thus it can be seen that the government initiated reforms mainly aim at transference of the function of irrigation distribution to farmers and their management and for financial recovery and efficiency for the time being.

Andhra Pradesh reform process, which is currently in its first phase should eventually take up IWRM within canal irrigation commands as the situation is congenial for management of water not only for irrigation but also for the functions gaining increased importance: drinking water, water for industrial use, ecological effects of water resources etc. The most

far reaching paradigm shift would be to think the whole approach to the canal irrigation to see it as one element of watershed based resource.

The country paper presented and other papers which will follow raise several issues at the meso level. It is only recalled here that the issues at the state level are very complex and are further complicated by institutional and contextual issues.

The state of Andhra Pradesh offers diversity in the soils, climate, crops and a rich cultural background. The projects under Nagarjuna Sagar dam left and right canals may provide a platform for undertaking in-depth studies. However, in order to comprehend the Indian context, studies in different states are called for.

In Andhra Pradesh, the irrigation component in economic restructuring project envisages minimum rehabilitation of major and medium projects and recurrent maintenance of all schemes including minor irrigation for irrigation performance improvement. Scheme improvement/modernization and farmer turnover, agricultural (extension) intensification and institutional development of farmer organizations and government departments and software development are also in the agenda.

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Pro-Poor Interventions in Irrigated Agriculture in Andhra Pradesh

C. Sithapathi Rao *

IRRIGATION IN ANDHRA PRADESH

Andhra Pradesh (AP) is the fifth largest State in India with a geographical area of 2.75 lakh sq.km., and a population of about 750 million. More than 70 percent of the population depend on agriculture, and in this context, development of irrigation has become an important component in the various plan programs.

Two of the major rivers in India, the Krishna and Godavari pass through the heart of the State before joining the Bay of Bengal. In addition, a large number of medium-sized rivers like Vamsadhara, Nagavali, Pennar, and a number of coastal rivers like Sarada, Paleru, Thandava, Varaha, Yeleru, Swamamukhi etc., flow through the State and have immense potential for irrigation development.

The estimated availability of surface flows of water from these rivers at 75 percent dependability is estimated as 2,746 TMC. Around 66 percent of these dependable surface flows have been tapped so far for irrigation (table 1).

Table 1. Water utilization and balance available.

River basins in AP	Availability (TMC)	Utilization (TMC)	Balance (TMC)
Godavari	1,479	795	684
Krishna	811	811	Nil
Pennar	98	98	Nil
Nine other inter-State rivers and veers within the State	358	124	234
Total	2,746	1,828	918

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The surface flows are harnessed through various irrigation projects. There are 18 major and 104 medium irrigation projects in AP, which have created irrigation on around 36 lakhs ha. However, irrigation utilization is reported to be around 55 percent due to various reasons.

Also various observations have indicated that the efficiency of irrigation utilization is around 35 percent.

Recent Initiative in AP

Irrigation has been the primary sector not only for increasing the agricultural production but also for improving the livelihoods of rural poor. It generates more employment and incomes particularly to the small and marginal farmers and landless laborers.

However, the irrigation potential created is utilized stands around 59 percent only. Further the yields and incomes have not reached the expected levels.

The white paper prepared by the Government of AP in 1996 indicated that this situation has arisen due to a combination of mutually supporting negative influences that have dominated the irrigation sector over the past few years. These are:

a. Limited involvement of the water users in operation, management, and maintenance of the system;

b. Deteriorated condition of the irrigation system, due to inadequate and poor maintenance; and

c. Inadequate agricultural extension.

To remedy the situation, the Government of AP initiated irrigation reform process in early 1997, central theme being to promote participatory irrigation management (PIM), through farmer organizations.

The vision 2020 document of the government of AP states:

> *"The development of water resources is critical to several aspects of the state's development. Irrigation has been the key force behind the agricultural revolution in the state— yields of food grains and other crops have almost trebled under irrigated conditions. Increased and assured irrigation leads to greater investments in inputs by farmers, a shift to high-value crops, intensification of agriculture and increased employment. Irrigation, therefore, can be considered a lead input in agricultural and rural development. Irrigation also ensures the availability of potable water to all urban and rural areas in the state and water supplies to industries."*

Since irrigation utilizes a major share of water, the vision document has laid special emphasis on:

i. Realizing maximum irrigation potential of the State;

ii. Improving the efficiency of the existing irrigation utilization, which is to be increased from the present level of 30–35 percent to at least 57 percent; and

iii. Managing water resources better through stakeholder participation.

Legal framework to facilitate stakeholder participation is developed in AP through a special Act called *Andhra Pradesh Farmers' Management of Irrigation Systems (APFMIS) Act, 1997.*

The following are the main features of the Act:

a. Creation of farmers' organization in all irrigation projects of the State. At the field level these are called Water User Associations (WUAs) covering a group of minors/ or small distributaries on a hydraulic unit basis, under major and medium irrigation projects. These are federated at the middle and upper level depending on the size of the irrigation project.

b. Gives water rights to the WUAs;

c. Provides functional and administrative autonomy in managing and operating the system to the WUAs;

d. Makes irrigation department (ID) staff accountable to the WUAs, requiring ID staff to implement the decisions of the WUA;

e. Enables WUAs to resolve conflicts by themselves within their area of operation;

f. Enables proper maintenance and improvement of the irrigation systems by the WUAs based on resources raised by them and from out of the grants as a percentage of water charges collected in the area;

g. Allows access to information on project operations;

h. Permits preparation of the operational plan for water distribution by the WUA and ensures assured and reliable supplies to all farmers;

i. Provides freedom of cropping pattern to farmers within the overall availability of water, and

j. Contains procedures and guidelines on accounting, social auditing, water budgeting, election procedures, and other matters of administration.

Through these farmers' organizations it is envisaged that large number of poor farmers, whose lands are generally in the tail-end reaches and who are now not getting any irrigation from the projects, even though their lands are included in the command area, will be benefited.

INTERVENTIONS

Formation of WUA

In a WUA all the landholders within its boundaries are its members. The Act provided for two types of membership:

1. Members with voting rights: These are members who have been registered as owners or tenants in the record of rights. Where both the owner and the tenant are landholders of the same land, the rights are given to the tenant.

2. Members with no voting rights— other water users: All other water users are categorized as members with no voting right. These include any individual or body corporate or a society using water for domestic, power, non-domestic commercial, industrial or any other purpose from a government source of irrigation. This would also include cultivators who have not been recorded in the revenue records.

The WUA will have a managing committee, which attends to the day-to-day functioning. This body will have a president and members ranging from 4 to 10, all elected by the voting members. The operational area of a WUA is divided into segments called territorial units and the voting members in that area elect its members. This is done to give equitable representation by the entire area. The President is elected directly by all the voters. This elected body called Managing Committee will operate and manage the system within its area for providing irrigation to all holdings in its area in a dependable way. The tenure of these elected bodies is fixed for a period of 5 years.

The President or the member of the managing committee can be, recalled by the members after a period of one year if he is found to be misusing his position. This is to be done by giving a written notice signed by not less than one-third of the members of the organization. The motion for recall has to be adopted by a simple majority of the members present in the general body meeting specially convened for the purpose.

In the state, around 1,700 WUAs under major irrigation systems and 400 WUAs covering medium irrigation projects have been formed.

A special program to assist the WUAs for taking up minimum rehabilitation and maintenance was taken up as part of the World Bank assisted project from 1998 onwards. The works were identified and prioritized by WUA. They also organized the execution ensuring the quality of work. The number of work done and amounts utilized are as follows:

Year	Amount utilized (Rs. in Crores)	Number of work done
1998-1999	118.82	21,406
1999-2000	169.57	17,185
2000-2001	51.55	9,289

Maintenance of the System

This has improved the distribution system to a large extent.

Finance for WUA

One of the major requirements for the sound functioning of an organization is the need to have adequate financial resources and the WUAs are no exception to this.

The Government of AP has decided to pass on 50 percent of the water tax (Rs.250 per ha) to the WUAs and to the higher bodies at the distributary level and project level which can form their regular recurring income. The Mandal Revenue Officer, who at the local level keeps track of the collections of water tax, is authorized to transfer the funds at the end of each quarter.

A study in one district (Krishna) has shown that as against the normal grant of Rs.1.00 crore by the Government for 0&M, this year by end of May 2001, these organizations have Rs.5.2 crores by the end of May 2001.

Progress

The experience of the working of WUA in the past 3 years has shown considerable awakening in the rural side and the importance of the WUA has been on the increase.

Information on various aspects of WUA was gathered from the Presidents of the WUAs, in the form of "Yes" and "No" answers during 1999–2000. The summary is given below:

Particulars	Yes (Percentage)
a. Maintenance of System:	
i. Have you conducted walk through surveys for fixing up item of maintenance	84.79
ii. Maintenance work done:	
- Removal of silt	62.02
- Removal of vegetation	61.25
- Repairs of structures and outlets	65.24
- Closing of breaches	65.55
- Strengthening of embankments.	66.14
- Repairs to drains.	31.58
b.Water regulation and distribution	
i. Preparation of operational plan and water distribution	79.63
ii. Getting irrigation water in time.	80.67
iii. Irrigation reaching the tail-end areas.	81.12
iv. Reduction in disputes - in water distribution.	81.72
v. Improvements due to repairs to drains.	54.73
c. Other Items:	
i. Raising internal resources through contribution	11.06
ii. More trainings to be organized	85.75

OUTLOOK FOR FUTURE - PRO-POOR INTERVENTION

Pro-poor intervention in an irrigation system essentially entails providing irrigation water to small and marginal farmers within the command whose lands are generally situated in tail-end reaches. The supplies should be reliable, adequate, time-specific to enable the poor farmers to plan their crop production. This entails essentially three things. They are:

i. Proper maintenance of the system, to enable the designed/ desired flows to reach farm holding;

ii. Implementation of an operational plan, to enable a definiteness in water flows; and

iii. Involving the farmers in the above (i) & (ii) activities.

The WUAs already formed in AP have created the necessary platform for this. However, there is a need to pursue them vigorously so that it becomes a regular practice and forms a part of irrigation management culture.

RESEARCH ISSUES

All major and medium irrigation projects are designed and constructed to provide irrigation by gravity flow. The command areas are demarcated taking into consideration the elevations, and have hydraulic boundaries. Water is expected to reach each outlet, below which the lands for irrigated agriculture are available.

Experience has shown that due to various reasons the designed water flows do not reach the outlets, more particularly in the lower reaches of the command area. This deprivation of water is termed as *"tail end problem"* resulting in *"gap"* in the irrigation potential created.

In this situation, generally big and influential farmers manage to get water for irrigated agriculture in their lands by various means and the small and poor farmers, within this gap command remain as helpless spectators and continue to remain as dry land farmers. The irrigation agency, due to its own work culture, has not been able to do much in this direction.

Measures to remedy this depend on implementing a proper *"operation and maintenance"* (0&M) of the system involving the water users (farmers) as partners and developing a good agriculture support program.

A "pro-poor" approach to improve irrigated agriculture is adopted in Andhra Pradesh, through the process of *"Participatory Irrigation Management"* (PIM), and creating farmer organizations at various levels in the system. An enabling law called *"Andhra Pradesh Farmers' Management of Irrigation* Systems Act 1997" is also made in the State and farmer organizations (Water Users Associations/ Distributary Committees) are operating from the past three (3) years in all major and medium irrigation projects in the State.

Looking from the angle of *"pro-poor strategies"* in any major and medium irrigation systems the issues mainly are:

i. Nonavailability of water;

ii. Flow of irrigation in a non-dependable pattern;

iii. No information regarding the water supplies;

iv. Delayed water flows;

v. Effected by waterlogging and salinity'; and

vi. Inadequate or poor agriculture extension support:

The research study "*to determine what can be realistically done to* improve *the returns* to *poor farmers in the low productivity irrigated areas"* need to be planned taking into consideration the present ground situation. These can broadly be classified into:

- General Issues

  i. Overall water utilization in the command area/area irrigated/crops grown/water use efficiency;
  ii. Levels of productivity in the command— at head, middle, and tail reaches of important crops; and
  iii. Organization/responsibilities in relation to water supplies and maintenance.

- Specific Issues – Country Level

  i. Operational procedures (for water regulation/deliveries);
  ii. Maintenance/procedure and process;
  iii. Cropped areas/productivity/input usage; and
  iv. Assessment/water tax recoveries.

- Macro-Level

  i. Project level organization/operation/maintenance procedures;
  ii. Performance (in the past five years); linkages with the distributary committee;
  iii. Water budgeting at project level; and
  iv. Overall crop pattern/productivity levels in different reaches.

- Meso-Level

  i. Functioning of distributary level committees;
  ii. Water regulation/supplies to each WUA;

iii. Maintenance;
iv. Resolving disputes;
v. Transparency and accountability in its functioning; and
vi. Linkages with irrigation/agriculture/revenue departments.

- Micro-Level - (Here it will be a combined area of minor/outlet/farm level)

i. Water user association level;
ii. Functioning in relation to providing transparency and accountability;
iii. Tail-end poor farmers' role in the WUA; and
iv. Linkages for improving productivity in poor farmers' fields.

For this study Nagarjuna Sagar Left and Tungabhadra Low Level Canal can be taken as they provide different situations.

Pro-Poor Intervention Strategies in Irrigated Agriculture in India

Syed Turabul Hassan *

In India, before the British rule, the concept that water resources are god's gifts and as such, the common property of the members of the community is accepted as a religious doctrine. Harnessing of flow of water for the benefits of others chiefly for irrigation was considered to be the act of great virtue.

Development of irrigation from surface flow in the past has been the result of communal (religious philanthropic persons, religious endowments) or State enterprises (Kings, Rajas, and big Landlords), where as irrigation from groundwater has been mostly the results of private enterprises for their personal use. The maintenance and management of the irrigation system remains basically with the beneficiaries or panchayats (Kudimaramath) and no fee was collected from the users of water. Since the British East India Company undertook administration of the irrigation sector, irrigation was considered a revenue generating sector and its 0&M taken over from the users' group.

The development of irrigation in India after independence was subject to a number of forces; most important being the effect of partition in the form of large-scale migration of rich and efficient farmers, loss of developed irrigated areas to Pakistan, creating food scarcity and in some cases, even famine. To mitigate the same, enormous funds were allotted to increase food production by constructing major and medium irrigation projects under the government sector and providing all facilities to those who were prepared to invest and take the risk of converting dry land to irrigated land. The progressive farmers and big landlords along with refugees having the experience of irrigated farming took advantage of these projects and the poor farmers remained high and dry.

To achieve self-sufficiency in food and fiber in the shortest period, no serious action was taken up against farmers even if their action affected adversely the irrigation network and in some cases, deprive the poor of their share of water and created tail-end problems.

This policy was vigorously followed till 1970 resulting in a quick utilization of irrigation facilities, along with consolidating the then existing system that is biased towards rich progressive farmers ignoring rights of the poor farmers whose land lie in the tail end of the command area.

To get the full benefits of the country's land and water resources and to develop a sustained system of irrigation projects and to ensure the water in the entire command, steps were suggested by the Central Government to all the States.

To ensure that the benefits of building large dams with high investment are not lost and much of their potential does not remain unutilized, the concept of the Command Area Development Program was introduced. This changed the priority, in place of going for new projects to completing the on-gang projects and extending the canal network so as to reach water to the designed command area and help the farmers to take up SLID work considering

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the chak as one unit. To promote utilization of the irrigation potential already created under the major and medium projects and to restore all tanks which were the main source of water for flow irrigation as well as ground recharge, technical support and other input supports were provided. These steps increased irrigation potential from 22.6 million ha in 1951 to about 94,73 million ha at the end of 1999-2000 (provisional). But it was noticed that the gap between the potential created and utilized is on increase.

To ensure that this trend may not continue and there should not be a time lag between potential created and potential utilized and the benefit of building large dams with high investments are not lost, the Government changed its priority by giving importance to solving problems of tail-end farmers. For this, the Government's (Central) task should be to provide financial assistance to states (but no positive action suggested) to help the small and marginal farmers so as to take up the full benefit of irrigation facilities available to them as their right. Only in the end of 1997, G0I placed high priority in providing early and comprehensive support to "reforming states"; that were providing programs for poverty alleviation, high priority to social and environmental impact, and promotion of private sector development. For the rural sector in particular the Country Assistance Strategy supports the increased focus on policies and institutional reforms which should provide weaker sections of the society a say in all sectors and related programs that will foster sustained agriculture growth (for which water is a critical input) to reduce poverty in rural areas where majority of poor reside.

Even after three years of the above two policy directives, if we look into the working of irrigation projects we will notice that the sense of equity and egalitarianism, that access to water be brought to small and marginal farmers through implementation of different directives issued from time to time, failed and that more than the real scarcity, water has been rendered scarce by shear management lapses. Currently most government-managed surface irrigation schemes are in a state of despair, many canals are heavily silted, lining is punctured or missing and outlets are damaged.

The main reason for such poor maintenance according to the Irrigation Department (ID) officials is inadequate funds for 0&M and the interference of the users group in water schedule and the upkeep of the irrigation network; farmers feel that it is due to inadequate emphasis on operation and neglect of maintenance works, as the ID staff is more interested in taking up new work as it is more remunerative for them. They also feel that ID staff is happy and feel satisfied if water reaches the fields of big farmers and politically heavy weight.

Studies taken up by our organization and others indicated many reasons for tail-end problems and was of the opinion that the gap between the potential created and utilized is increasing due to non-maintenance of irrigation systems and misuse by the upper reach farmers. In some projects, the gap is between 20 percent and 25 percent due to loss of land because of waterlogging and salinity. This can be bridged through the standardization of canals, drains, field channels, and involving participation of both users and supplier groups, so that the entire command is irrigated. Saving of water which is responsible for waterlogging and salinity can be pushed further in the irrigation network in order to bring water to the fields of poor and small farmers whose lands generally lie in the lower reaches (tail end).

We also feel that agricultural extension program and the supply inputs will have to be taken up enabling small farmers to follow appropriate cropping pattern.

Most of the states now feel that a water-scarce situation demands fundamental institutional changes, more specifically one needs to examine the irrigation bureaucracy and its rules that have degraded, over exploited, or under-utilized water resources; one needs to know how these well-established powerful institutions have affected this crisis, and adversely affected quality and quantity of supply of water requirement to poor farmers.

Our study in Andhra Pradesh, Bihar, Haryana, and Orissa indicates that the main issues affecting water to reach the field of small and marginal farmers are:

1. Absence of irrigation and other government officials' capacity to workout water requirements of a crop specific to lands, and water environment based on rain soil moisture and irrigation available from their canal system and groundwater; and

2. Departments failed to take up steps against un-social elements and water grabber, to keep water flowing in the entire system.

There will be a catastrophe with the present population growth, land remaining constant and water being increasingly wasted and not fully utilized. New calamities are bound to arise if harnessed water is not utilized on the scientific basis.

There is a need for careful use of irrigation resources, both surface and groundwater and efficient management of the entire land, seed, and fertilizer in crop production i.e., more productivity per drop of water without affecting the future productivity through maintenance of the system, capable of supplying equitable water in the entire command, and if possible matching with poor and needy farmers' crop requirements.

This requires effective planning, development and allocation of water resources among users' groups by integrated and environmentally sustainable planning of management process and establishment of well functioning and financially sustainable farmer organizations at the project, distributary and farm gates.

To bring in change in the attitude of unsocial elements and water grabbers, requires increased focus on policy and institutional reforms and related programs that will foster sustainable agricultural growth in the basin and the uncommand areas of the project (uplands). This can be by utilization of the existing tanks and exploitation of groundwater, which will simultaneously help in solving the problem of waterlog and continuous raising of the water table. Due to inefficient use of water, irrigation efficiency which is reported to be between 35 percent and 40 percent can be raised to 50 percent or more with comprehensive and integrated approach by planning and management of water resources on a multi-sectoral and river-basin basis.

As regards polices now being followed by the G01 and progressive irrigation States, the brightest part is the emphasis on civil societies i.e., major, medium, and minor. The strategy for transferring participation in all water projects water vision to action reaffirms participation and institutional mechanism to involve all sections and sectors of the society irrespective of caste, creed, sex, landholding, age, and literacy in decision making.

The stratified nature of rural societies, the unequal power structure and the wide variation in landholding with a large number of small and marginal farmers, the dependence syndrome nurtured over decades all act against effective and responsible peoples'

participation and collective action. To negate the same, an irrigation system needs to be reoriented to provide for effective participation of user groups. Government organizations and irrigation department, suffer from a number of infirmities, which are inherent in the very nature of bureaucratic functioning against the concept of self-regulation that provides a way for responsible utilization of water without state control. They hesitate even accepting the idea of collective regulation by the farmers' organization in practice above the last point of their delivery system.

They are of the opinion that major irrigation is complex in nature and has essentially three components: 1) the irrigation system itself with its extensive network of distributaries and drains; 2) the large numbers of farmers in the command area who formed heterogeneous groups with different socioeconomic background; and 3) the irrigation department functionaries who are expected to maintain and operate system with almost no funds for systems' maintenance. For providing PIM it is essential that all these components are effectively brought together so that dependable and reliable irrigation supplies are made to users on an equitable basis, depending upon the extent of landholding which to them appears an unachievable task.

In this background the farmers' organizations, water user associations and government functionaries who are for participatory irrigation management (PIM) have a great role to play. They need to be backed by a law nurtured, supported, and groomed for sometime so that it can overcome the initial hiccups and become mature enough to carry on not only with the assigned mandate provided by the law but also to innovate things on their own. This should be aimed to improve all round efficiency not only of the system but irrigation itself which is now, as mentioned earlier, vary from 35 percent to 40 percent to at least 50 percent or more.

It is not out of place to mention the achievements in Andhra Pradesh after the introduction of the Act and its policy of encouraging water user associations for taking up PIM, how it has proved within three years to be a pro-poor intervention strategy in irrigated agriculture.

As per the Andhra Pradesh Farmers' Management of Irrigation System' (APFMIS) Act all beneficiaries and landholders are eligible to become members of distributary committee, and project committee vote and stand for any post of WUA, This equity of representation regardless of holding size, income, and social status is bound to affect the entire democratic system in near future. Critics of the Act feels that in a traditional Indian village where in spite of 50 years of democratic rule, still caste and landholding play an important role how this new Act will bring in a change. But soon after the election, the study taken up by Sri Rao of IRDAS of 6500 WUAs revealed that about 69 percent of WUAs are in the age group of 25 to 50 years. Twenty three percent are big farmers. About 80 percent are literate among whom 11 percent are graduates, post graduates and some engineers and doctors also among them. He said that even those who are illiterate had leadership qualities. In regard to the perceptions and aspirations of the farmers from the WUAs, Rao stated that the farmers wanted transparency in the distribution of water so that everybody knows who was getting water and in what quantity. The farmers expected better decision making, better management, better supervision, effective maintenance, satisfactory quality control and corruption-free management through farmers' organization.

Two regional conferences of the presidents of WUAs had been organized to get feedback on the performance of WUAs—one during crop seasons and the other in the maintenance season soon after their formation. The Chief Minister also participated in both the conferences. The feedback indicated that maintenance work was efficiently done, irrigation disputes were effectively resolved and the distribution of water was satisfactory. It is further revealed that the farmers wanted more training to make their participation more effective. Maintenance of accounts, mobilization of resources, development of operational plans and their implementation required training. The farmers also suggested that they should be entrusted with the authority to collect water charges. Social audit is also mentioned as one of the functions of WUAs.

The big bang approach of Andhra Pradesh to implement PIM attracted almost all states in India, national and international organizations interested in irrigation. Many workshops, seminars, and conferences were organized by national and international organizations and a lot of literature is available indicating the importance of PIM in improving the efficiency of the system and increasing the prosperity of the area.

After a lapse of two years, IRDAS took up, from January 2001 to April 2001, an in-depth study on the working of WUAs, to illustrate how far the WUA groups and DCs succeeded in their role as water users and decision makers. Are they able to build water awareness, monitor and control wasteful use of water, suggested and implemented measures to improve the effectiveness of water supplies? How far the government officials as facilitators helped WUAs and DCs? Have the Managing Committee (MC) pointed out to the individual farmers the different methods with which they can generate enough funds so as to afford the full cost price of water supplied by the government or private organization?

How are the decisions taken up by the Management Committees and the General Bodies of the WUAs and, what methods are being adopted for transparency and accountability, and whether social audit is being carried out?

Participation, when genuine, finds its own agenda and appropriate roles and linkages. Is this noticeable and are the democratic values of franchise (number of stakeholders with a voice in decision-making), scope (extent or range of items on which these groups/ individuals have a say in decision-making) and authenticates visible?

To find out the field level situation, three districts i.e., Krishna, Kurnool, and Karimnagar were selected. From these 18 WUAs are from major irrigation projects, 12 WUAs from the medium, and 30 from the minor irrigation projects. In all these WUAs the area and the command structure under the Act was fixed. Based on the area Territorial Constituencies (TCs) strength is laid down which varies from 3-10 in the major and medium irrigation sectors and in minor at the most 2. In 60 WUAs selected, number of TCs are 116 i,e., out of which 36 belong to 18 major WUAs, 24 belong to medium, and the 56 belong to minor irrigation sector. Managing Committee member's strength is laid down under the Act, which varies from 5 to 11. In 60 WUAs, total strength of TC is to be 300 and in no WUA TC be of less than 4+1 i.e., at least 4 TC members and 1 President. Command areas of the sample vary under major, medium, and minor systems, the maximum area under major WUAs being 15,970 acres and minimum 1,151 acres, under medium WUAs maximum area is 4,200 acres and minimum 788 acres, in the minor irrigation maximum 866 acres and minimum 118 acres.

The total command area of 18 major WUAs is 94,684 acres and that of 12 medium WUAs 25,447 acres, and the cumulative total of all the 30 minor WUAs is only 9800 acres.

District-wise localized area of identified WUAs is 74,968 acres of wet in Krishna, 1,092 acres under wet, and 23,792 acres under ID in Kurnool, and 10,449 wet and 10,281 acres under ID in Karimnagar.

Responses on the questionnaire covering all these issues directly or indirectly reflect the present scenario. This was gathered from 60 Presidents, 104 TC members, and 23 CAOs, and by looking in books and ledgers maintained by the WUAs and other primary sources, field visits in the command area which reveal that the present composition of the Presidents is dominated by the big landlords who are literate, middle-aged, and belong to upper caste, but as regard TC members combined strength of backward and schedule caste is more than that of the higher caste. It is hoped with more awareness, members of the WUAs will be amenable to the idea of voting for the Chairman and TC members based on their leadership quality, willingness to spend the time and share the responsibilities for the greatest benefit to its members and that caste, landholding, and age factor will play a smaller role.

The success and failure of an organization can be judged by the General Body meetings organized and placed before its members. It was noticed that in all general bodies, the WUAs Chairman reported the entire working of the WUAs comprehensively covering the different decisions taken by the MC members as well as spot decisions taken up at the time of walkthrough along with audited accounts.

For an effective management of water resources, 4 major tasks, that is water regulation, routine maintenance, major repairs, and social issues are needed to be attended to urgently. A look on the main purposes for which the GB meetings were held indicates that these were taken up in the GBs held between 1997-1999. In 46 GB meetings, problems and solutions regarding effective and efficient water regulation were addressed. GB members were informed with regard to the maintenance of works to be taken up in 117 cases and their role to be played was discussed with regard to efficient use of water. In 52 GB meetings, the repairs taken up, cost involved, and benefit accrued were discussed. 44 GBs exclusively were called for to place social audit reports before its members indicating how social issues hindering water delivery were tackled.

In addition to these above mentioned specific topics in the 104 routine GBs specialists were invited to provide latest knowledge with regard to most productive and economic use of water.

In all the 60 WUAs, MC meetings were convened at least three times in a year at different locations to discuss water regulation, water distribution, and resource management. In 197 meetings, the work program to be taken were discussed, and in 270 MC meetings administrative approval were obtained for all the works decided on the priority basis which include bund repairs, drainage works, and maintenance of main drainage system. To meet the extra amount needed for the work over and above the government grants, 10 MC meetings were called resulting in a collection of about Rs.100000/-.

As regards formation of other sub-committees, almost all WUAs members were for it. But only 12 WUAs out of 18 major WUAs formed separate sub-committees for water regulation, works execution, finances and resources, and monitoring and evaluation, whereas in 12 medium WUAs, 6 subcommittees were formed for water regulation, 5 for work execution, 5 for financial resources and 6 for monitoring and evaluation, while in 30 minor irrigation WUAs 6 were formed for water regulation, 8 for work execution, 6 for finance and resources, and 7 for monitoring and evaluation. Thus until now the progress in the

formation of sub-committees is not appreciable. The reason appears to be that these sub-committees' role is not effectively brought before the GBs.

To ensure the most optimal handling of water, it is imperative that the State should work out and adopt a strategy to mobilize funds, and among other things, introduce appropriate coordination of engineering department officials and the beneficiary farmers. State under the Act created a Competent Authority and depending on the area and type of work to be undertaken by WUA or DC, nominated an Assistant Engineer (AE)/Assistant Executive Engineer (AEE)/Junior Engineer (JE)/Deputy Executive Engineer (DEE)/Executive Engineer (EE) for different levels of work.

Overall perception of the CAs was that in their areas, water allocation is as per the availability in the system. And if the water is not enough they inform the WUAs about the same. They also mentioned that out of 50 WUAs, in 47 WUAs water was allocated in proportion of the area under the command. And they have noticed that with that quantity 46 WUAs somehow satisfied their members and convinced them to take up the maintenance of the irrigation system along with field channels and succeeded in providing water up to the tail end. Majority of the government officials were of the opinion that water distribution in 45 WUAs is better than it was before the implementation of PIM. Chiefly the information with regard to water availability, water distribution, time of release, schedule of release are now being made known to all the members by their respective WUA Managing Committee and much before the release irrigation network is brought to the original design by removing debris, cleaning of weeds, and strengthening the canals bunds by the WUAs.

Transparency of WUAs functioning is excellent in 50 WUAs as reported by CAS. This they attributed to the presence of the Competent Authority and MC members in GB meetings of WUAs. They also reported that in 15 GB meetings along with them senior project officials, territorial constituency members, and farmers took an active part to discuss various issues raised in the meetings. The presence of CAs in 83 GBs indicated the interest taken by them in understanding the working of the WUA.

No doubt PIM in these three years have now taken a shape of an administrative and technical system substituting traditional, administrative machinery which was more bureaucratic, more costly, and less responsive to the real problems at the field level. Still PIM has many elements which could not be usefully adopted and practiced like forming Project Level Committees (PLCs) which would have provided a say in policy matters like allocating the water, its release to different subareas of the project, collection of water cess by the WUA and implementing conjunctive use of water on taking basin as a hydraulic unit. Collection of water charges remains with the revenue department though some improvement in it was noticed.

The working of WUAs in AP formed under the Act clearly indicates that WUA is a community activity which while maintaining and operating the irrigation network in its operation area needs coordination at the district level with other WUAs to help the farmers to know when the irrigation will be available to users, how much water they will get, how long they will get irrigation, at what interval they will get irrigation, and how they can enforce the availability of their entitlement. The working indicates that this has helped chiefly tail enders pressurizing the upper reach farmers and WUAs not to take water more than their designed quantity. Thus, flow of water reached their respective fields. Thus, the working of WUA has shown a dear pro-poor intervention strategy.

In the light of the experience of AP the most important issue is the sustainability of the system and ensuring irrigation to the entire command thus not depriving the small and marginal farmers anymore.

To implement the policy of pro-poor intervention strategy our study indicates the following steps to be taken up:

i. A change in the work culture of irrigation personnel at the field level to work with farmers as a facilitator and not as a provider;

ii. Formation of WUAs only after obtaining the acceptance by the majority of the farmers of its objectives which clearly is to be pro-poor by taking the water to the tail end where majority of their lands are;

iii. Members have to learn what they should do and what the users stand to gain by collective action. In this process the role of the irrigation personnel at various levels need to be redefined;

iv. Human resource development through extensive training to be taken up for the promotion of PIM through WUA itself;

v. Development of ownership leading to generation of resources, irrigation and agricultural extension;

vi. Regular conduct of GB and MC meetings is a must for transparency and accountability, similarly walk-through for taking up work and ensuring its quality; and

vii. Close working relationship between ID and the members of the WUA is to be developed to provide sustainability.

It is necessary to build self-confidence in the ability to manage the system by users themselves and a right for a regular dialogue on policy issues is required to take care of changing water demand and meeting the same with operation of the system independent of the schedules fixed by the departments. There is a need to institutionalize the procedure of levying of irrigation fee and its collection. Training should be imparted to cover agricultural production, marketing, financial management, administrative skills and on-farm development. Maintenance work needs inspection of the system, walk-through along with farmers chiefly tail enders, ID staff, and the NGOs, fixing of the priorities keeping in view the requirement of poor farmers.

Thus, the work done should result in water to flow to the tail end area. Once this is achieved, attention should be moved more toward water distribution, regulation, and obtaining the allocated quantity at the starting pant of the WUAs. To see that this achievement of water in the entire command meeting the requirement of crops grown if not perpetually at least for a long period of say 2 or 3 decades, sustainability of the system is a must.

This needs a multifaceted approach with environmental management, integrating all aspects of the project design and management. Financial sustainability will also be essential, achieved by raising of water charges to cover 0&M and by WUA allowed to direct collection and retention of major water fees to enable self-reliance for 0&M. Finally the all important institutional and social sustainability would be achieved through building up at the grass root of empowered community structure (WUA) funded by the members themselves.

Pro-Poor Intervention Strategies in Irrigated Agriculture in India: Some Issues

S.G. Bhogle *

INTRODUCTION

Irrigation projects—major, medium, minor—have been accepted as powerful tools of agricultural and economic growth . However, it is observed that the earlier strategy of protective or seasonal irrigation alone does not provide adequate income to the farmers to move above the poverty line. Irrigation projects, therefore, should be planned as area development measures and should fulfil social criteria besides the techno-economic criteria. Irrigation projects should therefore be regarded as one of the essential inputs for food security and rural development because, in spite of growing efforts in rainfed crops, irrigation synchronized with new high yielding varieties of seeds, chemical and organic fertilizers and pesticides can play a more decisive role. With this background the following discussion leading to pro-poor intervention strategies in irrigated agriculture in the Indian context is presented.

BENEFITS OF IRRIGATION

The following benefits of irrigation projects are expected if the projects are properly planned with social and techno-economic objectives.

a Limitations of seasonal irrigation can be overcome;

b. proofing (drought, floods etc.);

c. High value crops can be produced;

d. Small farmers' handicaps can be removed;

e. Employment generation for landless laborers and for other rural people;

f. Hydropower generation;

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g. Boosting agro-based industries (sugar factories, rice mills etc.);

h. Water supply for drinking and industrial purposes;

i. Improvement in infrastructure facilities;

j. Increase in fisheries, trade, transport, tourism etc.

However, proper and adequate documentation of benefits due to irrigation projects has not been done meticulously and seriously. On the contrary, the ill effects or hazards due to irrigation projects are given wide publicity through excellent documentation in print and electronic media. It is therefore necessary to identify the factors which are directly or indirectly responsible for poverty alleviation. With this idea in mind the following issues/ questions for taking up research studies are suggested.

1. Completion of irrigation project itself is one of the prime pro-poor interventions in irrigated agriculture in India. Systematic planning for the completion of ongoing irrigation projects and provision of adequate budget is the need of the time. If irrigation projects are completed on time, the most vital step of poverty alleviation is taken. Completing "project" (and not just civil works!) in the truest sense of the term without cost-and-time-overruns would be the most fundamental and crucial pro-poor intervention. Equity and increased productivity are just not possible in the following scenario, which has become common everywhere.

   "Incomplete project --> poor performance --> inequitable water distribution --> tail-end problem --> faulty system --> inability to implement any good idea --> 50-60 percent rainfed area in the irrigation command --> poverty with-and-within an irrigation project."

   It is therefore necessary to take an in-depth performance evaluation studies of irrigation projects to start with on a sample basis. In all the agro-climatic zones of India, one major, one medium and one minor irrigation project should be evaluated by comparing the project objectives and if the objectives are not accomplished, the lessons learnt as feed back will be useful for the redesigning of the proposed irrigation projects.

2. Developing user friendly canal systems with simple hardware and software ("KISS" principle—keep it simple and stupid!) that can be understood, operated and maintained mostly by the users themselves would be the second important pro-poor intervention. This is technically feasible with the following strategy.

Software	Hardware
Location-specific	- Ungated self-regulating outlets(SRO)
various combinations of	- Proportionate flow dividers(PFD)
- Phad	- Weirs (e.g., diagonal, duck-bill)
- Warabandi	- Hydro-mechanical gates(e.g., AVID, AVIS)
- RWS	- Night storages
- Limited rate demand schedules	- Balancing reservoirs

(LRDS) - Indirect flow measurement with (SRO & PFD)
- Simultaneous operation of outlets
- Simultaneous manual operation of motorized CRs on main canal
- Low pressure underground pipe lines below outlet.

A pilot action research study on a major or medium irrigation project can be taken up for evolving user- friendly canal system.

3. Developing and implementing water rights compatible to—

   i. User-friendly systems suggested earlier.

   ii. Realistically revised irrigation potential.

4. Evolving a better Irrigation Act which would provide for:

   - PIM
   - Right to water
   - Right to information
   - Accountability for all concerned

   These would also be a basic pro-poor intervention because in the absence of implementation of Irrigation Act, anarchy will prevail. A "free-for-all" situation leads to "might is right" and is, therefore, anti-poor.

5. To resist privatization of irrigation or for that matter complete water sector would be a timely and most-needed pro-poor intervention. A genuine Water User Cooperative Society (WUSC) is a welcome thing but if WUCS is being used only as a stop-gap arrangement towards bringing privatization then it is an anti-poor intervention and should be resisted.

6. Many socioeconomic benchmark and post-project surveys of different irrigation projects have been carried out in the last 3 decades in India. However, in almost all such studies, the contact persons for getting information/data have been farmers possessing land on his or her name. Landless laborers, small traders, artisans and rural people at large are not covered through such surveys. It is therefore suggested that such research studies be taken up in all the States of India.

7. Most of the irrigation projects in India have major emphasis on providing canal water in rabi and hot weather seasons. However, one or two rotations in kharif season in the event of long dry spells can prove to be an important pro-poor intervention in irrigated agriculture. A few research studies using the technique of "case study" should be taken up so that some pro-poor policy measures in this respect can be evolved.

8. Access to technical information such as rainfall data, availability of water in the reservoirs, rotation schedules, package of practices for all major irrigated crops, storage/processing/marketing facilities, etc. should be made available to all the rural people at no cost. This is expected to be helpful in increasing the productivity of different crops especially of poor farmers.

9. It has been observed that irrigation projects are instrumental in improving the availability of drinking water to the rural as well as the urban people. This, particularly in rural areas, has helped the women folk in reducing the time spent in fetching water from distant sources. In other words, the productive work hours resulting in gainful employment have increased for women as well as men in rural areas. Research studies exactly quantifying this very important social impact should be taken up in the case of a few irrigation projects.

10. For the Government of India schemes, data for population Below Poverty Line (BPL) is any way collected from rural as well as urban areas. Irrigation Departments in India have data regarding land holdings, survey number. etc., of the beneficiaries. Using both these data sets, research studies of a few irrigation projects, if taken up, will be able to exactly quantify as to how many people have been brought above the poverty line due to irrigation projects. Methodology for this purpose could be to have benchmark surveys done of a few irrigation projects at the time of their starting and then with an interval of five years such surveys can be repeated. Such data sets will reveal the contribution of irrigation projects in poverty alleviation.

Pro-Poor Intervention Strategies in Irrigated Agriculture in India

R.K. Patil and S.N. Lele

INTRODUCTION

Before we proceed, let us first clarify who the poor are in the context of irrigation area: In general, poor people are identified on the basis of nonavailability of some well-defined norms of food, clothing and shelter. With respect to irrigated areas, this definition may not be of much value.

The crux of poverty in the irrigable area lies in the nonavailability of water to those whose lands lie within the irrigable areas (irrespective of the landholding). Viewed this way tail-enders who are the disadvantaged in irrigable areas are the major segment of the poor. Similarly, even in the head and middle reaches of the canal, socially disadvantaged landowners may also be deprived of water and can be included in the category of 'poor.'

There is a third category in the area who could be considered as poor, namely, landless laborers. With better irrigation, the job opportunities for the landless increase and hence their poverty status is indirectly linked to irrigation.

There is a reference to 'equitable economic growth' in the context of 'goals' and objectives' of the proposed study on *Pro-poor intervention strategies in irrigated agriculture in Asia*. One has to be clear as to the meaning of 'equity.' Equity does not mean 'equality.' In a society of disparate endowments of natural resources and a variety of land ownership and tenures, equal allotment to water either on the basis of area or population may not be conducive to equitable economic growth. For need /demand (and hence quantity) for water depends on many factors such as types of soil, climatic conditions, varieties of crops, etc. There are wide variations in these factors and a centralized agency is incapable of doing justice. These issues would have to be resolved at the local level.

INTERVENTION STRATEGIES

Currently, the strategy of water management and distribution is decided and implemented by the Irrigation Department, on the theory that the Government is the sole and neutral arbiter of water disputes arising within the farming community. However, in practice, the strategy is biased in favor of the influential segments in the irrigation sector who are also well represented in the governance (i.e., ruling party). Under these circumstances, any strategy framed at the Government level is not likely to become pro-poor in practice.

Therefore, at first, all the powers of water distribution should be handed over to the WUAs. Behind such devolution of power is the assumption that the individual users at the local level are willing and capable to ensure equity in water distribution and thus protect the interest of the poor.

If, in practice, this does not happen, then the question of 'pro-poor' intervention arises. There are many ways in which such an intervention can be designed as to ensure equity in water distribution. Therefore, the first step would be to transfer management responsibilities to the community (i.e., people) and then to supervise the community activities to see that the poor are not deprived of their dues (regulation). In short, the Irrigation Department should shed the executive responsibilities below the distributary level and substitute these by quasi judicial procedures to protect the interests of the poor.

SLIPPAGE OF PRACTICE FROM GOALS

The irrigation projects are by definition and design constructed to improve the quality of life of the rural population particularly the farmers directly through additional crop areas and higher productivity, and the farm labor (landless persons) through increased job opportunities in the area.

However, the experience shows very clearly that these objectives are not fulfilled, especially in large and medium projects, where large pockets of low productivity areas have remained and would continue to remain in the near future. A large number of poor people remain poor around a few very rich farmers or islands of prosperity.

This is not a new discovery but a hard truth, which has been discussed, debated continuously among the irrigation planners, management experts and social scientists. A number of interventions, packages and practices were suggested from to time to change the situation. Constructing field channels up to last farms, providing field drains, lateral drains to remove excess water, land leveling, constructing roads to connect villages to the market-yards, etc., are considered as physical infrastructure, and on the other hand, enforcing cropping pattern, introducing warabandi, training of farmers, direct linkage between agriculture research services and farmers, are called institutional interventions. All these interventions are provided as packages under the Command Area Development(CAD) Program. But even after nearly three decades of launching the CAD program, the problem of low productivity, lack of guaranteed, reliable and equitable supply of water to all the farmers in the command have not been fully resolved.

The irrigation agency cannot provide high degree of service directly to all the farmers to supply water equitably, reliably, as per the crop water demands of thousands of farmers in the command. It was therefore thought that the involvement of farmers in all aspects of irrigation, and particularly in operation and management is essential. This Participatory Irrigation Management is now initiated in a few states. The impact of Participatory Irrigation Management on removing the pockets of low productivity, and equitable distribution of water to all the farmers can be seen only after a couple of years.

PRODUCTIVITY

This brings us back to square one. Let us therefore take a fresh look at the irrigated agriculture in general and that under major/medium irrigation projects in particular. The productivity of agriculture crops depends up on a number of factors. The farmers have to take high risk in each of these. Some of these factors are:

- Availability of good quality, high potency seeds
- Appropriate fertilizers and adequate farm manure
- Timely availability of pesticides
- Labor
- Reliable, timely and predictable irrigation water supplies

These are controllable and can be managed with efficient and highly responsible management. Besides, the incidence of pests and diseases, climatological factors such as low temperatures, hail storms, high and continuous rainfall are natural and uncontrolled risk factors. All these risks influence the productivity. Water availability is the principal risk.

It is understood that, when the major risk involved in timely, adequate, and reliable supplementation of water is reduced or minimized, through irrigation, farmers can *afford to* take high risks in other areas to get higher productivity. The question therefore revolves on one single factor of providing efficient irrigation service to all the farmers.

Before we go into the possible solutions, let us again take a quick look at the existing services under major/medium irrigation projects, the constrains, inherent deficiencies of the physical system along with the drawbacks in the existing water management practices.

THE CONSTRAINTS

- The canals are designed and constructed with upstream control. The response time is high; (3-4 days, in major systems) due to filling time. The water once released cannot be stored/conserved or retrieved, but will have to be supplied through outlets or wasted though escapes.
- The irrigation supply cannot be done to various subcommands/minors *on-demand.* A certain type of scheduling on/off or rotational supply to be followed.
- All farmers cannot get water simultaneously at any time. The farmers have to take water by rotation or as per certain system under the outlets in a cyclic order either head to tail or tail to head.

- The canals cannot supply water to all the crops as per their actual water demands. The frequency of supply can be tuned to one or two principal crops and all farmers can get water at the critical stages of these crops, only if, sowing/planting is done by the farmers in a cyclic order as per the order of receiving water.

INTERVENTIONS

By now we have experimented with physical interventions such as lining of canals, modernization of systems, increasing canal capacities, extending canals/field channels, improving controls, but these interventions have not improved the equity or reliability of supply nor have they led to conservation, saving or judicious use of water. Hence institutional interventions need to be organized on priority. After improving the management, possibly further interventions in physical structure of canals would be able to bring about the desired effects like judicious water use and high productivity.

EQUITY IN SUPPLY/ACCESS TO IRRIGATION BY TAIL ENDERS

The government agency cannot bring equity in water supply so long as the agency is responsible to allocate and supply water to individual farmers. Involvement of farmers, entrusting O&M at a certain level, like minors/distributary to the farmer organizations with the clear responsibility of providing water to all farmers is essentially a prerequisite to this tail-end/deprived farmers' problems.

Further, the equity will not be the same in different projects and will change according to the water availability, landholding and land-use pattern. The equity issue will have to be addressed by the general body of the WUAs and rules for water allocation/supply framed by majority.

GUARANTEE/RELIABILITY

In order to assure certain quantity of water to each WUA; the irrigation agency will have to take the responsibility of allocating/supplying water equitably to all WUAs. Based on the available water in a normal year, allocation needs to be made to each WUA, or a quota of water needs to be determined proportionate to the CCA of each WUA.

The water availability will change from season to season according to the rainfall. Based on probability, as well as actual observations, the quantity/quota which will be supplied will have to be made known to the WUA before commencing irrigation in that season. The number of irrigation/rotations will have to be decided by the irrigation agency and the Apex body of all WUAs, so that the water users can plan the crops and crop area precisely.

CROP PLANNING

Based on water availability and the number of irrigations, the WUAs will have to identity the crops which can be grown (within the water quota) and the crop area as well as the period of water supply (rotation schedule) to match critical crop stages for higher productivity.

Once the crops and crop areas are fixed, the WUAs will have to allocate the water to individual farmers based on equity defined by the WUAs and thereafter plan sowing/planting of crops in the cyclic order as per the irrigation rotations from head to tail/or tail to head.

JUDICIOUS USE OF WATER

Water saving/conservation or judicious use of water is essential to ensure that all WUAs actually get the sanctioned quota. To achieve this following steps/intervention are essential.

- Volumetric supply
- Incentives for water saving by way of carry-over of water not utilized in a season to the next season.
- Storing water on ground through en-route storages, service reservoirs, farm ponds or underground storage though recharge of water in the ground when not needed by crops.

FLEXIBILITY IN IRRIGATION SCHEDULING

Process of continuous dialogue/exchange of information between irrigation agency/ agriculture extension, Apex body of WUAs and farmers, needs to be initiated before each irrigation season for planning, implementation, and monitoring water deliveries. The long dry spells in the monsoon need to be identified and additional rotation planned quickly. Similarly, the period of heavy rains, winter rains need to be utilized for storing water, increasing area in Rabi or providing additional rotations if needed later on for increasing productivity.

CONJUNCTIVE USE OF GROUNDWATER

When farmers get organized, participate in water management and undertake responsibility of O&M, the WUAs should be able to control groundwater for equitable distribution. The government should empower them with legal back up so that the WUAs' Apex bodies can undertake various measures for recharging rain/canal water (if not needed by the crops) in

the ground and make arrangements to lift and supply this water equitably to all farmers on a community basis for increasing irrigation, or increase frequency of supply to sensitive/ delicate crops, which cannot be grown only on canal water with low frequency supply.

Strategies for Fighting Poverty in Irrigated Agriculture

Hemnath Rao H [*]

The emerging environment for agri-business calls for a fundamental shift from the policies of the past that envisaged closing the demand-supply gap in agricultural production. It is essential that future strategic interventions for agricultural development in general and irrigated agriculture in particular, are oriented more toward value addition to the agricultural output so that the farmer produces not for the mass market but for value enhancement at every stage in the value chain. This paper conceptualizes three possible strategies that could contribute to relentless search for value-addition through knowledge and information flow in irrigated agriculture.

INTRODUCTION

In the wake of the process of economic reforms set in motion by the Government of India in July, 1991, a regional workshop was organized by the Food and Agricultural Organization and the Association of Food Marketing Agencies (AFMA), in 1992 at New Delhi. While inaugurating the workshop, Dr. Balram Jakhar, the then Union Minister for Agriculture, Government of India informed that "All the State Governments have been advised to strengthen their organizational structure at the field and operational level and specially the extension machinery so as to transfer the technology to the farmers at the field. Special effort is also directed to encourage farmer-owned organizations which would help in cutting out the middlemen and thus provide opportunities for better remunerative prices to the farmers and lower cost to the consumer. Our own experience and all the world over has been that the fruit/vegetable sector can best be developed and protected only through well organized and managerially competent, farmer-based institutions and organizations. Our experience of Grape Growers Federation in Maharashtra is a fine example of farmers turned exporters. This helps to ensure higher profitability from production to marketing and exports."

Almost ten years down the reform path, the above observation seems more relevant than ever before. A vast country of sub-continental size like India, with marked regional diversities in soil types, agro-climatic environment, resource endowment, cropping patterns, farmer profiles and population density,

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is bound to reflect variance in economic and agricultural development among various regions. These regional differences in agricultural development tend to get accentuated further because of the varying levels of investment in development infrastructure and differences in adoption of technological innovations. Hence, the impact of high yielding varieties of seeds and fertilizer-intensive technology of the late 1960s and 1970s on the regional pattern of agricultural development has been criticized as much for developmental imbalances as has been appreciated for reducing the country's dependence on large-scale imports of food-grain through PL480. In the same spirit, even as we continue to negotiate the more challenging task of alleviating poverty in the less-endowed irrigated-dry and dryland areas within the agricultural sector, it is necessary to look at strategies that can help release the irrigated farming community from the pangs of poverty.

There is undoubtedly less uncertainty and hence lesser risk in managing irrigated farming, which positions the irrigated farmer in a more privileged position relative to his counterparts engaged in dry land and rain-fed agriculture. Hence approaches to tackling poverty in irrigated agriculture will have to reflect an enlarged focus from mere production and productivity so important in dry land agriculture to relentless value addition across the entire value-chain in irrigated agriculture. It is in this context that a firm and widely agreed strategic agenda for value enhancement in irrigated farming assumes great significance. Given the fact that the irrigated farmer has access to such a valuable resource as water, the strategies for value addition leading to improved returns from irrigated crops, should place knowledge at the center of all development efforts.

INDIA'S STRATEGY FOR AGRICULTURE DEVELOPMENT IN RETROSPECT

Before attempting to strategize for the future, it is a basic tenet of strategic management to look back in retrospect at the past strategic initiatives and their outcomes. Indian agriculture has had a chequered history. After a prolonged period of stagnation in the first half of the twentieth century, as Bhalla, G. S. and Singh, G. (2001) point out, "its rate of growth accelerated from 0.37 percent per annum during 1901-04 to 1940-44 to 2.68 percent per annum during 1949-50 to 1996-97". No wonder it always evokes a mixed response as Rangarajan, C. (2001) observes, "The progress of Indian agriculture since independence is, in many ways, impressive. The output of food grains which stood at around 50 million tones in the early 1950s has risen to 200 million tones as of last year. This is a fourfold increase as compared with an increase in population of 2.5 times. In fact, planning for agriculture has been an outstanding example of indicative planning in this country. Agriculture is a sector where millions of farmers take their independent decisions.

However, when self-sufficiency in food was set as the goal, the government sought to create conditions in which farmers would take such decisions in their own interest which would help in achieving the policy objective. Agriculture thus provides a successful experiment of policy influencing private behavior to achieve public goals. Striking as may be the performance of Indian agriculture in the last five decades, as the saying goes, "we have miles to go before achieving self-sufficiency in food-grains at higher levels of per capita consumption. Besides, we are yet to reach, in relation to several crops, productivity levels that have been achieved elsewhere."

If one has to encapsulate India's strategic orientation toward agricultural development in the post-independence period, it is best possible by looking back at two distinct phases,

as Bhalla, G. S. and Singh G. (2001) suggest— the pre-green revolution (1949-50 to 1964-65) and post-green revolution (1967-68 to 1996-97) periods. In the pre-green revolution period, the two main planks of agricultural policy were land reforms and large investments in irrigation infrastructure (Bhalla, G.S. and Singh G. 2001). This did contribute to breaking the stasis that had gripped Indian agriculture earlier in the century, as the growth rate of all crops rose to 3.15 percent per annum between 1949-50 and 1964-65 from less than half a percent in the preceding five decades.

The agricultural development strategy in the post-green revolution period, " since the mid-1960s, centered around the enlargement of irrigation, stepped up use of fertilizers and adoption of improved varieties of seeds" (Rangarajan, C. 2000). The advent of this seed fertilizer technology in the late 1960s ushered in the green revolution which changed the face of Indian agriculture for good. Initially, the benefits of this new wave of agricultural development were confined to the irrigated areas of Northwestern parts of India, notably, the States such as Punjab, Haryana and Western Uttar Pradesh, but other states did catch up subsequently leading to a more balanced spread of agricultural growth. Well, it is not difficult to infer from the above that the tone and tenor of the strategies have so far been clearly directed toward pushing the productivity frontier taking advantage of irrigation facilities wherever available. Given the commitments that India has to fulfill as a member of the World Trade Organization (WTO) under the 'Agreement on Agriculture' (AOA) and the pressures emanating from the global marketplace, the strategies for the future need to go far beyond productivity increases.

PERSPECTIVES FOR THE FUTURE: A TRI-PRONGED STRATEGY

While the need to augment crop yields further is by no means less urgent in the current scenario, it is equally or perhaps more important to temper future strategic interventions with sharper attention to the changing market preferences and the consequent demands on knowledge intensity and competitiveness of Indian agriculture. Here, the brunt of these demands is likely to be almost entirely on the irrigated farmer since the pattern of irrigated cropping in India has so much in common with the product-mix traded globally. It is, therefore, not merely a question of alleviating poverty in irrigated agriculture but strategizing for its fundamental competitiveness in the world market. Three broad strategies are discussed below in approaching this vital issue of competitiveness of irrigated agriculture and its future growth.

SUSTAINABLE STRATEGIC PARTNERSHIPS

The developments sweeping the corporate sector at large in recent years offer many useful lessons to policy makers and development analysts in realizing the potential benefits that well-chosen and sustained partnerships can offer, in irrigated agriculture. As Hutt, D.M. et al. (2000) suggest, the history of any alliance reveals periods of optimism and doubt, cooperation and conflict and a host of forces that advance or threaten the future prospects of one or more partners. In the agricultural sector in India, there have been isolated cases of successful partnerships, for example, between industry and farmers (see box 1) but the linkages between farmers and industry are far from strong.

Box 1. Lessons from the Pepsi Experience(NCAER 1996).

Irrespective of the outcome of the Pepsi experiment, it is worthwhile to recapitulate what we consider to be the main reasons behind the success of the tomato paste production at this firm. For one, the extension work of their field staff has been remarkable. If another firm is to replicate the success of this firm, an important first step would be to retain an assiduous field staff which interacts almost on a daily basis with farmers. The main input of the staff would be to ensure that the seedlings are being planted at the appropriate time, and fertilizer and pesticides application occur at the right time, and in the right quantity.

The extension work thus performed assures that the right quantity of tomato is produced. This quantity includes not just the demand of the processing plant, but also ensures that enough surplus is created so that the farmer is not lured to sell on the open market the quantity apportioned for Pepsi. Such a step is absolutely essential in making a success in contract farming, because the contracts with farmers, as stated earlier, are not legally binding. Therefore, if a firm wishes to ensure the steady supply of raw material to its factory, a quantity which is in excess of its own demand must be grown. Assuring sufficient amounts to meet the needs of the consumers, through extension work, has therefore been yet another step taken by Pepsi which is essential to keep prices of the raw material under control.

But most importantly, the role of extension work in making the contract farming operation a success is to provide the farmer with the assurance that the firm will buy the stipulated quantity of tomato. This, in turn, reinforces the stabilizing effect on both prices as well as quantity supplied to the plant.

It may be worthwhile to contrast this extension work with that of a domestic firm also involved in the production of tomato paste. This firm has also attempted contract farming, although with considerably less success. One of the reasons has been that the entrepreneurs do not always carry through the contract on the agreed terms of price and quantity. As a result, the farmers are rather unwilling to continue contract farming with this firm. Hence, the role of continual communication and assurance in contract farming cannot be understated.

Research focused on increasing tomato yields has also been a significant reason for the success of the operations at Pepsi. Intensified efforts at R & D have helped the firm procure raw materials in the quantity and quality desired. Another fallout of increased yields which has contributed to the success of this operation has been that farmer incomes have gone up. It has been estimated that on an average, the per acre income of farmers (net of price paid for seedlings and fertilizer) is approximately Rs. 1,000-1,500 during the tomato season. That the farmers return year after year to contract with Pepsi gives a clear indication that their financial situation has improved since they began working with this firm. This aspect of contract farming must be kept in mind if one has to sustain operations over a long period of time.

Finally, it is worth stating that the operations set up by Pepsi at Zahura, while successful in the context of contract farming, incurred financial losses which amounted to about Rs. 4 crores per annum on an average during the first three years of its operations, and is expected to break even only in the current financial year (Abhiram Seth). While a firm of the financial clout of Pepsi can afford to bear the losses for several years, the same will most probably not hold true for a medium sized domestic firm.

However, most elements of this experiment would have to be emulated, particularly with regards to contract farming. Such essential factors include, for one, working in close connection with the farmer, for another, honoring the contract established between the two parties as an essential step towards establishing a positive working relation with the farmer. Most essentially, however, the firm must attempt to increase the farmers' incomes, preferably through yield augmentation, if it wishes to be successful in contract farming.

This applies to both the linkage between the industry engaged in supply of inputs to the farmers as well as the industry segments that procure agricultural output from the farmers. How could such linkages be successfully forged not only between industry and farmers but also with other stakeholders like the Government, Nongovernmental Organizations (NGOs), Research and Academic Institutions to facilitate a vivid understanding of the market demands and assemble the apparatus needed to satisfy them.

INSTITUTIONALIZING FARMERS' NETWORKS

A wealth of literature surrounds the subject of accelerated economic progress through networking. Though large organizations seem to have benefited more from networking, it is the small and medium enterprises and farmers who can perhaps derive the best mileage by forming and sustaining networks. Organizations like Xerox Corporation, General Electric and International Business Machines are often cited as examples of success in unleashing the collective creativity within them through formation of strategic networks and strategic communities. It is common knowledge among the agricultural extension community that farmers are gregarious by nature and are amenable to influence leaders and innovators. Training and involving the youth as change agents and network instruments for faster diffusion of knowledge could be explored (see box 2).

Box 2. Disseminating knowledge on sustainable irrigation in Brazil (World Development Report 1998/99).

In many countries the irrigation sector is the largest water user accounting for up to 80 percent of consumption. It is also a wasteful user because of poorly maintained infrastructure, inefficient technology, and negligent management. Low-value crops are often grown with expensive irrigation water that could be put to better use on higher value crops or outside agriculture altogether. In addition to the high cost of governments of subsidizing irrigation systems, widespread irrigation contributes to drainage and salinization problems and groundwater pollution, and thus to the abandonment of formerly fertile land.

Often the problem is that knowledge about appropriate technology is likewise inefficiently distributed. A counter example comes from a World Bank project in the Formosa irrigation district in Brazil's northeastern state of Bahia. When the project started, farmers in the local water user association were reluctant to adopt efficient water management options, such as water-saving sprinkler systems and higher-value crops. Water changes did not cover operation and maintenance costs, and the system was unsustainable.

In 1995, an analysis of the reasons for the limited interest in change led to an emphasis on involving the farmers' children and thus to Projeto Amanha (Project Tomorrow). A vocational school was founded to teach the younger generation about better irrigation, new agricultural techniques, and plant nursery management. With 120 students per class, the school has expanded to offer classes on sewing, furniture building, and beef and poultry production. Students also learn how to run saw mills and repair tractors. The school has 100 hectares of land planted with high-value crops for educational purposes. With the revenues from all these activities, it is self-sufficient.

The school has turned the project around. The water user association which administers Projeto amanha, now has both older and younger members and is recovering between 80 and 100 percent of the irrigation district's operation and maintenance costs. The young people have convinced their parents to try new technologies and to plant high-value crops. One 1996 graduate reported that, before the project, his mother and eight siblings had barely survived by planting beans on their 15-hectare plot. Now he has started to grow high-value mangoes, bananas, and passionfruit, in the process increasing his family's net annual income 30-fold, from about US$400 to US$12,000.

Organized networks of small farmer groups on a large scale which is often described as 'Large Scale Small Group Activity,' among weak farmers in irrigated areas could also help them in moving from a laggard to adaptive and further on to a innovative phase in diversifying their product mix through diversified cropping pattern and improved quality of their farm output. Such small farmer groups also lend themselves well to problem-solving exercises in matters of pest management, land reclamation etc. The transaction costs of obtaining new information about availability of better and more effective agricultural inputs, superior crop husbanding practices, processing possibilities and marketing opportunities decline when farmers are organized into small manageable groups. In the context of privatizing agricultural extension services and promoting farmer-centered extension services, the prospects of organizing farmer networks should be fully exploited.

CLOSING KNOWLEDGE GAPS— LEVERAGING INFORMATION TECHNOLOGY (IT)

While networking has proved to be a powerful strategy in increasing the knowledge levels as also enabling the farmers to exploit opportunities in their environment, information technology is yet another lever that could be used to close knowledge gaps that have a critical bearing on agricultural productivity, quality and markets. While the Brazilian example underlines the importance of youth participation, one would not be hard pressed to imagine how much more progress could be achieved, if information technology is utilized as a support system for knowledge diffusion.

Information problems lead to market failures and impede efficiency and growth. Development thus entails the need for an institutional system that improves information which is the life blood of all markets and creates incentives for effort, innovation, saving, and investment, and enables progressively complex exchanges that span increased distances and time. The exploding capacity and plummeting costs of communications technology could greatly expand the potential for both the acquisition and the absorption of knowledge. The efforts being made in states like Andhra Pradesh and Madhya Pradesh in India to promote the Internet revolution through broad band optic fibre networks across both urban and rural areas is illustrative of the significance being attached to IT in the context of agricultural and rural development.

CONCLUSION

Clearly, the unfolding scenario in the global business environment emphasizes that a strategic thrust on productivity is necessary but not sufficient for the long-term growth of irrigated agriculture. What is at hand is not merely the problem of combating poverty among irrigated farmers but ensuring their competitiveness in the global marketplace as the irrigated cropping pattern in India resembles so closely the globally traded agricultural product-mix. Farmers

need to look at newer and more innovative ways of relentlessly seeking and adding value to the agricultural output in pursuit of higher returns, through a blend of knowledge-intensive and market-driven strategies.

REPORT ON WORKSHOP DISCUSSIONS

INAUGURAL AND TECHNICAL SESSION

The India national workshop for the proposed "Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia: India" was held on 25 June 2001 in Hyderabad, India. The workshop was organized by the Administrative Staff College of India (ASCI) in collaboration with the International Water Management Institute (IWMI). The workshop was held at ASCI in Bella Vista, Hyderabad. Attendance included a wide range of experts from government, academic, and nongovernmental organizations. Co-chairs for the workshop were Dr. K. V. Raju, Dr. Tushaar Shah from IWMI-India, and Dr. Mahdusudan Bhattarai from IWMI.

The inaugural address was given by the Secretary of the Ministry of Water Resources, Dr. Shri B. N. Navalawala. Dr. Navalawala stated that poverty alleviation has been the primary objective of development planning since India's independence. In line with this, the government has been a key player in the development of India's water resources. While India has been able to achieve food security, they still have much to do in the fight against poverty. Dr. Navalawala highlighted the fact that hunger perpetuates poverty. Problems facing irrigation in India include low levels of public investment and poor maintenance of rural infrastructure. Previous efforts have primarily involved subsidized inputs and output price supports. The sustainability of the positive achievements is uncertain, as the subsidies have come at the cost of other infrastructure investments. In addition, growing food demand will place further strain on the agricultural sector. Current policies for water resources have rarely balanced the goals of efficiency, equity, and ecological integrity. Dr. Navalwala expressed the idea that the objective should be to optimize output per unit of water rather than per unit of land. The planning strategy should focus on conservation-oriented approaches in light of the growing water scarcity. Achieving irrigation management that provides equitable distribution of water in marginal areas is possible, but requires more attention that responds to the local conditions of poverty.

Dr. Madhusudan Bhattarai of IWMI made the next presentation giving the broad background of the proposed project. His presentation was entitled "Study on Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia." The presentation began with a brief history of IWMI and a review of specific research themes within IWMI. Dr. Bhattarai then introduced the project. Motivations for the project are based upon the history of agricultural and rural development in the Asian region. While great progress has been made, benefits from irrigation remain highly skewed in their distribution and performance remains generally poor. These conditions have led to persistent poverty within irrigated areas. Therefore, the project will initially conduct research in order to identify the linkages between irrigation performance and poverty. Then from these finding potential intervention strategies in irrigation will be identified that have a positive impact on poverty alleviation.

The next presentation was made by Dr. K. V. Raju concerning India's proposed work plan for the study. Dr. Raju established that the remaining areas of poverty in existing

irrigation schemes was due to inequitable distribution of water caused by poor management, among other factors. Dr. Raju briefly discussed the background of water resources and irrigation in India. Compounding the existing management problems is the rapid rise of competition for water resources. These conditions call for a more elaborate set of interventions that provide the incentives and mechanisms necessary to realize a more equitable distribution of water, in order to further alleviate poverty. These interventions should be flexible enough to respond to unique local conditions. He then presented the objectives, hypothesis, and methodologies for the research.

The next presentation was given by Dr. M. V. K. Sivamohan who discussed some issues concerning the research topic. General issues included the seriousness of poverty in India, evolution of the policy agenda to include environmental and poverty concerns, low performance of irrigation, degree of decentralization and market mechanisms, a widening gap between the haves and the have-nots, and integrated water resource management. Dr. Sivamohan then discussed country specific, macro-level, and meso-level issues.

In the pre-lunch session, there were six brief presentations. Dr. Wani presented ICRISAT's watershed work. Mr. Pangare presented India PIM's work. Dr. Sithapathi Rao presented the experiences of IRDAS, a Hyderabad-based NGO with irrigation reforms in the state. Dr. Jasween Jairath, a social scientist who has written on Andhra reforms and is now associated with SaciWATER, presented a new capacity building initiative for South Asia.

In particular, Dr. Rao defined the poor as those who did not have adequate access to equitable water supplies or lack the capacity to utilize the water they did receive. Dr. Rao stated the importance of establishing appropriate systems to ensure access to reliable and equitable water. He further stated that the principal responsibility of the irrigation agency is to assess water availability and to allocate it equitably. Water tariffs should be put in place in such a manner that the costs of operations and maintenance are covered. Farmer should be encouraged to adopt an integrated farming system to supplement their income. This ties in with extension activities that would also transfer technologies to the water user associations. Another aspect that Dr. Rao mentioned was the strengthening of infrastructure to facilitate marketing activities. Finally, management needs to be the recipient of capacity building activities at both the government and WUA levels.

BRAINSTORMING SESSION

The post-lunch session discussion focused on two issues: [a] exploring alternative hypotheses/ propositions about poverty-impacts of surface irrigation systems; and [b] alternative interventions in system design, institutions, system management, and water use with the potential to enhance the positive poverty impacts of irrigation.

The major theme for question 'a' regarded the fact that surface irrigation systems confer maximum benefits to mid-reach farmers. It was stated that head-reach farmers tend to suffer from self-inflicted waterlogging and salinity, while tail-end farmers suffer from a lack of access to irrigation water. Some participants argued, albeit without supporting data that the tail-end areas tend to be populated by the poor, whereas the head reaches are controlled by the well off. It was finally decided to treat this as a researchable hypothesis.

The issues were raised concerning the plight of farmers located within command areas who neither get irrigation water, nor get access to new development schemes outside the command area. Moreover, in some systems, they even have to pay levies charged on canal irrigators. Here there is a clear case of inequity; but it is not clear if a poverty issue is involved since even the 'uncommanded' farmers can be large and affluent ones. The culmination of this discussion addressed the problem of determining an operationally meaningful definition of poverty for the ADB project's specific context. The majority suggestion was to use the "level of water deprivation" as a surrogate for poverty in irrigation systems.

An insightful remark was made that canal systems attract rural poverty from the surrounding areas. Irrigation schemes in Punjab and Haryana have seen an influx of rural poor from Bihar looking for wage labor. Therefore, a headcount of the people residing in the command may ignore the "imported" poverty. Mr. Bhogale pointed out that analysis should not be in terms of command areas of irrigation systems but, rather, the irrigation scheme's "zone of socioeconomic influence." This area may extend beyond the command area in to the downstream as well as the catchment areas.

Concerning question 'b', much was said about how to make surface irrigation more efficient and reliable, but not much was offered concerning how to make it pro-poor. An undercurrent was that institutional reform and participatory irrigation management (PIM) are a panacea for all problems of canal irrigation. Alternatively, it was countered that while institutional reforms in Andhra Pradesh may improve operating efficiency, collection performance, and even water productivity, there is no indication that it will help poor people get more out of irrigation. Some (like Mr. Patil and Lele) suggested that the new dynamic and political economy unleashed by the reforms gave the village leaders control, which may even lead to further exclusion and water deprivation of the poor.

Other points raised from the discussion that can be tied to further development of the research work under the ADB Project include:

1. Dr. Bhogale, from WALMI, Aurangabad, suggested that if irrigation systems are made "simple and stupid," then they could shed the oppression of technocracy and become more accessible to the poor and the disadvantaged. For example, Dr. Bhogale discussed the Mazalgaon scheme in the Giakwadi system near Aurangabad where automation has improved the system performance and access to the poor. This seemed like a contradiction, as a computer-run system might be more inaccessible and mystical to the poor than a "simple and stupid" system. However, it would be useful to examine the Manzakgaon system to gain understanding of how the poor relate to it.

2. A related point was that design changes through physical interventions produce better equity outcomes in terms of water deprivation within the design command. Under the World Bank supported National Water Management Program (NWMP), physical design changes were made in several Indian surface irrigation systems (e.g., cross regulators replaced sluice gates; limited automation was introduced; upward communication was improved). One explicit objective was to improve

spatial equity. It would be interesting to analyze whether the NWMP actually achieved better spatial equity.

3. S. N. Lele suggested that as systems become more rule-bound and less subject to the whims of local functionaries, it is likely that the poor will benefit more from them. He referred to work by S. A. Dabholkar, a Kolhapur mathematician, that it is possible with good land and water resources to create public-sector-bank-clerk level household income from 1/10th of a hectare. That is 1 square foot of foliage with 8 hours of leaf area exposure to sunshine produces 3 grams of dry matter per day, which was Dabholkar's crop-per-drop equation.[1]

4. Water rights were discussed within the context of whether they can produce more equity and equitably shared "water deprivation." Lele and Patil observed that a notion of local water rights and associated obligations might begin to emerge only when a community invests in producing new water. They cited the example of Ozar village near Nasik in Maharashtra where three WUAs began to use drainage water from canals to recharge aquifers by constructing check dams. Since groundwater users are not always WUA members, they began charging for groundwater use by farmers. Initially, the farmers resisted the charge, but then the WUAs threatened to stop damming the drainage water for use as recharge, the notion of paying for groundwater was accepted and internalized.

5. The point was raised that surface irrigation can empower local communities and give them greater freedom when irrigation design integrates decentralized local water storage under local community control. Mr. Sarma pointed out that the Pochampad project in Nagarjun Sagar in Andhra Pradesh fills up 300 tanks in the command, which makes two irrigated crops per year possible. It would be useful to examine if this system is more equitable than the conventional flow irrigation systems.

6. Another point was made regarding the *warabandi* system. It was suggested that the *warabandi* system (popular in the Indus basin in Pakistan Punjab and the Gang canal in Sri Ganganagar in Rajasthan and in Indian Punjab) has better equity in irrigation access than compared to the *sejpali* system (popular in Western and Southern India). An important issue for research would be an examination of the difference of water deprivation in design command under *varabandi* compared with the *shejpali* system.

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[1]Dabholkar (who wrote "Plenty for All", Mehta Publisher, Pune: Ramya) was one of the few barefoot scientists who charged farmers a fee of Rs 15 for every lecture he gave. He eventually bought a Fiat car for himself from the fees farmers paid to him. He is widely considered the father of the grape-orchard revolution that is being widely adopted in parts of rural Maharashtra. Regrettably, he passed away 4 months ago and has left few working sheets on a life full of farmer experiments that he guided.

Overall, it seems that the ADB project needs to be designed to capture the diversity of system designs, institutions, operations management, and conditions found in surface irrigation in India. This approach will be required to reach the meaningful and insightful conclusions that ADB is expecting the project to produce. If the study is limited to a single system in Andhra Pradesh and a single system in Gujarat, then this may not capture enough variety of situations to carry out meaningful policy analysis.

Possible research hypotheses given in the group report include:

1. Tail-end farmers are generally smallholders.
2. If landholdings are greater, there is less deprivation of water.
3. Head reach farmers realize less water deprivation.
4. Socially backward farmers experience more water deprivation.
5. Conjunctive use: only rich farmers can go for wells, however, if done collectively, it is likely to help poor farmers.
6. Canal water and watershed development works in bad years can be complementary to each other.
7. A case study of Kharif utilization of canal water as pro-poor intervention.
8. Mere availability of water is not enough. Water availability with credit facility is the real requirement of poor farmers.
9. Training and capacity building at the grass-root level, namely of farmers and officers of WUAs, will serve as pressure on the bureaucracy for understanding the WUAs. This is indirectly imparted training to the officials of irrigation department.
10. User-friendly canal systems are tested on a pilot basis.
11. Government domination in irrigation sector has to be greatly reduced. Therefore, appropriate institutional, policy, and legal interventions are needed, which are necessarily pro-poor.

INDONESIA

Country Workshop

23 May 2001

Sectoral and Structural Poverty Syndrome in Irrigated Agriculture in Indonesia

Mochammad Maksum * *and Sigit Supadmo Arief* **

INTRODUCTION

It is very interesting to recall the suggestion of the Center for Rural and Regional Development Studies of Gadjah Mada University (CRRDS-GMU) to the Minister of Agriculture years ago to change the official name of the Department of Agriculture (DOA) of this republic to the Department of Agronomy. This suggestion was raised in a national seminar before the DOA Minister as a serious criticism due to the fact that the overall efforts of DOA at that time was strongly concentrated on production-oriented programs; and it was not very surprising that the country successfully achieved self-sufficiency in rice in 1984. However, such development progress was not very well accompanied by meaningful progress in human development of the farmers as primary producers.

Many more empirical criticism have also been forwarded by CRRDS to the government knowing the fact that the government followed too many development policies that were very insensitive to the socioeconomic needs of the people. To illustrate a few, among other *socioeconomically insensitive policies* were TRI, BPPC, food monopoly, rice biased development policy in agriculture, and many farmers' insensitive institutional development policies.

It was an irony considering the case of the TRI (people's sugarcane intensification) program. Through a very intensive study conducted right after the issuance of Presidential Instruction on TRI, documented as INPRES No. 09/1975, the Center recommended the government to abolish that program as soon as possible due to socioeconomic unsuitability of the program to the farmers. The same study, conducted by the Center twenty years later, produced just the same recommendation on that issue to the government, but such a recommendation was never taken into proportional consideration. However, such policies: TRI, BPPC, monopoly, etc., were abolished after the issuance of the IMF Letter of Intent (LOI) during the crisis.

The country's irrigation development was not an exception. This sector had been very strongly positioned to support the rice-biased agricultural development for the sake of food self-sufficiency. Radical reformation of the national irrigation policy that has been well

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drafted and socialized strongly indicates the need for having a more comprehensive and socially sensitive development policies. Otherwise agricultural sector would be dampened more deeply into its sectoral and structural poverty in the *next crisis*.

THE INDONESIAN CRISIS: A REVIEW[1]

In the aftermath of the Asian financial crisis, it is now nationally accepted that agricultural sector of Indonesia has been impoverished within the country's development model. Economic growth has been selected by the country's development planners as the primary development priority, joining other countries in adopting what has been called the "Asian development model." This model has successfully improved the living standards of many countries but with very limited attention to the need of attaining the *growth-equity-sustainability*[2] objectives of the country's development.

Development progress of Indonesia has presented a typical case of the *successful* economic development model of a country with a very authoritarian and interventionist state. During the past decade, Indonesia made rapid and remarkable economic growth with the help of strong government-oriented policy thrust. The successful economic progress has functioned to legitimize the government dependent economic development under the authoritarian regime.

During the first month of the crisis, the International monetary Fund (IMF) was still forecasting 3 percent of GDP (Gross Domestic Product) growth for Indonesia in 1998–1999. Moreover, the Vancouver Conference of APEC was predicting even higher GDP growth of 6 percent. And the World Bank President, James Wolfensohn was still very optimistic by stating his belief to the Jakarta Post that the Indonesian economic crisis was over. Only after few months of his optimism, he finally accepted that his optimism was completely misleading.[3]

There was no prediction at all that the Indonesian economy would be seriously hit by a currency drop from Rp 3,200 per US Dollar before the crisis to its minimum level of Rp 17.000 per US Dollar, in December 1998. Such optimism could be very well understood, due to the promising statistics of the Indonesian macroeconomy before the crisis[4] (tables 1 and 2).

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[1]Major part of this review is adopted from Mochammad Maksum 2001. Economic Crisis and its Human-Social Cost in Indonesia. Paper presented at an international seminar on: Civil Society Response to the Asian Crisis in Three Countries: Indonesia, Korea and Thailand. Seoul, Korea, April 20-21, 2001

[2]The critical triangle as cited by Mochammad Maksum. 1997. The Critical Triangle of Agricultural Development. In Maksum, M. et al. (eds.) 1997. People Based Sustainable Agricultural Development for a Global World. P3PK-UGM.

[3]He was saying to the Jakarta Post that he was not alone in thinking that 12 months before Indonesia was on a very good path. There was no prediction at all then, he said, of an 80% drop in the Indonesian currency. Read more in Mann, Richard 1998. Economic Crisis in Indonesia: the Full Story.

[4]Mann, Richard. 1998. Economic Crisis in Indonesia: the Full Story.

Table 1. Annual growth rate of GDP and population, 1970-1996.

Year	GDP Growth (%)	Population growth (%)
1970	7.5	2.32
1975	5.0	2.32
1980	9.9	1.98
1985	2.5	1.98
1990	7.4	1.98
1994	7.5	1.69
1995	8.2	1.69
1996	7.8	1.69

Source: Central Bureau of Statistics of Indonesia.[5]

Table 2. The number of poor population in Indonesia, 1976-1999.

Year	Number (millions) of			Percentage of
	Rural poor	Urban poor	Total poor	Poor population
1976	44.2	10.0	54.2	40.08
1979	38.9	8.3	47.2	32.30
1980	32.8	9.5	42.3	28.56
1981	31.3	9.3	40.6	26.85
1984	25.7	9.3	35.0	21.64
1987	20.3	9.7	30.0	17.42
1990	17.8	9.4	27.2	15.08
1993	17.2	8.7	25.9	13.79
1996	15.3	7.2	22.5	11.35
1998	31.9	17.6	49.5	24.2
1999	32.3	15.6	48.0	23.4

Source: Recalculated from the Central Bureau of Statistics.[6]

[5]Cited from SUHARDJO. 1998. Country Paper on Food and Agriculture Policy in Indonesia. Presented in the First Regional Experts' Workshop on Food and Agriculture Policy. Los Banos, Philippines, June 23-24.

[6]Cited from various series published by the Central Bureau od Statistics (CBS) of the Republic of Indonesia. This poverty statistics, according to DILLON, H.S left approximately 50 million people classified as near poverty community which is very fragile to any poverty line changes. Read Dillon. 2001. New Paradigm in Poverty Alleviation Program in Indonesia. Presented in a Half-Day Seminar on Poverty Alleviation, at the Center for Rural and Regional Development Studies (CRRDS) Gadjah Mada University, June 18, 2001.

The Asian financial crisis is undoubtedly the one single event in 1997 creating the most destabilizing impact in Asia. The economic and growth performance of the so-called Asian 4: Thailand, Indonesia, Malaysia and the Philippines, were suddenly challenged by the onslaught of the financial debacle that originated by the depreciation of the Thai Baht, which was soon followed by the Indonesian Rupiah, Malaysian Ringgit and the Philippines Peso. Such contagion has also spread even to Hong Kong, Korea, Singapore and the Russian states.[7]

Compared to the crisis faced by other Asian countries, the crisis faced by Indonesia is unique in several aspects. The uniqueness can be seen in the multidimensional nature and the extent of the crisis. The latter has placed Indonesian rupiah comparatively the most affected local currency by the Asian crisis (table 3).

Table 3. Rates of depreciation of Selected Asian Currencies.[8]

Currency	Exchange rates to US$		% Change
	1 July, 1997	24 January, 1998	
Indonesian Rupiah	2,432.00	14,800.00	-83.6
Malaysian Ringgit	2.52	4.58	-44.9
Philippine Peso	26.37	43.50	-39.4
Singapore Baht	1.43	1.76	-18.8
Thai Baht	24.53	54.00	-54.6
Korean Won	888.00	1,744.00	-49.1

The crisis in Indonesia actually began months before the Asian crisis began. The Indonesian macroeconomy at that time was disturbed by serious natural calamities. Forest fire destructing large forest area and very long drought destroying agricultural production could be considered as the preliminary crises of the country. The former has also disrupted both the national and regional economies as it decreased strongly the flow of foreign tourists and foreign capital to the country.

Before the country fully recovered from the natural crisis, Indonesia faced the financial crisis with several other Asian countries. Indonesia, which for decades had enjoyed a robust economic growth suddenly plunged itself into deep economic crisis which washed away almost all the achievements that the country had gained until then. Indonesia, which before the crisis had achieved an average of annual GDP growth rate of above 7 percent in 1996, suddenly had to face negative growth rate of its national economy.

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[7]Manalili, Nerlita M and Luis Santiago,Jr. in their paper: The Implication of the Asian Financial Crisis on South East Asia-the Case of the Philippine Food and Agricultural Sector, moreover elaborated a little about possible conspiratorial move from the west with a political agenda to punish the Asean for accepting Myanmar to its ranks. But they claimed further the contagion has spread much more than the Asean.

[8]Source: Montess, Manuel F. 1998. Currency Crisis in Southeast Asia. Updated Edition. ISEAS Publication. Stamford Press. Pte. Ltd.

While Indonesia was in the middle of facing the impacts of the economic crisis, the country suddenly entered into its political crisis. Although several macroeconomic indicators recently showed the progress against the crisis, there is no reason to claim that the Indonesian crisis is completely over. People may hope that the country stability would be very significantly determined by the final result and the quality of the electoral process.

To summarize: there are two dimensions of the Indonesian crisis, the short-term and the long-term. The short-term condition is attributable to the result of the Asian crisis characterized by the massive out-flow of foreign capital from Indonesia and the rest of Southeast Asia, following the floating of the Thai Baht on July 2, 1997. For the case of Indonesia, this out flow has been made even worse by the failure of business sector in paying foreign debt due to unproductive investment decision.

The Indonesian crisis was an event waiting to happen very long before it was precipitated by the Asian crisis. Aside from other minor causes including natural calamities, this collapse has its roots in a development model imposed on the country over the last three decades by the Indonesia's development planners of the Soeharto authoritarian government and the World Bank. The element of this model, which has been criticized by many development experts of the country, basically had four main roots, namely: (i) the adoption of the top-down development model; (ii) foreign capital and foreign input based development; (iii) industry biased development; and (iv) rice biased development in agriculture.[9]

SECTORAL POVERTY OF AGRICULTURE

Social cost of such main roots was very high at the expense of the domestic resource-based sector, including agriculture. The first root, the strategy which can be described as the 'top-down development model,' was pushed by an alliance between the military elite and its technocratic partners in order to gain legitimacy for the ruling regime by delivering economic growth. By this approach, therefore, local potentials, natural resources capacity, and local community needs have never been taken into serious consideration.[10] The adoption of this development model has resulted in a more serious social cleavage with potential social conflicts and collective violence which could be easily observed in the country nowadays.[11]

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[9]Read Maksum, Mochammad. 2001. Economic Crisis and its Human-Social Cost in Indonesia Presented at an International Seminar on: Civil Society Response to the Asian Crisis in Three Countries: Indonesia, Korea and Thailand. Seoul, Korea, April 20-21, 2001.

[10]It is clearly elaborated in MAKSUM, Mochammad, 1998. *Ringkihnya Ketahanan Pangan National Kita*. (The Fragility of Our National Food Security). Paper presented at the CRRDS-GMU monthly Seminar, August, 1998.

[11]About collective violence could be read further in Mohtar Mas'oed, M. Maksum and Moh Syuhada (eds). 2001. Kekerasan Kolektif: Kondisi dan Pemicu. (Collective Violence: Condition and Precipitation). P3PK-UGM. And read also Maksum, Mochammad. 2001. Sampit: Konflik SARA, Politis atau Marjinalisasi Lokal. Press-Release Material. P3PK-UGM, March 8, 2001.

Sectoral poverty of agriculture has also resulted from the second root, which can be regarded as 'foreign-based development.' To make foreign input and imported capital goods cheaper in order to make import-dependent industrial enterprises more feasible, some policy measures were selected. The most crucial policies adopted during this development period were monetary policies that tended to overvalue local currency. This *rupiah overvaluation*, coupled with some fiscal policy measures that made import of raw materials cheaper, made both local raw material and local product relatively very expensive *vis-à-vis* the imported commodity. Again, these policies directly penalized natural resource intensive industry (NRI) of the country. To illustrate the condition, it was fresh in mind, that producing a grain of rice and a drop of animal feed domestically, during that period, were much more expensive than importing both, while the present limitation to import these two strongly indicates part of the economic collapse. Such a *currency overvaluation* has made the import of raw material, which shared more than 70 percent of total import value, possible (table 4).

Being the third root, 'industry biased development model' adopted by the regime amplified the effectiveness of the first and the second roots. It was not coincidental if the industrial sector selected by the regime was not the locally Indonesian based industry. The regime, in order to legitimize its supremacy, selected capital-intensive industry (CII), skilled

Table 4. Data on import distribution value based on commodity economic group (in million US$ and %).[12]

Year	Commodity grouping			Total
	Consumer good	Raw material	Capital good	
1993	1,146,10	20,034.80	7,146.90	28,237.80
	(4.06)	(70.95)	(25.31)	(100.00)
1994	1,430.18	23,133.57	7,419.70	31,983.50
	(4.47)	(72.33)	(23.20)	(100.00)
1995	2,350.45	29.586.56	8,691.73	40,628.74
	(5.78)	(72.82)	(21.39)	(100.00)
1996	2,805.93	30,469.65	9,652.93	42,928.50
	(6.54)	(70.98)	(22.49)	(100.00)
1997	2,166.26	30.229.54	9,283.98	41,679.78
	(5.20)	(72.53)	(22.27)	(100.00)
1998	1,970.47	19,581.00	5,785.40	27,336.87
	(7.21)	(71.63)	(21.16)	(100.00)
1999	2,468.30	18,475.00	3,060.00	27,336,87
	(10.28)	(76.97)	(12.74)	(100.00)

Note: Values in parenthesis indicate corresponding percentages.

[12]*Source*: percentage calculation based on http://indag.dprin.go.id/indo/perdag/exim>

labor-intensive industry (SLI) and high technology intensive industry (HTI), instead of choosing natural resource- intensive industry (NRI) and unskilled labor-intensive industry (ULI). Basically that choice was clearly misleading knowing the fact that these last two industrial sectors, NRI and ULI, have been the economic sectors dominating the non-petroleum and non-gas foreign earnings for a very long period. Many indicators showing the industrial bias at the expense of NRI and ULI are presented by unfair credit distribution (table 5).

Table 5. Sector credit absorption and default rate as of September 1998 (Based on Bank Indonesia estimate).[13]

Economic sector	Credit absorption (%)	Credit problem (%)
Industry	37.8	80
Services and real Estate	26.2	75
Trade	21.7	50
Agriculture	6.7	n.a.
Others	6.6	n.a.
Total	100.0	

The theoretical base of the three roots was developing and fighting for a competitive advantage in facing liberalized global market during the twenty-first century. However, developing such advantage by penalizing the sectors naturally having comparative advantage, such as NRI and ULI, was a very unreasonable strategy. Competitive advantage should have been developed without destroying the already endowed comparative advantage of the economy.[14]

By considering the 'rice biased agricultural development' as the fourth root, the writers do not mean that this root was the least damaging policy. It has to some degree the same damaging impact on agricultural development. This rice-centered development had some negative impacts on agricultural development. Among other impacts are: (i) its productive approach has left the farmers remain poor; (ii) input dependency of rice farming made rice sustainability questionable; (iii) rice biased agricultural policy left almost no incentive for producing other agricultural commodities; (iv) non-rice economic development, including R&D, was very minimal; (v) production diversification was not encouraged; (vi) more MNCs dependent of non-rice production system; and (vii) food security profile tends to depend on a single staple food, which is rice, instead of diversified staple foods as previously practiced

[13]See further in Chafrany, Gabriel. 1998. *Fokuskan Prakarsa Jakarta pada Sektor Pertanian dan Ekspor* (Concentrate the *Prakarsa Jakarta* Fund for Agriculture and Export). Kompas, September 17, 1998 p.3.

[14]Read further in Maksum, Mochammad. 1998. *Pembangunan Pertanian Berbasis Ketahanan Pangan.* (Food Security Based Agricultural Development). Paper presented at the Seminar on the Structural Change of Agricultural Development. Organized during the 34th Anniversary of the faculty of Agricultural Technology, GMU.

by Indonesians. In turns, due to sectoral mal-development, agricultural sector including fishery and forestry subsectors hardly gain any global trade advantage during the crisis.[15]

Agriculture is in trouble in Indonesia, but it is a crisis that is predominantly man-made through, for example the main roots above-mentioned, not a crisis that significantly stemmed from drought and forest fire, although the contribution of them could not be nullified. The combined effect of several factors have been mentioned, forest fire, severe drought, and the financial crisis amplified by socio-political crisis, pushed half of Indonesia's 203 million people below the poverty line by the end of 1998 and left 7.5 million people in Indonesia facing acute food shortages.[16]

Unlike the production estimate issued by the Indonesia Central Bureau of Statistics, FAO Mission more extremely projected that rice production for 1998 was 47.5 million tons of paddy, 3.6 percent down from the previous year's harvest, 6 percent above the 1996 harvest, and 11 percent below the official target. Consequently, Indonesia which fought hard to achieve self-sufficiency in rice production in the 1980s, faces a record food deficit of approximately 3.5 million tons for the marketing year 1998/1999, which ends on 31 March 1999.[17] In addition to rice as the staple food, Indonesia had to import 4 million tons of wheat during the same period (table 6). This deficit, combined with decreasing purchasing power of the nation due to the crisis, has drastically downgraded Indonesia into a country group classified as the Low Income Food Deficit Countries (LIFDCs).[18]

Table 6. Production growth of paddy rice in Indonesia 1995-2001.

Year	Harvested area (ha)	Yield (Q/Ha)	Production (ton)	Growth (%)
1995	11,438,764	43.49	49,744,140	6.65
1996#	11,569,729	44.17	51,101,506	2.73
1997#	11,140,594	44.32	49,377,054	-3.37
1998#	11,730,325	41.97	49,236,692	-0.36
1999	11,963,204	42.52	50,866,387	-3.31
2000+	11,608,281	44.09	51,179,412	0.62
2001*	11,413,784	43.08	50,080,787	-2.15

Note: + Preliminary Figures;* First Forecast; # Including East Timor.
Source: Central Bureau of Statistics, Indonesia.

[15]Export development of agricultural sector showed minimum growth in 1997 and 1998, while some industries in this sector showed even negative growth. When local currency depreciated, this negative or minimum growth of domestic based sector should have not been the case if sectoral development is normal. See Appendix tables 2 and 3.

[16]FAO. 1998. Draought and financial crisis leave Indonesia facing record food deficit. http://www.fao.org/NEWS/GLOBALWATCH/GW98 10-Ehtm.

[17]Ibid.

[18]Read Mission Report on Indonesia of the FAO Special Program for Food Security (1998).

It has been globally accepted that food security is not food self-sufficiency. Food security has been globally defined as the access by all people at all times to enough food for an active healthy life. Four key elements, therefore, could be properly derived from this definition, mainly: (i) *availability*, (ii) *reliability*, (iii) *accessibility*, and (iv) *quality*. By the word availability, food security requires that food must be available, and the word reliability means that food supply should be stable both inter-temporally and inter-spacially. The third element,accessibility, tells us that food security should insure that all households have access to food either through their own production or through sufficient purchasing power, while the term quality means that the food should be in a socially *suitable and acceptable* quality.[19] Based on this understanding therefore, food insecurity can be logically defined to be the failure of availability, accessibility, reliability, or some combination of them, of healthy food.

The food security status of Indonesia before the crisis was characterized by significant proportion of calorie and protein deficient households. The current condition of serious food deficit, coupled with the fact that the nation is currently facing financial deficit and limited purchasing power at both the government and the household levels shows that the food security status of Indonesia is much worse than that during the years before. Some portion of the population has been reported as having acute food insecurity.

It must be clear in mind, that food insecurity was not the sole impact of the Asian crisis. Limited purchasing power of the nation due to currency depreciation has made the import of raw materials, which share over 70 percent of import value previously reported, remarkably low. In turn, this will reduce the absorptive capacity of industrial sector towards employment. Evolutionary movement of labor force from modern sectors to traditional one and from employee status to self-employed strongly indicates the impact of the Asian crisis on employment.

Among many other impacts, to mention a few, are: hyper-inflation, sky-rocketing price indices, increase in number of poor people, unfavorable change in trade balance and decrease in export earning of several dominant industries. Unfavorable change in trade balance would not have happened if the industrial choice had not been misleading, while the decrease in export earning of dominant industries would have never been experienced if the development of the NRI and ULI had been *implicitly* encouraged. Shifting the development strategy towards improving the competitive advantage of the NRI and ULI, seems to be the only solution of the country to survive during any future economic crisis. It is expected that with domestic resource-based industries, the competitive advantage could be very well developed through industrial development approach to progressively catch the global market tomorrow.

STRUCTURAL POVERTY IN IRRIGATED AGRICULTURE

An intensive workshop in structural poverty conducted in Yogyakarta, 1999[20] poverty, defined as absolute or relative inability of people to meet their basic needs, was classified into:

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[19]Derived from HEKS (Swiss Interchurch Aid). 1998. Petition and Recommendation of the International Conference on Food Security organized by HEKS in Bacolod City, the Philippines, July 19-24, 1998.

[20]That workshop was conducted by the Center for Rural and Regional Development Studies (CRRDS) of Gadjah Mada University in cooperation with KIKIS, Percik and AUS-Aid. December, 1999.

(i) natural poverty; (ii) cultural poverty; and (iii) structural poverty.[21,22] Natural poverty in this case was defined as the poverty due to natural constraints such as: sickness, age, disability, and other natural problems, and cultural poverty was understood as that due to cultural problems such as: laziness, consumptive habit, indisciplinary habit, and the like. Whereas, structural poverty was defined as that due to man-made or structural problems, such as: pricing policy, inequitable distribution of asset, input availability, etc.

By comparing the three kinds of poverty incidence, structural poverty was considered by the workshop as the most important to notice due to the fact that this kind of poverty has very significant impact on marginalizing the people, both in absolute and relative terms, with many possible consequences. Furthermore, for the case of Indonesia this marginalization has resulted in the displacement of the local people to become what is called as the internally displaced people (IDPs) in their region. Collective violence that could be easily observed in Indonesia nowadays is one among social impact of ill-structural treatment at the community level[23].

Sectoral poverty in agriculture as has been elaborated in the previous discussion could be considered as structurally affecting the incidence of structural poverty at the grass-root level, including irrigated agriculture. Though there is no figure differentiating the poverty level in irrigated agriculture, it is very reasonable to assume that it has significant contribution to poverty figures in rural areas, especially in Java.

The basic problems connected with structural poverty incidence are classified as: (i) power relation; (ii) institutional infrastructure; (iii) constraining policies; (iv) environment; and (v) cultural constraints.[24] For the case of irrigated agriculture, every single point of the problems is elaborated in table 7.

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[21]Read: Revrisond Baswir. 1999. Pembangunan Pedesaan dan Penanggulangan Kemiskinan. Paper presented at the Workshop on Structural Poverty Alleviation in Irrigated Agriculture. CRRDS-GMU.

[22]Sectoral poverty in irrigated agriculture has in fact structurallu happende also during the colonial era in solving the food shortage. This can be read in Yasmo Eumora. 2001. The Food Shortage and Javanese Society: From the Ends of 1910s to 1920. in Lembaran Sejarah. Volume 3. No. 01.

[23]Read: Mohtar Mas'oed, Mochammad Maksum and Moh Syuhada. 2000. Kekerasan Kolektif: Kondisi dan Pemicu. (Collective Violence-Condition and Precipitation). P3PK-UGM. Yogyakarta.

[24]This classification is well elaborated in KIKIS and AusAID. 2000. Agenda Keadilan dan Pemberdayaan Rakyat: Dialog Nasioonal tentang Kemiskinan Struktural. Jakarta. Seven focal points are: irrigated agriculture, urban poor, small scale industry, upland agriculture, forest community, labor community and fishery focal point.

Table 7: Basic problems connected with structural poverty in irrigated agriculture.

No	Basic problems	Observed problems
1	Power relation	• Top-down development
		• Low bargaining power in input and output markets
		• Input dependent farming
		• Low profitability
		• Unclear right on production inputs (water)
2	Institutional infrastructure	• Government oriented rural institutions
		• Village Unit Cooperative (KUDs) functioning more in favor of input companies and local capitalist
		• Low credit availability, bank plecit is more favorable
		• Farmer union is wrong representation of the farmers
		• Low agriculture and irrigation research
3	Constraining policies	• Industry biased economic policy
		• Rice-biased agricultural development
		• Pricing policy in favor of urban community
		• Capitalist-oriented export policy
		• Production-based agriculture and irrigation
4	Environment	• Water availability, reliability and equity
		• Higher input dependent of agricultural land
		• High land conversion
		• Lower carrying capacity
		• Higher population pressure and rural dependency of the economy
5	Cultural constraints	• More fragmented land
		• Women's role is limited
		• Subsistent oriented farming

IRRIGATION-RELATED FARM INCOME

It is globally accepted that farm income is normally connected with farm relative position, in terms of irrigation. Socioeconomic condition of the society varies as well, though it does not necessarily vary parallel with irrigation.

In Glapan Irrigation system, as in many irrigation systems, water is very unequally distributed and is characterized by excessive use of water in the head-area, while the tail-area is strongly marked by unavailability of water. Structural imbalance of water distribution in irrigation systems under observation indicated diverse socioeconomic impacts on the community. Consequently, agricultural income varies depending on access to irrigation water.

Cropping intensity, farming intensification level, commodity choice and other agricultural practices in the downstream area are significantly much poorer than that in the upstream area. Though farm income has been positively related to water availability in these areas, overall socioeconomic condition does not necessarily have the same pattern. In anticipating poor irrigation water availability, the downstream community has been more innovative in creating alternative sources of employment and income, as compared to those in the upstream area.

Unlike the Glapan system agriculture, agricultural practice in Kalibawang scheme presented a contradictory profile of farm income. Table 8 shows clearly this contradiction. A simple survey involving120 farmers of the head, middle and tail areas of the Kalibawang scheme shows that rice farming in the middle irrigated area has the highest income, followed by the tail and the head areas. These differences could be attributed to the fact that the efficiency in input use among three irrigation parts is remarkably different due to water availability. Provided by excessive water supply, the head area, which is located in a relatively hilly area experienced serious leaching in fertilizer and other chemical input use as compared to other parts.

Socioeconomic dynamics in this scheme was also very interesting to notice. Being constrained by poor availability of irrigation water, the tail-end community has been able to significantly mobilize their efforts in intensifying nonirrigated farm activities, such as, intensive gardening and animal husbandry. Though better income condition is still dominated by the middle area community, proportional contribution of various farming activities is remarkably different among areas.

Table 8. Percentage distribution of average household farm income across head, middle and tail reaches of the Kalibawang Irrigation System.

	Low-land	Housing garden	Animal (%)	Aquaculture	Total	Total value (Rupia)
Head	45.07	33.06	20.22	1.65	100	3,787,381
Middle	77.20	7.69	10.79	4.32	100	7,115,389
Tail	47.11	24.31	27.63	0.94	100	4,426,301

CONCLUDING REMARKS

Structural poverty of agriculture has been the most important social consequence of the economic development model of the country that was very strongly concentrated on its capital accumulation strategies with the strong support of state building measures. Natural resource and labor-intensive industries have been marginalized, but supporting the other sectors was discriminatively selected by the regime. In turn, structural poverty incidence in this sector escalated, both in absolute and relative terms.

The progress of poverty alleviation programs in Indonesia has never been very promising due to the fact that many of them were conducted very politically without prior understanding on the poverty incidence itself.

Structural poverty could be considered as the most important problem to consider. Agriculture and irrigation development in this country have never been very influential in alleviating poverty. These two sectors have been among the sectors marginalized within the economic development model of the country.

Paradigmatic changes have been well started in these two sectors, however, the potential influence of their development, to some extent, will be very much dependent on our understanding of structural poverty incidence on irrigated agriculture. Otherwise, potential impact of this sectoral development would never be optimally realized. Significant contribution of the irrigation sector would be very much dependent on the sectoral progress in agriculture. We may hope that agriculture and irrigation development have a very effective role in alleviating poverty, as far as irrigated agriculture is concerned.

Knowing the facts that the income structure might remarkably differ among areas within a single irrigation scheme or irrigation system, intensive observation and study connected with the area potential and dynamics are required to be able to come up with better agenda and policy measures of irrigation intervention. Otherwise, the local fitness of new policy agenda would be very poor and might create much more serious social problems.

Development Perspectives of Irrigated Agriculture in Indonesia

Effendi Pasandaran and Neulis Zuliasri *

INTRODUCTION

Indonesia's economic development is depended in large part on changes in the agricultural sector, particularly in the irrigated agriculture. The importance of irrigation development and management has been demonstrated by its significant contribution to food crop production and its significant share of public expenditures. Despite favorable policy support on irrigation in the past, in recent years, however, there has been a considerable slowdown in the rate of growth in rice yields.

This paper explores the complex issues related to irrigation management in Indonesia from the view point of development perspective. First it highlights irrigation development during the colonial and post-colonial period, followed by discussions on the trend of land and water resources utilization, and its consequence on production. Finally it draws some implications on food security and poverty reduction in Indonesia.

IRRIGATED AGRICULTURE DURING COLONIAL PERIOD

Irrigation was developed during the period of Hindu Rulers around the end of the first millennium in Java and Bali. This was considered major revolution in rice culture, which then gave rise to important social change in terms of division of labor and accumulation of wealth. Because of the increasing population pressure traditional methods of rice culture did not produce sufficient food. Irrigated agricultural practices were expanded to meet the increasing demand for rice. However, as the capacity of rice fields increased through irrigation, so did the population (Leander1992).This is particularly true for Java as reported by Boeke (1966), that the increasing production of rice was followed by the increasing population which caused the farmers in irrigated areas in Java remain poor.

One of the cultural inheritances on irrigation is the Balinese Subak system. Following Geertz (1963) the Subak is more than just "irrigation society" although its central role is on water management. The Subak is in fact an agricultural planning unit, an autonomous legal corporation and a religious community. It is quite different from the large irrigation systems in continental Asia which exhibit "despotism." Water management of the Subak systems and

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other traditional systems in Java are local and intensely democratic in nature. The advantages of these traditional systems, in which the canal layout generally classified as bifurcating system water, are divided in fixed proportion (Horst1998). Water allocation and its control system are open to society and the system is designed to enable equal access of water as an important principle of justice.

Contrary to the traditional systems, modern irrigation systems were introduced by the colonial rulers in the middle of nineteenth century as a response to inadequacy of food and most likely as a trial and error for larger scale irrigation in the downstream areas of river basins. The hierarchical canal layout is mostly adopted in modern irrigation projects. The water is distributed to large blocks and subdivided into smaller units.

The main feature of this modern system is the establishment of "a yearly cultural plan." It consists of two major components namely the cropping system plan and water distribution plan (Gruyter1933; Graadt van Roggen1935). The first refers to the arrangement of the crops within an irrigation system in a given year or in a given planting season and the second refers to allocation and scheduling of water supply to meet crops demand for water in a given cropping system plan.

The use of control structures such as "romijn" gates and geographically unequal positions of irrigation units may render unequal access to water (Horst 1998). Inherent in the design of modern irrigation system is the need for bureaucratic control of water to manage conflicts in water distribution during a planting season. The studies of irrigation management during the colonial period were focused on improving irrigation performance to support the cultural plan.

Most of the irrigation systems were run-of-the river type diversion systems with two major constraints during the beginning of the rainy seasons namely low water flow and limited availability of labor for land preparation. One of the major challenges was to develop water delivery scheduling in such a way so that the time for the peak demand for water matched with the time of the peak supply of water. The institution to regulate water distribution and scheduling of water delivery in pre-determined sections of irrigation system was established in 1933 by the name "golongan system"(Gruyter 1933). The development of this institution was supported by earlier studies such as that of Paerels and Eysvogel (1926) on crop-irrigation requirement and by van Maanen (1931) on the optimum size of irrigation unit.

The amount of water required by the irrigation systems in central Java varied between 0.25 liter/second/ha and 0.35 liter/second/ha assuming that all irrigated areas in an irrigation system were planted with secondary crops. Although there is a fixed number of sections of "golongan" in an irrigation system, in practice, there is a flexibility in terms of timing of water delivery depending on the level of water in the canal and availability of labor for land preparation. Generally, water was scheduled with differential time interval of two weeks from the first to the subsequent sections of a "golongan."

The appropriate section of a golongan is a tertiary unit with the maximum size of 100 ha (van der Giessen 1946). By this arrangement it is possible to split the total area irrigated in a village into several sections of golongan so that labor supply for land preparation can be appropriately scheduled. Ideally, the sections of the golongan system should be rotated every year, the last section scheduled in a year should be the first to be planted in the following year. In reality, however, such an arrangement is not always workable (Van der Giessen1946).

Another relevant issue of water management that emerged during the colonial period was water allocation among crops. For this purpose, there are several studies worthwhile to be discussed. Based on the study of Paerels and Eysvogel on the so-called normal supply there was a need to specify the relative irrigation requirement of major crops. There were three major crops identified namely: Paddy, secondary crops which comprise of soybean, corn, peanut, and other upland crops planted on irrigated rice field, and sugarcane as an export commodity. The ratio of irrigation requirements (RIR) between the crops varies from place to place depending on the factors such as topography, groundwater surface, rainfall, and the growing stages of crops.

For practical reasons, however, Van der Ploeg (1936) introduced the use of normative RIR that is 4:1.5:1 for paddy, sugarcane, and secondary crops, respectively. The normative RIR has been used particularly in the irrigated area planted to sugarcane and the secondary crops in addition to rice. The concept of normal supply to irrigate secondary crops is called "Pasten."

The institutional development of water management system at the community level was reviewed by Happe (1936), and Witzenburg (1936). One of the controversial issues was centered around whether irrigation organization should be based on a village-bound system or irrigation unit- bound system as in the case of Balinese Subak system. In Java "Ulu ulu" is an institution responsible for water management at the village level. As reported by Clason (1936) even though a so-called distributor "Ulu ulu" i.e., an Ulu ulu system organized around a tertiary unit was considered more advantageous as compared to "village Ulu ulu system," but this newly introduced Ulu ulu system was not widely accepted by the farmer community.

Basic to the development of water management is the development of physical infrastructure or hardware component. Historically, there were three stages of hardware technological development in Java. The first stage is the development of irrigation systems in the hilly areas where relatively simple hydraulic structures were used. Many of the systems developed by the local community belong to this category. The rules for water delivery are supply driven, continuous flow with relatively minimum need for water control. The second stage is the development of large-scale irrigation systems in the downstream area of river basins with the primary emphasize on the main delivery system. During this stage the principles of water allocation were tested and the results from experiments were used as feedback for the design criteria of canals. During the third stage, further refinement of water distribution and control system took place through further development of physical infrastructures such as field reservoirs, tertiary and quaternary canals. The concept of the Golongan system and Pasten were developed where information on crops planted and scheduling were taken into consideration.

Irrigated agriculture has been the subject of trial and error for centuries; one of the important features of irrigated rice culture is its capacity to absorb a large amount of labor without affecting its production capacity. As emphasized by Geertz and others it was the successful adaptation of wet rice to increasingly labor-intensive cultivation methods that permitted the increase in rural population that have occurred in Java. During the period of heavy irrigation investment between 1880 and 1930 population of Java leapt from 19.5 million to 41.7 million.

There were several reasons for the heavy emphasis on irrigation investment during the first three decades of the twentieth century. In 1901, the Queen Wilhelmina, in addressing

the parliament of Netherlands drew attention on the declining state of the native welfare of Java. There were three policy instruments proposed in implementing the " ethical policies" as the key to improve the welfare of the natives namely irrigation, education, and trans-migration. There were disagreements among professionals, however, on the role of irrigation to improve the welfare of the natives. The proponents of irrigation development felt that the major constraint in improving the level of rice production was the shortage of irrigation. Moreover, improved irrigation meant higher yields of non-rice crops, improved rivers, roads and bridges, and better drinking and bathing facilities for human beings and animals (Booth 1971).

Skeptics of the development of irrigation of whom Boeke was one, point to the fact that 25 years of heavy investment on irrigation had not raised yields per hectare of rice in Java nor had it led to any marked improvement in the standard of food consumption per capita. The rapid increase of population of Java was one of the important reasons for the low level of welfare. In addition, the absence of other components of modern production technology such as high yielding varieties and fertilizers was the likely reason for insignificant increase in rice production. The increase of production during the period of 25 years was mainly due to the expansion of harvested rice area.

There was another important fact reported by Booth (1971). For the latter part of the1930s, data on rice yield were available for Bali and Lombok. Although there were no irrigation investments made by the government, the rice yield in this region was more than 50 percent higher compared with those of Java for the same period. The possible reason was that the water management of the indigenous irrigation system in Bali had been brought to a considerable degree of sophistication over centuries and the higher yield figures testify its performance.

IRRIGATED AGRICULTURE DURING THE POST-COLONIAL PERIOD

During the post-colonial period the changes in rice cultivation practices occurred quite rapidly, particularly induced by the advent of green revolution and the increasing demand for food. Irrigation systems inherited from the colonial period are important endowments to meet one of the national development objectives, that is self-sufficiency in rice production. Most of the irrigation systems constructed during the colonial period were good in the quality of construction. Through the rehabilitation program that occurred during early seventies to early eighties and also due to incentives such as fertilizer subsidy, rice yields were increased significantly during this period. Boeke (1966) and other "pessimists" were apparently right that irrigation investment during the colonial period had little positive impact on the welfare of the local community. On the other hand, the proponents of the development of irrigation systems were very right from a long-term perspective—that because of this important irrigation investment, Indonesia was able to achieve self-sufficiency in rice production in 1984.

The principles of water allocation based on Pasten as the decision-making criteria is still used particularly in an irrigation system with diversified crops. The Golongan system is

continually planned to optimize the use of labor and water for land preparation at the beginning of the planting season.

Other cultivation techniques in rice-based farming systems exercised by the farmer community in response to variability of water availability are well known *sorjan* and *gogorancah* . At the early stages of development sorjan used to be practiced in the downstream portion of an irrigation system in the northern coastal area of Java. It is used either to solve the problem of floods or drought. It is the land-shaping management comprising furrow and bed. In the case of risk reduction of floods as practiced in the north-eastern tip of West Java, paddy is planted at the top of the furrow and the lower part of the bed is used for fish ponds. On the contrary, paddy is planted at the lower part of the bed and secondary crops at the upper part as in the case of the irrigation systems in the coastal area of Central Java, to reduce the risk of water scarcity that occurs in the downstream area of the irrigation system. Now, sorjan is being practiced extensively in the tidal-swamp reclaimed area of Sumatra and Kalimantan.

Gogorancah is another response to the variability of water status in the field. In the areas of high risk of flood, the upland cultivation technique is practiced even before the onset of rainy season. The field is planted with paddy by direct seeding without soil puddling. During the peak of the rainfall the plant is quite high so that when the flood occurs its effect will not be serious. This technique is practiced in the flood-prone areas or in the irrigated area with relatively late commencement of irrigation, and also in the rainfed paddy fields. Introduction of this practice in Lombok Island, eastern part of Indonesia, during the early seventies had increased rice production and reduced poverty.

As the demand for rice continually increased in response to population and better incomes, the effort to increase paddy cropping intensity became essential. In the irrigated areas with a year round flow of water, three crops a year are attainable by adoption of short duration high yielding varieties and by application of "Walik jerami" technique where at the end of the cropping season soil moisture is high enough to enable the next planting without adequate land preparation as it is usually done during the rainy season. Planting three paddy crops a year, however, is only practiced in limited irrigation systems as it is considered sensitive to pests and diseases. In Java, there are about three hundred thousand ha of irrigated land planted with three paddy crops a year.

TRENDS IN LAND AND WATER RESOURCES

Land and water resources are not well distributed throughout the country due to population density and resource-endowment differences. The present total population of Indonesia is more than 200 million, of which 60 percent is living in Java although it only comprises about 7 percent of the total land area of two million square kilometers. Water resources management has played an important role in economic development, in terms of both production and public expenditures: by 1980, irrigation investment accounted for more than half of the public expenditure, with publicly funded irrigation accounting for 85 percent of the irrigated area and 75 percent of the country's rice production (Rosegrant et al. 1987).

The program is often cited as a success; with the spread of irrigation, Indonesia's rice production has achieved and maintained a level of self-sufficiency during the period from 1984 until early 1990s.

The country's continued economic development will require additional development of its water resources. Even though Indonesia is blessed with abundant water resources, some parts—especially the crowded island of Java—have begun to feel the effects of water scarcity as well as land scarcity. There is a tendency of Java dwindling as a rice producer of the country. The share of Java as a rice producer had declined from 60 percent in the early 1980s to 52 percent in the 1990s. There has been continuous reduction of irrigated lands in Java. For example, between the period 1980–1990 there was a conversion of about 170,000 ha of wetland rice to other uses (Pasandaran 1996). The area converted in the early 1990s was about 23,000 ha per year with about 38 percent of the total converted land in East Java and an additional 32 percent in West Java. Substantial portion of the converted area comes from highly productive technical irrigation systems. In East Java, for example, about 30 percent of 38,000 ha converted to other uses from 1989 to 1992, was originally technically irrigated area.

Two patterns of conversion can be discerned: a) contiguous blocks of area surrounding development concentrations (such as in the northern coastal area of West Java), around development of settlements, industries, and roads; or b) more fragmented blocks of area, converted as a result of degradation of rice-lands and declining income opportunities (or as dependency has shifted to other rice-fields).

In contrast with Java there has been a continuous increase of irrigated lands in outer islands although the net increase is not sufficient to compensate for losses of production in Java because of the differences in productivity and cropping intensity. The productivity of the new irrigated area outside Java is very low because these new irrigation systems face production constrains such as inadequate water management and production technologies. Inadequate capacity of water management is also the likely reason for low cropping intensity in addition to low opportunity cost of this endeavor compared to other farming development alternatives.

Agricultural land conversion is difficult to avoid, but policy intervention is needed because the problem is not only related to the losses in irrigation investment but also to food security. In the long run, conversion may have a significant impact on degradation of water resources which in turn will increase the social cost.

As a consequence of continuous conversion of irrigated land and increase in population the size of the landholding is decreasing. In Central Java, for example, the average size of the landholding declined from 0.39 ha in 1994 to 0.35 ha in 1998 (CASER 2000). There are regulations regarding conversion of land which are essentially prohibitive to convert the status of technically irrigated land into other uses, but in practice there are no effective measures to enforce these regulations. Because of the increasing demand for nonagricultural lands the local governments tend to endorse the conversion for the sake of regional development.
If the above mentioned permissive policy implementation on land conversion continues to occur in the future without any compensating policy measures such as investment on new irrigated land and improvement in crop productivity, the gap between rice production and consumption will continue to increase, and consequently, the increasing burden on import of rice.

Even though in the past the policy priority was on rice self–sufficiency, to be achieved by promoting irrigation, the current policy objectives are broader. It includes promoting diversification of agricultural commodities. Law 12 (1992) on crop cultivation system provided farmers the freedom to plant crops of their own choice, with the presumed effect of inducing crop diversification in irrigated areas. The practice of crop diversification, however, is generally effective in the area that has a long experience in water management support system such as the Pekalen sampean irrigation systems, East Java.

PRODUCTION AND POLICY SUPPORT

As rice has been considered a main food commodity, greater attention was paid to rice production. Significant growth in the past was achieved due to the government policies including investment in irrigation and research, extension programs for new technologies and inputs, and favorable input and output pricing policies. The irrigation investment program has included not only the construction of a new system, but also large investments in the rehabilitation of the existing systems, and in the development of tertiary distribution systems within existing irrigation schemes.

The combination of research, investment, and pricing policies has led to rapid growth in the use of modern varieties and fertilizer with impressive gains in rice yield per hectare. Data on area harvested, production and productivity from 1970 to 2000 is presented in table 1 and the share of area harvested and yield to the growth of production is presented in table 2. The share of area harvested fluctuates with the maximum contribution of 2.10 percent in Java during the period 1980-1985. The share of productivity/yield has shown a declining trend during the period 1975-2000 while in the outer island it shows a trend of increasing share of productivity in the first five year period and then followed by the declining share of productivity.

The area harvested in the outer island showed an increasing trend from the period between 1970 and 1995 and the period from 1995 to 2000 showed a declining trend in the share of area harvested. Table 3 indicates that the cropping intensities of irrigation rive both in Java and outer islands are already high. During the period from 1982 to 1999 the cropping intensity of irrigated rice in Java only slightly increased from 1.71 to 1.79 and in outer island from 1.43 to 1.70.

The slowdown in the rate of yield growth is due to near completion of the spread of modern varieties and intensified production programs, declining marginal productivity of fertilizers, a less favorable price environment and, reduction in irrigation investment and the completion of new and rehabilitated areas.

The possibility to increase rice production in the near future however is constrained by the lack of new innovation in production technology and lack of pace to complete the on-going activities in rehabilitation and land development.

IMPLICATIONS FOR FOOD SECURITY AND PRO-POOR INTERVENTION STRATEGIES

In the future Indonesia will enter an era of severe land and water shortage for food production. The population will continue to grow while the growth rate of food production shows sign of stagnation.

The fundamental reason for low production growth is the leveling-off of productivity factors i.e., cropping intensity and yield, and also area irrigated. Further analysis reveals that the yields have been stagnant for a decade. The average yields of paddy have remained at a level of 4.5 ton/ha. For the important crops such as maize, yields have been stagnant at the level of 2.2 tons/ha since 1989, while soybeans averaged 1.1-1.2 tons/ha. If Indonesia has to meet her own demand for food and feed, given the present level of productivity, cropping intensity and area irrigated, an additional 30 billion cubic meter of water has to be made available for irrigation in the year 2010 (Pasandaran and Sugiharto 1999). The challenge is to identify available potential land and water resources suitable to meet the above mentioned demand and analyze whether they are feasible to be developed in a given period of time.

If such resources are available, further challenge is to identify investment strategies which reduce poverty and provide maximum benefits for the poor people. The proposed actions worth considering are the following:

- Identify the characteristics of the land and water resources, which can be developed to improve the welfare of the poor people.
- Identify the possibility of development of small-scale irrigation systems in order to enable the development of irrigation systems in a relatively shorter period of time.
- Develop investment approach, which enable the poor farmers participate in the design and process of construction and management of irrigation.
- Develop agribusiness model including micro-finance schemes that meet the need of the poor people.

Table 1. Percentage change of harvested area, production and productivity of paddy (wetland + dryland), 1970-2000.

Year	Java			Outside Java			Indonesia		
	Harvested area	Production	Productivity	Harvested area	Production	Productivity	Harvested area	Production	Productivity
1970-1975	1.58	3.42	1.81	1.33	3.96	2.60	1.47	3.63	2.13
1975-1980	0.53	6.06	5.50	1.93	5.45	3.45	1.17	5.83	4.60
1980-1985	2.10	5.63	3.45	1.71	5.68	3.91	1.92	5.65	3.66
1985-1990	0.44	2.33	1.88	2.02	3.98	1.93	1.18	2.97	1.76
1990-1995	0.22	0.71	0.49	3.23	3.70	0.46	1.72	1.94	0.22
1995-2000	0.96	0.70	-0.26	-0.34	0.67	1.01	0.29	0.69	0.27

Table 2. Harvested area, production and productivity of paddy (wetland + dryland) 1970-2000.

Year	Java			Outside Java			Indonesia		
	Harvested area (ha)	Production ton	Productivity ku/ha	Harvested area (ha)	Production ton	Productivity ku/ha	Harvested area (ha)	Production ton	Productivity ku/ha
1970	4,302,202	11,601,576	26.97	3,596,048	7,092,073	19.72	7,898,250	18,693,649	23.67
1971	4,416,135	12,414,686	28.11	3,908,187	8,069,001	20.65	8,324,322	20,483,687	24.25
1972	4,331,759	11,924,848	27.53	3,565,879	7,469,085	20.95	7,897,638	19,393,933	24.56
1973	4,567,136	13,041,042	28.55	3,836,468	8,449,536	22.02	8,403,604	21,490,578	25.57
1974	4,730,002	13,884,085	29.35	3,778,596	8,591,988	22.74	8,508,598	22,476,073	26.42
1975	4,653,270	13,726,424	29.50	3,841,826	8,613,031	22.42	8,495,096	22,339,455	26.3
1976	4,465,569	14,062,052	31.49	3,903,190	9,238,887	23.67	8,368,759	23,300,939	27.84
1977	4,377,719	13,726,163	31.35	3,981,849	9,620,969	24.16	8,359,568	23,347,132	27.93
1978	4,750,299	15,597,877	32.84	4,178,870	10,173,693	24.35	8,929,169	25,771,570	28.86
1979	4,628,496	15,702,591	33.93	4,175,068	10,580,072	25.34	8,803,564	26,282,663	29.85
1980	4,777,139	18,420,506	38.56	4,227,926	11,231,399	26.56	9,005,065	29,651,905	32.93
1981	5,045,975	20,530,310	40.69	4,335,864	12,243,866	28.24	9,381,839	32,774,176	34.93
1982	4,749,073	20,855,038	43.91	4,239,382	12,728,639	30.02	8,988,455	33,583,677	37.36
1983	4,779,155	21,628,297	45.26	4,383,314	13,674,809	31.20	9,162,469	35,303,106	38.53
1984	5,211,599	23,700,326	45.48	4,551,981	14,436,120	31.71	9,763,580	38,136,446	39.06
1985	5,301,407	24,225,280	45.70	4,600,886	14,807,665	32.18	9,902,293	39,032,945	39.42
1986	5,330,560	24,458,814	45.88	4,657,893	15,267,947	32.78	9,988,453	39,726,761	39.77
1987	5,185,138	24,543,526	47.33	4,737,456	15,534,669	32.79	9,922,594	40,078,195	40.39
1988	5,207,779	25,088,279	48.17	4,932,376	16,587,891	33.63	10,140,155	41,676,170	41.1
1989	5,448,547	27,011,257	49.58	5,082,660	17,714,325	34.85	10,531,207	44,725,582	42.47
1990	5,418,824	27,177,422	50.15	5,083,533	18,001,329	35.41	10,502,357	45,178,751	43.02
1991	5,183,947	26,392,552	50.91	5,097,572	18,295,695	35.89	10,281,519	44,688,247	43.46
1992	5,552,565	28,292,421	50.95	5,550,752	19,947,588	35.94	11,103,317	48,240,009	43.45
1993	5,514,744	28,296,673	51.31	5,498,032	19,884,414	36.17	11,012,776	48,181,087	43.75
1994	5,176,237	26,545,565	51.28	5,557,593	20,095,959	36.16	10,733,830	46,641,524	43.45
1995	5,479,396	18,504,453	33.77	5,959,368	31,239,687	52.42	11,438,764	49,744,140	43.49
1996	5,488,947	28,414,056	51.77	6,080,782	22,687,450	37.31	11,569,729	51,101,506	44.17
1997	5,380,976	27,878,934	51.81	5,759,618	21,498,120	37.33	11,140,594	49,377,054	44.32
1998	5,752,012	27,717,293	48.19	5,978,313	21,519,399	36.00	11,730,325	49,236,692	41.97
1999	5,766,614	18,967,074	32.89	6,196,590	31,899,313	51.48	11,963,204	50,866,387	42.52
2000	5,748,247	29,160,286	50.73	5,860,034	22,319,126	38.09	11,608,281	51,479,412	44.09

Table 3. Irrigated cropping intensity of paddy in Indonesia 1982 –1999.

Year	Java			Outside Java		
	Area	Planted area	Crop intensity	Area	Planted area	Crop intensity
1982	2,516,213	4,298,838	1.71	n.a	n.a	n.a
1983	2,494,841	4,300,253	1.72	n.a	n.a	n.a
1984	2,501,258	4,366,307	1.75	1,657,118	2,699,395	1.63
1985	2,482,376	4,364,357	1.76	1,671,236	2,687,726	1.61
1986	2,479,270	4,385,672	1.77	1,713,711	2,704,604	1.58
1987	2,187,854	3,851,976	1.76	1,513,245	2,477,518	1.64
1988	2,523,154	4,441,464	1.76	1,792,192	2,890,296	1.61
1989	2,534,504	4,509,664	1.78	1,852,941	2,996,524	1.62
1990	2,535,665	4,504,367	1.78	1,912,073	3,093,103	1.62
1991	2,546,123	4,476,199	1.76	1,886,044	3,114,281	1.65
1992	2,572,463	4,572,504	1.78	n.a	n.a	n.a
1993	2,585,701	4,607,613	1.78	2,012,037	3,391,309	1.69
1994	2,564,617	4,535,414	1.77	2,017,043	3,360,807	1.67
1995	2,561,693	4,564,604	1.78	2,126,045	3,585,184	1.69
1996	2,566,209	4,572,248	1.78	2,193,944	3,688,311	1.68
1997	2,550,076	4,520,076	1.77	2,220,564	3,693,447	1.66
1998	2,536,503	4,548,992	1.79	2,247,949	3,796,923	1.69
1999	2,604,782	4,671,475	1.79	2,427,689	4,117,583	1.70

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Implementation of Irrigation Development in Central Java

Central Java Irrigation Service *

INTRODUCTION

Water and water resources are among the very vital natural resources for human life and livelihood. The monetary crisis followed by the economic as well as the multidimensional crises in Indonesia have made this nation realize that sectoral role of agriculture in the Indonesian economy is very strategic. Knowing the fact that irrigation is one of the most important production inputs in agriculture, irrigation sustainability needs to be maintained in terms of its social, physical, economic and institutional aspects.

In satisfying national food security, the Government of Indonesia has continuously followed agricultural development policies, including policies on irrigation development and management. Among others, irrigation rehabilitation and irrigation system operation and maintenance (O&M) in Central Java could be considered as a very important development program in this context.

The implementation of irrigation development in Central Java has significantly contributed a meaningful share in improving the food security status at the local, provincial and national levels.

Agriculture is an important economic sector in Central Java as it directly absorbs almost 47 percent of the provincial labor force. In addition, the agricultural sector in this province has been significantly functioning as an employment buffer at the provincial level, particularly when alternative employment opportunities are lacking.

DEVELOPMENT POLICY IN CENTRAL JAVA

Development policy priority in Central Java is focused on the six important development agendas:

1. Poverty and crisis impact rehabilitation

2. Promotion of unity and democracy, community security and obedience

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3. Law enforcement and good government
4. Regional capacity empowerment and sustainable economic development
5. Social welfare and cultural security improvement
6. Community and regional empowerment

The programs aimed at improving the public welfare and public services include:

1. Food security program, food availability assurance, fair and equitable food distribution for the community.
2. Community economy empowerment through agricultural development covering food crops, animal husbandry, fishery, plantation, community forestry, and cooperatives.
3. Poverty alleviation program which is realized through better, clean water availability, human settlement and women's role.
4. Basic infrastructure maintenance program proportional to existing development assets.

Within the era of limited financial capacity, infrastructure maintenance and development will be conducted on a very selective basis.

In agriculture, the orientation of the development program is aimed at attaining a strong and efficient agriculture, sustaining food self-sufficiency, satisfying consumption needs and industrial raw materials, improving employment and business opportunities through community integrated farming.

The development policy in water resources and irrigation sector is prioritized to satisfy the needs for domestic, agriculture, industry, hydropower and tourism, flood control, drought supply, and maintaining the function of water resources and irrigation systems. This policy is implemented through programs on water resource conservation and development, domestic water supply and management, river and other water resources management, irrigation system operation and maintenance, irrigation improvement and rehabilitation, and irrigation system development.

IRRIGATION MANAGEMENT REFORM POLICY

The government policy reforms in irrigation management covers 5 policies:

Policy 1: Redefinition of duties and responsibilities of the irrigation management institutions

In order to implement more effective and efficient irrigation activities, the government has to reformulate and redefine the duties and responsibilities of the irrigation management institutions at the national, provincial, district/municipality, and the farmers' levels, with the WUAs as the most responsible decision makers within the irrigation system under WUAs' management.

The targets:

1. Effectivity and efficiency improvement in irrigation management. Much clearer duties and responsibilities of the irrigation management institutions concerned.
2. Empowering WUAs as a legal body having very strong authority in decision making for the irrigation system under their responsibility.
3. Improving financial effectiveness and efficiency, and shortening bureaucratic channels through a decision-making approach based on the local problems and needs.
4. Improving the level of transparency and accountability of irrigation management.
5. Better availability of qualified human resources suitable for the district/ municipality and WUA level.
6. Providing a conducive environment for WUA development.

Policy 2: Strengthening institutional capacity of WUAs

In order to have an autonomous and self-reliant WUAs, the government will encourage, facilitate and provide better opportunities to farmers' community to establish economic and business units at the farm level based on and representing the local needs in accommodating networking purposes with the outside community, managing production resources including water resources and irrigation systems based on democracy and community socioeconomic self-reliance.

The targets:

1. Creation of farmers' organizations and institutions capable of irrigation system management towards better efficiency, better effectivity, improving public welfare, satisfying public needs, autonomous, self-reliant and having an equitable position with other organizations.

2. Creation of WUAs under the principle of *one irrigation system-one management*.

3. WUAs as institutions perfectly representing farmers in Irrigation Committee, PPTPA and other stakeholders.

4. Improving the financial capacity of WUAs to enable them to improve financing and managing irrigation systems under their responsibility.

5. Creating a conducive environment for farmers and WUAs empowerment through training, participative development and social welfare improvement.

6. Better assurance of water rights of the farmers as a collective right through WUAs, in accordance with collectively acceptable operation plan.

Policy 3: Irrigation management transfer to the farmers

Under the principle of one system-one management, the government shall transfer the irrigation operation and maintenance (O&M), and its financial management of the overall system to WUAs on a gradual, selective and democratic basis.

The targets:

1. Management transfer of all irrigation systems to WUAs on a gradual and selective basis.

2. Improvement of irrigation system performance, for those who have been under management transfer and under joint management between the farmers and the government.

3. Joint management for the systems which have not been completely transferred to the farmers under the principles of equity, transparency and accountability.

4. Improvement of community participation and responsibility in irrigation management.

Policy 4: Irrigation service fee (IPAIR) and irrigation system management budget

Budgetary requirements for O&M, rehabilitation and irrigation system construction and other activities within the WUAs operational area, will be the responsibility of the farmers through the payment of the irrigation fee (IPAIR) in all irrigation system in Indonesia, whose collection, management and allocation are conducted by the concerned WUAs.

Based on the fact that irrigation has a strategic role in agricultural development, particularly in supporting food production, the government is responsible to provide support in development, financing and irrigation system management whenever needed by WUAs.

The targets :

1. Defining responsibilities more clearly in irrigation system financing.
2. Availability of funds for the irrigation system management and other activities according to the real needs observed at the grass-root level.
3. The existence of a single format irrigation fee which is simple, transparent and accountable and directly benefiting the farmers.
4. Stronger capacity of WUAs in fee collection and management.
5. Increasing responsibility of the farmers and WUAs in irrigation system sustainability through implementing an irrigation service fee.

Policy 5: Irrigation system sustainability

Knowing the fact that irrigation investment allocated by the government is very high (construction, O&M, rehabilitation and institutional development) the government is responsible for maintaining water resource sustainability and controlling the conversion of irrigated land to other uses through the issuance of macro-level policies and their consistent enforcement to maintain system sustainability.

For this sustainability purposes, participation of the farmers must be invited in any development stage starting from the survey, investigation, design, construction, O&M and monitoring and evaluation stages.

Stages in protecting and maintaining the sustainability of irrigation systems are designed to follow the following priorities: irrigation performance improvement, rehabilitation, and new construction whose implementation must be based on the local needs.

The targets:

1. Sustainability of irrigation systems.
2. Existence of strategic planning for water resources development at the river basin level.

3. The issuance of policies and their enforcement on the land-use planning (RUTR) to control ill-structured land conversion.

4. The formulation of the recovery mechanism of the government investment whenever land conversion is unavoidable.

THE IMPLEMENTATION OF IRRIGATION DEVELOPMENT

The implementation of the Irrigation Management Transfer (PPI) in the context of Irrigation Management Policy Reform (PKPI), hereby called PPKI-PPI, in Central Java could be classified into two modes of implementations, namely, through the Central Java irrigation Project (PIJT) at the Water Allocation Training Sub-Project (subbag PTGA) and through WUAs Empowerment Project (under BAPPEDA, the Central Java Development Planning Agency). The implementation of the PPI is basically adopting the PPI model in Krisak, Beton and Krogowanan Irrigation Schemes (DI) through the participation of community organizers (COs) based on the following stages:

a. Preparation

b. Assessment of the institutional profile

c. Assessment of socio-technical aspects

d. O&M activities

e. Monitoring and evaluation

f. Post-PPI activities

The implementation of the five-policies on irrigation management in Central Java is being undertaken through:

- Executing socialization activities on the Irrigation Management Policy Reform which has been well documented in the Presidential Decree, Inpres 3/1999 to all districts in Central Java.

- Mobilizing the participation of GP3A/IP3A as members of the District Irrigation Committee in order to support the effectivity of the irrigation committee after the involvement of WUAs.

- Implementing intensive and sustainable extension and guidance activities to the farmers.

- Conducting training activities for the GP3A/IP3A members as:
  - Institutional strengthening effort of GP3A/IP3A.
  - Skill and capacity strengthening effort for the members

- Strengthening active participation of GP3A/IP3A through participative design, construction and O&M activities.

- Implementing PKPI-PPI at pilot project areas, i.e., Krisak Scheme in Wonogiri District and Krogowanan scheme in Magelang District.

- Developing a collaboration pattern through operational collaboration (KSO) in O&M activities. At least there is one scheme in every district that is operated under the KSO system.

Implementing the irrigation fee (IPAIR) through the principles of the from-by-and-for the WUAs in order to have a self-reliant irrigation system.

The Problems

- From the socialization activities, it was evident that the irrigation bureaucrats were surprised for having fewer roles in irrigation management, while the farmers were wondering for having an overburden of activities.

- Limited availability of WUAs' human resources in water resource management. Agricultural sector is getting less and less interesting for the youth and consequently, WUAs members are dominated by old-aging farmers. The sustainability of empowerment activities of the government to WUAs is also a serious problem. Decreasing quality performance of WUAs status (recently surveyed),could be partly attributed to this problem.

- The farmers are in general reluctant to accept the transfer. It has been commonly perceived that irrigation management is the responsibility of the government in providing public service to the farmers. In addition to this, the farmers are not very convinced in their capacity to finance irrigation operation.

- Working pressure of the farmers in farming activities has been very high. The maximum capacity of IPAIR in O&M activities was about 17 percent only from the total budget of the yearly Local Government Budget (APBD) amounted to Rp 57,000/ha.

- Low bargaining power of farmers in preventing land conversion towards non-irrigated area and low capacity of law enforcement in the district land-use plan.

- High rate of conversion of the irrigated land.

- Decreasing availability of water during dry season and flood problems in rice production centers.

- Poor willingness of the youth to work in rural areas and agricultural sector.

SOME SUGGESTIONS

- Developing comprehensive understanding on PKPI accommodating the overall aspects both directly and indirectly related to irrigation management.
- There is an urgent need for having strong support of the government policies which are favorable for the farmers and protect their livelihood, such as favorable pricing policies, land reform, etc.
- The transfer of irrigation management to the farmers shall be implemented gradually through joint operation (KSO) to attain suitable level of understanding and capacity of WUAs.
- The government should be responsible to allocate the government budget on irrigation O&M as public subsidy to the fee (IPAIR) managed by the WUAs.
- Comprehensive review and study on law and regulation in water resource management and their enforcement are required.
- Law enforcement is urgently required to control the conversion of irrigated land.
- Demand-supply side management could probably minimize water oversupply and over-demand during rainy and dry seasons, respectively.
- The only way to bring the youth back to agriculture is by providing better profitability agricultural sector, as compared to the others.

CONCLUDING REMARKS

- The improvement of irrigation service would directly improve agricultural production and in turn the improvement of farmers' income.
- The success and effectivity of irrigation development will be very dependent upon active participation of the farmers, and the capacity and moral quality of irrigation bureaucrats at the planning, implementation, and the monitoring & evaluation stages.
- Irrigation management policy reform must be proportionally formulated based on the real need and condition at the community level.
- It is strongly expected that after this workshop, there will be relevant follow-up activities and policy improvement accommodating the overall aspects within the community dynamics.

Irrigation Management Policy Reform in Indonesia—Its Role in Supporting the Pro-Poor Agricultural Development

Bambang Adi Nugroho *

Inter-temporal policy analysis could be considered as one among many ways to assess the progress in agricultural development. The policy itself is very much theoretically dependent upon the paradigm being adopted as the policy basis. For the case of the Indonesian irrigated agriculture, two principal paradigms could be comparatively observed in the history of irrigation development. They are, (i) the old development paradigm; and (ii) the newly formulated development paradigm. Both paradigms are very well illustrated in figure 1 and figure 2, respectively.

As it is presented in figure 1, the old agricultural development paradigm has, at least three main features, i.e., (i) nontransparent; (ii) inconsistent; and (iii) undemocratic. These features were closely related to the macro level national development policy, which was very authoritarian and centralistic in nature. Several policy measures that could be considered as significantly characterizing the old development model were, among others, pricing policy, food self-sufficiency policy, production input subsidy covering seeds, fertilizers, insecticides, pesticides, working capital and irrigation. The primary objectives of those policies were mainly to improve the income level of farmers, and to increase the national food production level.

Along the way, the implementation of such policies has been a matter of public criticism in many ways connected with the development objectives that have been launched. Among others, the first issue was questioning whether the income improvement has been experienced by the farmers/producers or the consumers? The level of sufficiency: is it rice or food self-sufficiency? If rice self-sufficiency is the primary objective, what is the reason of the government for launching *gema palagung* (rice-soybean-maize development)? Regarding the production improvement policy, whether such a policy was dedicated for rice production improvement or food production improvement?

Unlike the old development paradigm, the newly formulated development paradigm is characterized by: (i) transparency; (ii) consistency; and (iii) democracy(figure 2). The main issue raised and relevant to this new development paradigm is *compensate income transfer or subsidy*.

*Irrigation Policy Senior Staff of BAPPENAS (National Planning Agency), the Republic of Indonesia, and Secretary General of the Irrigation Management Policy Reform Committee (WATSAL) of Indonesia.

Figure 1. Old paradigm policy setup.

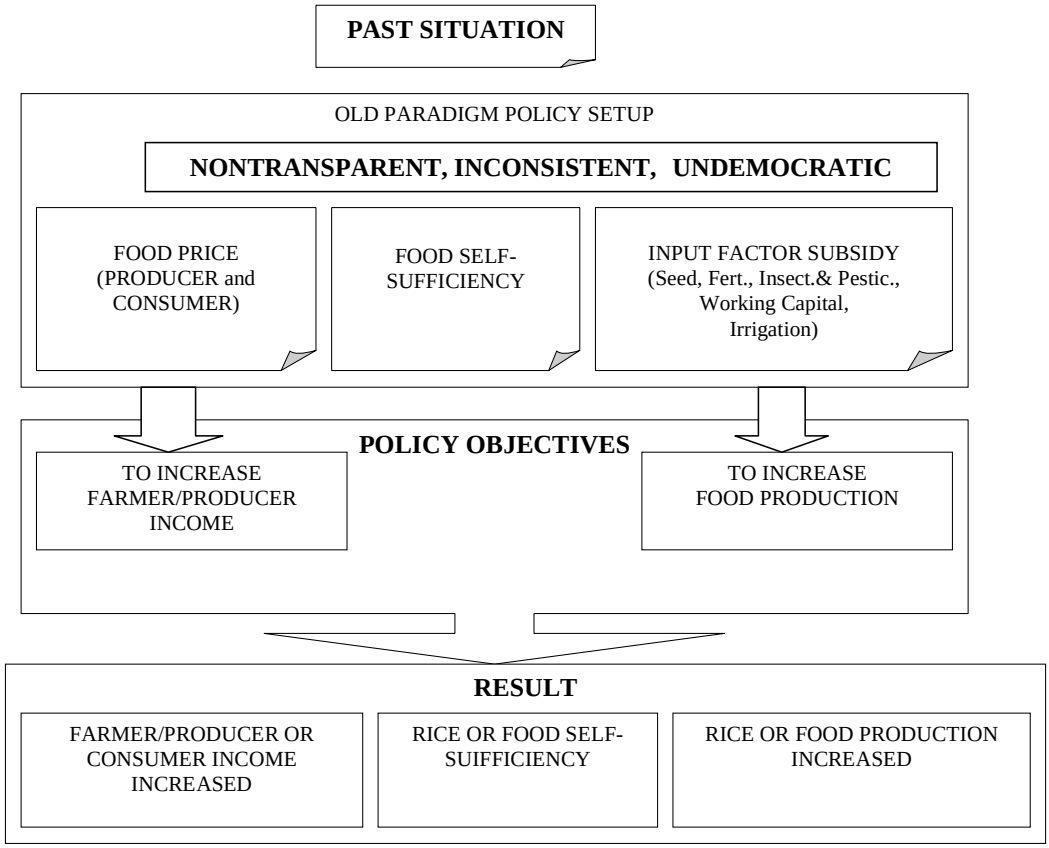
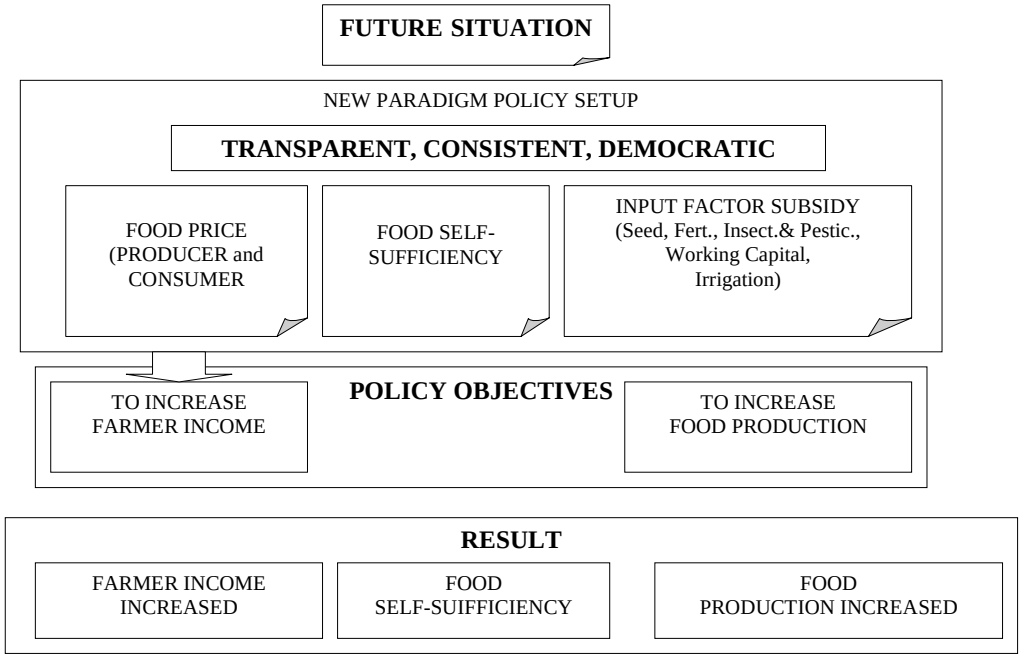


Figure 2. New paradigm policy setup.



Although the new paradigm has been set up with extremely different characters compared with those of the old one, its development policy orientation and objectives are basically the same with those under the old paradigm, which covers: pricing policy, food self-sufficiency policy, production input subsidy covering seeds, fertilizers, insecticides, pesticides, working capital and irrigation. However, the long-term objectives are expected to meet the attainment of (i) farmers' income improvement; (ii) national food self-sufficiency; and (iii) increasing food production. In connection with the issue of poverty, poverty characteristics relevant to the policy need to be understood clearly. This understanding is very important knowing the fact that there are many socioeconomic variables closely related to poverty, though economic variable has been considered by the most.

Consistent with the above paradigmatic changes, irrigation intervention in agricultural development has changed as well. Irrigation intervention was formerly oriented to support both rice production and farmers' income improvement, through irrigation project in the forms of new irrigation infrastructure development, irrigation rehabilitation and improvement, and irrigation system operation & maintenance (O&M). In the newly developed paradigm, the objective of irrigation intervention is concentrated more on farmers' income improvement through compensated income transfer. To compare the irrigation intervention under the old and the new paradigm, figures 3 and 4, are hereby presented.

Figure 3. Irrigation support policy (past situation).

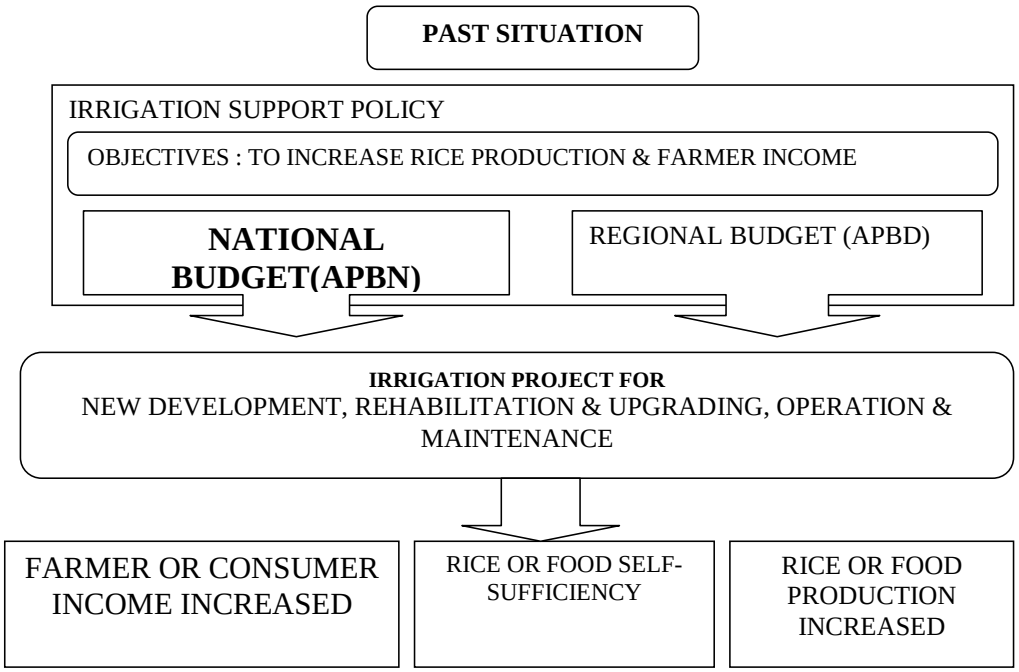
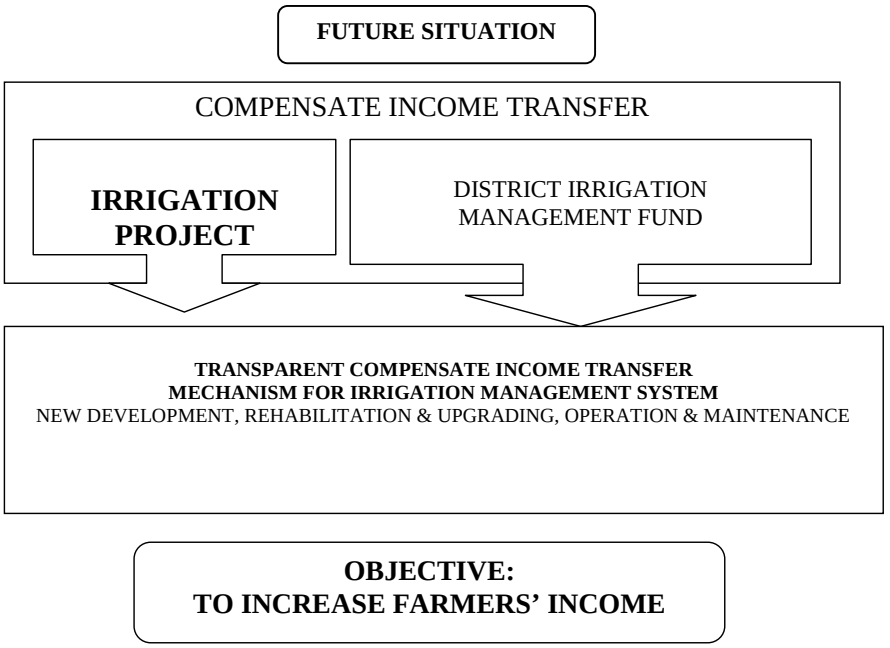


Figure 4. Irrigation Support Policy (future situation).



To summarize, the differences between those two paradigms in connection with their corresponding management policy could be well elaborated in table 1.

Table 1. Comparative characteristics of the old and newly formulated policy paradigms in irrigation intervention.

Item	Time	
	Past situation	Future situation
1. Main Issue	Irrigation support policy	Compensate income transfer
2. Objective	To increase rice production and farmer income	To increase farmers' income
3.echanism	Irrigation project for new development, rehabilitation and upgrading, and operation and maintenance	Transparent compensate income transfer mechanism for irrigation management system
4. Budget	- National budget (APBN) - Regional budget (APBD)	- Irrigation project - District irrigation management fund

Besides discussing the development strategy as has been mentioned, implementation characteristics are also very important to be taken into comparative consideration, particularly connected with the law and regulation in irrigation affairs. Inconsistency between irrigation laws and regulation and its implementation could be easily observed in the field. To illustrate one inconsistency, among many others, Constitution number 12/1996 very well mentioned that the Government is responsible for income decrease of the farmers as affected by rice self-sufficiency program (articles 6-1). However, the government has never satisfied farmers' income security, and consequently irrigation development was very questionable.

Due to those reasons, therefore, in line with the newly formulated development paradigm the government has to reform its irrigation policy through the following measures (figure 5):

1. Reorganizing of tasks and responsibilities of irrigation managing institutions
2. Empowerment of WUAs
3. Turn over for financing irrigation management to WUAs
4. Reformulation for financing irrigation development
5. Support for sustainable irrigation

In turn, such irrigation management reform policies must be implemented with the principles of transparency, democracy, consistency, accountability, *partnership, law supremacy, participatory, integrated planning, sociocultural, economic, dialogues, and should be local-resources based.* Sound principles and approaches are required to strengthen the institutional, technical and financial capacity in irrigation development.

Figure 5. Irrigation management policy.

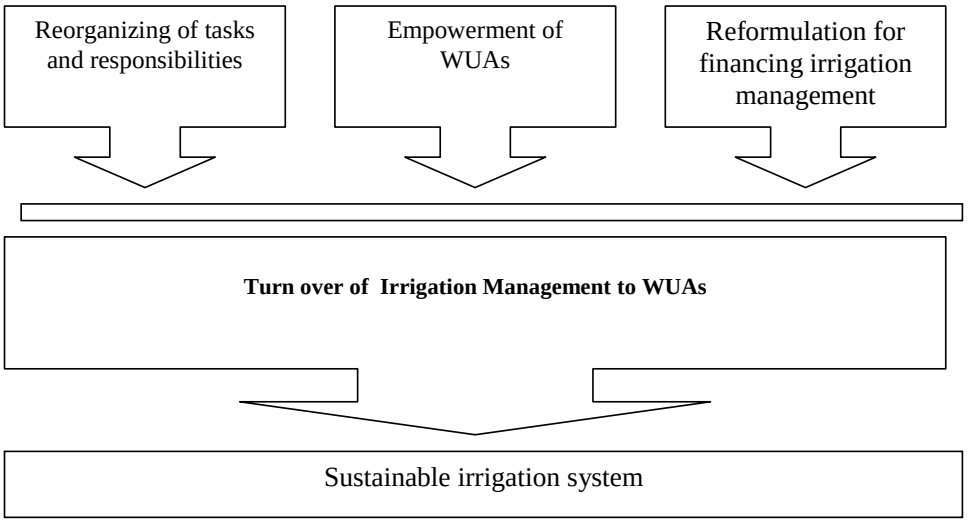
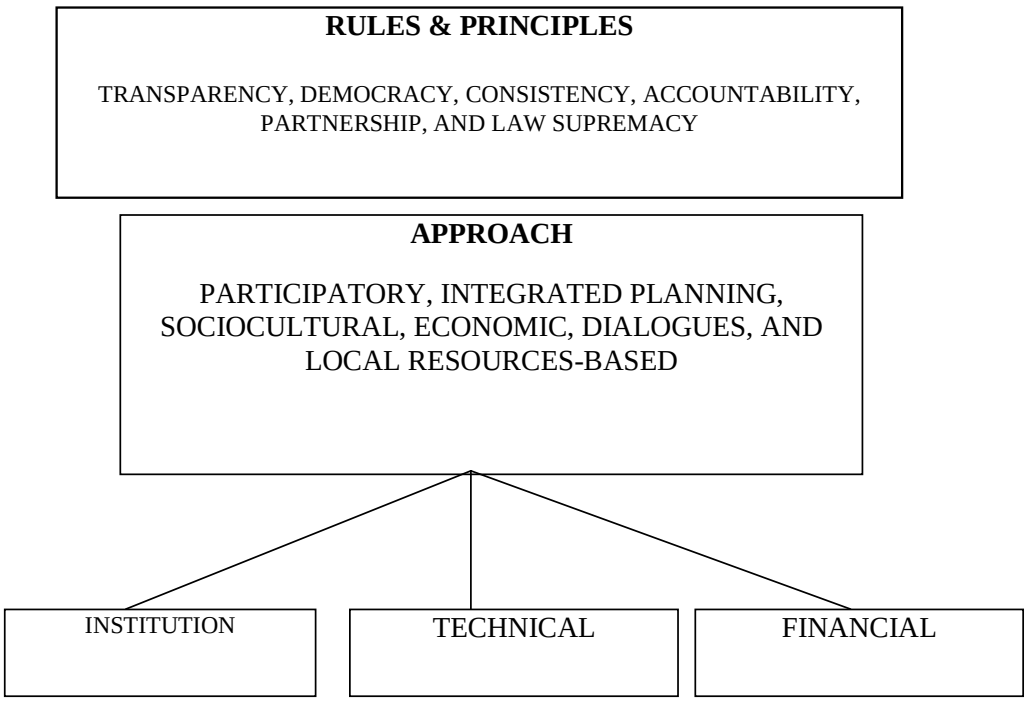


Figure 6. IMPR implementation strategy.



It is very rational to expect that, in the long-run, the effectiveness of this newly developed irrigation management policy would be made possible only when it is jointly supported by the development policies of other development sectors, such as, agriculture development policy, banking policy, pricing policy, and financial policies.

Figure 7. IMPR implementation mechanism.

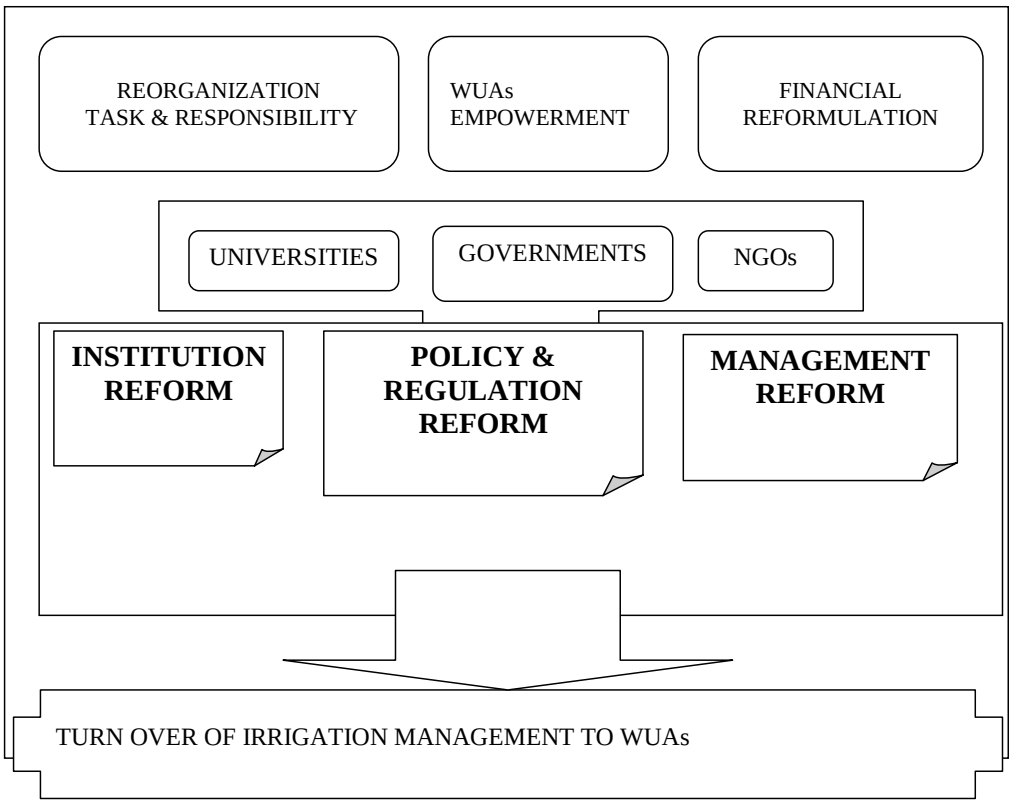
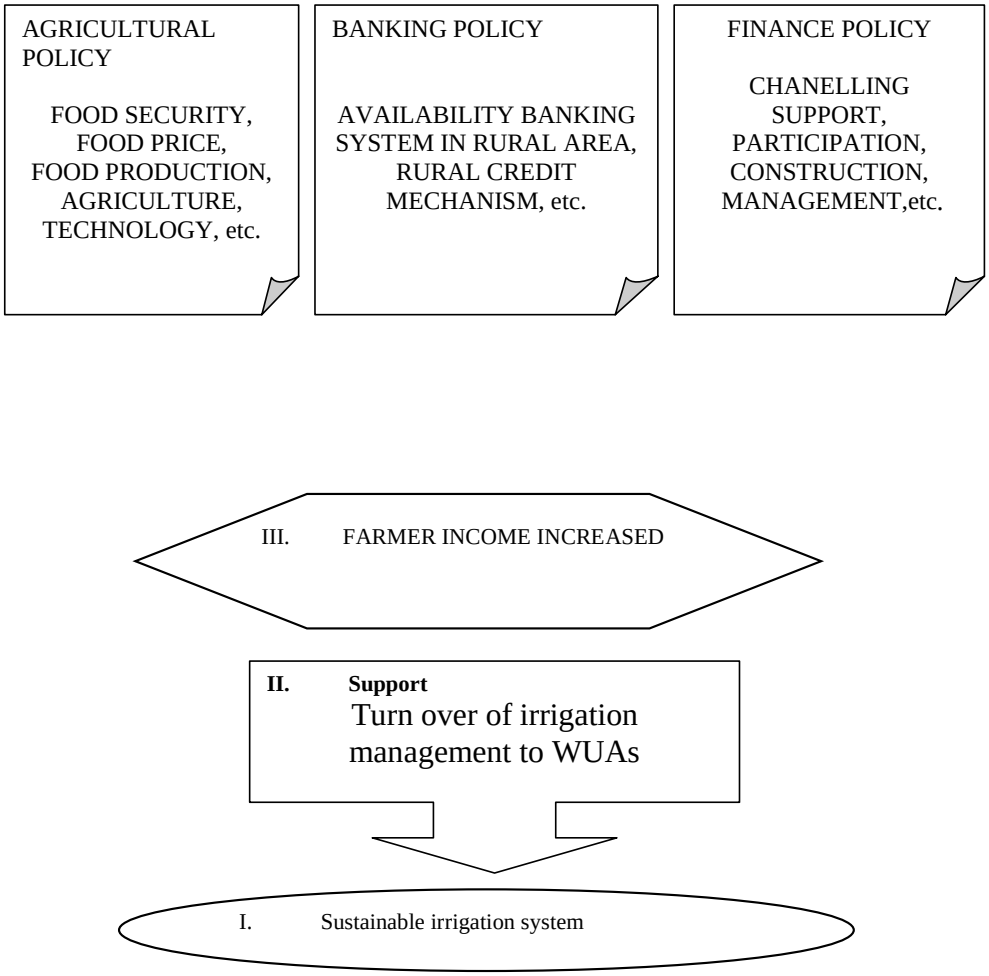


Figure 8. The development policies required for the success of the newly developed management policy.



REPORT ON WORKSHOP DISCUSSIONS

INAUGURAL AND TECHNICAL SESSION

The country workshop for the proposed project on "Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia: Indonesia was held at Jayakarta Hotel, Yogyakarta, on 23 May 2001.The workshop was organized by the Center for Rural and Regional Development Studies, University of Gadjah Mada (CRRDS-UGM) in collaboration with the International Water Management Institute (IWMI). The workshop was attended by over thirty experts and professionals representing various organizations and agencies including: (I) National Development Planning Agency (Secretariat for National Water Resources Policies Reform; (ii) Department of Settlement and Infrastructure Development; (iii) Department of Agriculture; (iv) Indonesia Irrigation Communication Network; (v) Provincial Development Planning Agency of Central Java and Yogyakarta; (vi) Provincial Water Resources Development Office of Central Java and Yogyakarta; (vii) District Water Resources Development Office of Kulon Progo, Grobogan and Demak; (viii) members of the project team (ix) non government organizations (NGOs); and (x) representative of ADB Mission in Indonesia. Detailed list of workshop participants is given in the Appendix.

The workshop began with a brief welcome address by Dr. M. Maksum, Director, Center for Rural and Regional Development Studies (CRRDS), Gadjah Mada (GM) University. He welcomed and thanked all guests and participants of the workshop. He briefly explained the purpose and objective of the workshop**.** Dr. Maksum invited all participants to actively participate in the discussions in order to make the workshop a useful event. He invited Prof. M. Anwar, Vice Rector for Academic Affairs of Gadjah Mada University, as representative of the Rector of the University to deliver the keynote address and officially open the workshop. Prof. Anwar expressed his gratitude to IWMI for collaboration and joint research with the University. He mentioned that the GM university is one of leading universities in the country that has a long history in agricultural research as well as in development of country level policies and strategies. He highlighted that the GM university is actively involved in irrigation management policy reforms that are currently underway in Indonesia, and that the Indonesian Government has requested four staff members of the University to be on the National Committee for Water Resources Policy Reforms and three of them are from CRRDS.

He indicated that Indonesia's past development policy was growth oriented, and that agriculture sector was considered as a supporting sector for industries. As a result, while the country achieved self-sufficiency in rice in 1984, living standard of farmers in rural areas remained low. Considering the poverty situation, the government is now adopting a new development paradigm that has an objective of attaining growth-equity-sustainability. Prof. Anwar suggested that the research project on pro-poor interventions in irrigated agriculture is a timely effort in the context of irrigation sector reforms in Indonesia. He ensured that

this joint research study would come up with useful findings and recommendations which could contribute towards solving the problems being faced in irrigation sector in Indonesia.

Dr. Intizar Hussain of IWMI thanked the GM University and specifically CRRDS for cooperation in this research project. Dr. Hussain then introduced IWMI as one of the leading research institutions in water sector in the world. He then introduced the project in some detail, and highlighted the fact that the study is very relevant to the present irrigation sector reforms in Indonesia.

The next session began with a briefing by Dr. Saiful Rochdiyanto, one of the members of the project team, on the methodology of discussions in the workshop. All participants were requested to raise suggestions or questions by writing down all what they wanted. The written suggestions and comments were displayed on boards, which were grouped/summarized into several topics/issues for further discussion by the participants.

Following a brief on workshop methodology, six papers including the Draft of Work plan of the study were presented in the morning sessions of the workshop. Dr. Ja'far Sidiq chaired this session.

Dr. Sigit S. Arif, team leader for the Indonesian component of the study presented the draft of work plan of the study. He explained that the country is under transition, and policy reforms are underway in various sectors including irrigation and water resources sectors. The old development paradigm that focused on economic growth has failed to increase farmers' welfare, and the reform policy focuses on attaining growth-equity and sustainability in the agricultural sector. In the irrigation sector, the old paradigm that focused on achieving self-sufficiency in rice is being reformed with focus on raising farmers' prosperity. However, some problems and issues are arising in the implementation of the policy reforms–including issues relevant to the capacity of existing bureaucracy (lack of capacity to implement reforms), poor accommodation for participatory approaches, inadequate support systems and inappropriate information systems. Other problems, specially at the irrigation system level relates to irrigation management performance, water rights, and quality of land and water resources. Dr. Arif explained the objectives and scope of the study, including the proposed study areas in Indonesia.

The second presentation was made by Mr. Bambang Adinugoho of National Planning Agency. He is currently the Secretary of Working Group of Water Resources Development Policy Reform. Firstly, he criticized the title of the study. He mentioned that the word 'intervention' is no longer used, it should be changed to something like 'supporting the new irrigation policy' that encourages participatory approaches and dialogues. He elaborated on the progress being made in the water resource policy reforms in Indonesia. He pointed out that in the past, irrigation management and development policies, like other policies, were developed under non-transparent, inconsistent and undemocratic ways, and that the past policies focused only on increasing food production in Indonesia.

The new paradigm of irrigation management is established on the basis of transparency, consistency, democracy, accountability, partnership and law supremacy. New irrigation policy consists of five main elements: (I) re-organization of tasks and responsibilities of irrigation institutions; (ii) empowerment of WUAs; (iii) turn over of irrigation management to WUAs; (iv) reformulation for financing irrigation management; and (v) development of sustainable irrigation systems. To achieve the objectives of the new policy, the government is adopting several strategies including: (i)providing support to WUAs to empower them technically,

financially and institutionally and (ii) involvement of universities and NGO at all levels of implementation. The overall objective is to improve the lives of the rural people.

Dr. Soenarno, a former Deputy of Minister and Director of Irrigation, Department of Public Works and Member of the Steering Committee of Indonesian Irrigation Communication Network presented the third paper. He explained the long historical journey of irrigation development and management policy starting with Hinduness Kingdom in ancient period until recent reforms.

During the imperial periods, farmers built their own irrigation systems, and support from the government was limited. During the colonial period, irrigation system was developed based on government needs i.e., to support sugarcane factories and tobacco estates. Efforts to support farmers came later. Initially, farmers had a minimal role in the development. After independence, the government of Republic of Indonesia built irrigation systems based on farmers' need and no longer practiced the colonial policy on irrigation system development and management.

Further, he explained that the Government had paid attention in developing irrigation systems since 1965 under the New Order Government with General Soeharto as a President. In this period the government had built a number of new technical irrigation systems and rehabilitated existing irrigation systems across the country. Dr. Soenarno further highlighted failures of the past irrigation development policies.

He also offered suggestions on incorporating poverty alleviation concerns into the new irrigation policy. He raised some questions such as: (a) to what extent the policy on IMT will succeed in getting commitment from farmers (since most Indonesian farmers do not work only in farming sector but they also work in off farm sectors); (b) how the relationship between policy on food security and agribusiness can work in line; (c) how appropriate empowerment concepts can be integrated to make farmers self-reliant.

Dr. Effendy Pasandaran made the next presentation. He elaborated on the development of irrigated agriculture policy in Indonesia since the Dutch Colonial Government period. He suggested that it is important to study the relationships between poverty and irrigation from a historical perspective. According to him, past irrigation developments could not solve the problems of poverty in Indonesia—he attributed this to growth in population, and uneven distribution of land and water resources in the country. He warned the audience that irrigation is unsustainable and that crop yields are stagnant and cropping intensities show decreasing trends. He pointed out that modern irrigation systems are less flexible in terms of management, compared to traditional irrigation systems like Subak of Bali which are more flexible in management to accommodate the dynamics of the community. He emphasized on the importance of small-scale irrigation and micro-finance for alleviating poverty in the poor areas of Indonesia.

Mr. Nidhom Azhary, head of Provincial Water Resources Development Services (PWRDS) of Central Java, presented the fourth paper on the implementation of new irrigation management policies. He mentioned that in implementing the plan, the province has done some restructuring of water resources development services at all levels from the provincial level down to subdistrict level. Secondly, for empowerment of WUAs, the provincial government is offering participatory training programs to farmers and lower level government officials, incorporating farmers' needs in irrigation management specially in relation to irrigation finance and O&M. Thirdly, turn over of irrigation management to WUAs is being

done in Krogowanan Irrigation Scheme, and Beton Irrigation schemes. Fourthly, reformulation for financing irrigation management i.e., cost recovery, is underway on a pilot basis in several schemes. However, some problems are hampering the implementation of reforms, including lack of capacity of farmers and low level government officials. Farmers feel that O&M is the responsibility of government, and they refuse to participate in implementation of IMT program.

Dr.M. Maksum, the Director of CRRDS-GMU, presented the last paper. He elaborated on the inappropriateness of past agriculture development policies, impact of crisis on the poor and the scope for poverty reduction with pro-poor strategies in irrigated agriculture in Indonesia. He indicated that structural poverty of agriculture has been the most important social consequence of the economic development model of the country that focused on capital accumulation strategies, and that agriculture and irrigation development in this country has never been influential in alleviating poverty.

BRAINSTORMING SESSIONS

After presentation of papers, there was some discussion on issues raised in presentations. Dr. Sigit S. Arif chaired this session. Project-related issues, concerns, suggestions given by participants were summarized into six broad topics: (i) definition of poverty and in-depth study on poverty in the selected irrigation systems, and implications of the government irrigation related policies for the poor; (ii) problems arising from implementation of decentralization in irrigation sector, financing and government budget, support and subsidies to irrigation systems, irrigation management transfer/IMT, water rights in the irrigation system and among users, irrigation institutions (restructuring both farmers and government institutions, roles and tasks, etc); (iii) developing criteria for assessing performance of irrigation management with IMT and new irrigation management policies; (iv) implications of new policies for food self-sufficiency and for rural poverty; (v) sharpening criteria for selection of irrigation systems to be studied; (vi) studying surface and groundwater irrigation in the context of conjunctive water management.

Dr. Efendy Pasandaran stressed on identifying the policy variables that push the poor up. He suggested that in the short-run adjustments of cropping plans/management according to availability of water should be pursued. He emphasized on looking at the factors that make the irrigation systems responsive to the needs of the poor. In the long run, irrigation needs to be expanded through rehabilitation, increased farmer participation and through development of new institutions.

Small size of landholding was highlighted as one of the major constraints in Indonesia – which limits the scope for poverty alleviation through irrigation in the context of medium and large-scale irrigation systems.

Dr. Rustam Syarif and Dr. Efendy Pasandaran felt that there is no clear definition of poverty in relation to irrigation and agricultural development. Furthermore, Dr. Syarif added that misleading definitions of poverty and farmers' economic and financial status could lead to wrong decisions on the selection of study areas. In this relation, Dr. Effendy proposed

that the study team should redefine poverty instead of using the existing commonly used definition of poverty which is based on a daily calorie intake. Bambang Adinugroho of BAPPENAS, Sarwoko and other participants of Central Java PWRDS suggested that the past policy on poverty alleviation should be evaluated first and the study should come up with recommendations for effectively reducing poverty in rural areas of Indonesia.

They also suggested that implications of new decentralization and autonomy policies for the poor should also be studied. The concern was raised that restructuring of irrigation institutions is not consistent with the new irrigation management policies. Other issues that were highlighted relate to government subsidies to WUAs, micro-banking for the poor, market systems, information systems and technical assistance for WUAs. Similarly, the issue of relationships between central-local governments in the context of decentralization was also raised. Participants from both Provincial governments, Yogyakarta and Central Java, pointed out that the IMT program, adopted with similar procedures, gave different results in different schemes, and they raised related concerns on the effectiveness of implementation of new irrigation policies in two provinces. The participants suggested for developing appropriate approaches for monitoring and evaluation of the IMT program, and for developing frameworks measuring the sustainability of irrigation systems.

Mr. Yoshiharu Kobayashi of the ADB mission in Indonesia briefly described ADB's poverty alleviation efforts in Indonesia. He mentioned that this study would provide a guide in implementing the new irrigation policies in Indonesia. He stressed on the role of small-scale irrigation in poverty alleviation and its importance in the poverty stricken areas of Indonesia. He informed the workshop that the ADB is planning a project in Central Java for improving the incomes of poor farmers by providing them with access to technologies and markets.

Participants from NGOs and districts discussed the issues related to water rights and conflicts in a river basin, and highlighted the importance of dialogues and forums for conflict resolution. In the later part of the second session, the discussion was focused on study areas. Dr. M. Maksum chaired this session.

The participants suggested the following criteria for selecting the areas/irrigation systems to be studied in the proposed project.

1. Poverty situation in the area/system
2. Type of irrigation management system : IMT and non-IMT; technical or non technical irrigation system
3. Water availability and distribution patterns
4. Cropping patterns, agricultural technologies, crop productivity

Based on the above criteria, several areas and irrigation systems were discussed and proposed as suitable candidates for the study. The following four irrigation systems/schemes were finally proposed, and there was a general consensus on their suitability for this study: Kalibawang Irrigation System in Yogyakarta Special province; Klambu Kiri Irrigation Scheme

and Glapan Irrigation Scheme in Jratunseluna basin and Krogowanan Irrigation System in Central Java Province.

The workshop was closed with some discussion on the proposed study areas and irrigation systems. Dr. M. Maksum and Dr. Hussain thanked all participants for their fruitful contributions to the research project.

PAKISTAN

Country Workshop

12 March 2001

Poverty across the Agro-Ecological Zones in Rural Pakistan

G.M. Arif and Munir Ahmad *

INTRODUCTION

The poverty concern has been intensified by an emerging general consensus that rapidly declining poverty trends during the 1980s had got reversed in the beginning of the 1990s and continued to scale up indiscriminately in Pakistan. Based on this surge and the trends of Pakistan's economic performance, it is being argued that this destitution is likely to be persistent and may become a permanent gesture of this nation. Poverty has therefore emerged as a major challenge constraining the economic development of the country. In order to cope with this peril, the government of Pakistan is presently in the process of preparing a national poverty alleviation strategy.

Historically, poverty has mainly concentrated in rural areas of the country, which are diverse in terms of climate, land fertility, availability of water for irrigation, level of integration with urban sector, population growth and skill levels. Most of the studies relating to poverty focused on the analysis of rural/urban disparities. However, the existing considerable variability in agricultural productivity levels in different cropping zones suggest that it could be a useful exercise that accommodate these variations while examining the extent and the nature of poverty in the country. Recently, a few studies have considered these variations and determined the incidence of poverty in the 1980s and the 1990s at the ecological zone levels. The main objective of the paper is to review these studies in order to examine the changes in incidence of poverty across the agro-ecological zones of the country.

CLASSIFICATION OF RURAL AREAS INTO AGRO-ECOLOGICAL ZONES

Pakistan has two main cropping seasons: Kharif and Rabi. Cotton, rice, maize, sorghum and sugarcane are Kharif crops, while wheat, oilseeds, grams and barley are Rabi crops. Pickney's (1989) classification of rural areas into agro-climatic zones is based primarily on the Kharif crops, because wheat is the dominant crop in the Rabi season virtually in all areas of the

*Authors are Senior Research Demographer and Senior Research Economist, respectively at the Pakistan Institute of Development Economics, Islamabad.

country. Classification of districts into agro-climatic zones is reported in Appendix table 1, which shows that one major division is between the areas suited to rice and areas suited to cotton. There are four distinct cotton or rice zones: cotton/wheat Punjab (zone 3), cotton/ wheat Sindh (zone 6), rice/other Sindh (zone 7) and rice/wheat Punjab (zone 1). Pickney (1989) termed one zone centred around Faisalabad as the mixed zone (2), since no single crop dominates the area. In the classification, Barani areas are considered as a separate zone because of their dependence on rainfall (zone 5). Having similar cropping pattern and climate, the D.I.Khan district of NWFP is included in the low-intensity zone of Punjab (zone 4). This zone is situated on the left bank of the Indus in Punjab, which has relatively less developed irrigation facilities and thus low cropping intensities. The remaining districts in NWFP and Balochistan are included in the last two zones (8 and 9). Pickney argues that in spite of the fact that these districts of NWFP and Balochistan are agro-climatically heterogeneous, they are not disaggregated because they contribute only 6.3 and 1.2 per cent of wheat production, respectively.

TRENDS IN POVERTY

Studies undertaken during the last four decades to assess the extent and nature of poverty have in general been based on data sets generated by the Household Integrated Economic Surveys (HIES)[1], the earliest relate to 1963-64. To view the poverty trends, the last four decades are generally grouped into two broad periods: 1963/64–1987/88 and 1987/88–1998/ 2000. Various conclusions can be drawn from the first period, i.e., 1963/64-1969/70.

The first is that the overall poverty levels as well as poverty in rural areas increased, while the urban areas experienced a declining trend. Higher growth rates particularly in the manufacturing sector were the main factors in reducing poverty in urban areas during the 1960s. In spite of the government efforts to revamp the sector through Land Reforms Act of 1959, providing subsidies to encourage the use of fertilizer, providing plant protection services, encouraging farm mechanization, the introduction of Green Revolution during the mid 60s, the completion of the Mangla Dam in 1967 making more water available for irrigation and the resulting expansion in agriculture sector, the poverty increased in rural areas during this period. The reasons for this trend could be the following: the terms of trade remained more or less in favor of the industrial sector; greater income inequality since the major beneficiaries of the technological breakthrough at the very outset and of subsidies provided to agriculture were the large farmers; and the early beneficiaries of the nonagricultural sector's expansion were the urban people, not the rural.

The second relates to the period from 1969/70 to 1979 that witnessed a declining trend in poverty levels both in rural and urban areas. The third is that this declining trend in poverty continued till 1987-88. A number of factors including the 1972 land reforms, increase in urban employment and wages due to a boom in the construction sector and more importantly

[1]Or named previously as the Household Income and Expenditure Surveys.

the inflow of workers' remittances from the Middle East started in the mid-1970s led the poverty levels to decline.

The poverty trends, however, reversed in the 1990s as shown by the recent studies conducted by Amjad and Kemal (1997), Ali and Tahir (1999), Jafri (1999), and Arif et al. (2001).[2] These studies have estimated the poverty at least for the three years including some years of the 1990s and the results are summarized in table 1. All of these studies used the basic needs approach to determine the trends in poverty.[3] According to Amjad and Kemal, the overall poverty increased by 5 percentage point during the period 1987-88 and 1992-93. They observed a general increasing trend in rural areas. As regards the urban areas, results of this study show that the poverty increased from 15 percent in 1987-88 to about 19 percent in 1990-91 and then declined in 1992-93 to a level of 15.5 percent. The study by Ali and Tahir (1999) also shows an increase in both rural and urban poverty during the same period.

Table 1.Poverty trends in the 1990s in Pakistan.

Year	Amjadand Kemal (1997)	Ali and Tahir (1999)	Jafri (1999)	World Bank (2000)	Arif, Nazli and Haq (2001)
1987-88	17.32	19.18	29.2	37.0	-
1990-91	22.10	23.0	26.1	34.0	-
1992-93	22.40	28.11	26.8	25.0	-
1993-94	-	27.93	28.7	28.0	27.4
1996-97	-	-	-	24.0	29.6
1998-99	-	-	-	-	35.2

Jafri (1999), who estimated poverty for five years (1986-87, 1987-88, 1990-91, 1992-93 and 1993-94), shows that poverty declined between 1987-88 and 1990-91, but it increased during the next two survey years, 1992-93 and 1993-94. Arif et al. (2001) provides the poverty estimates for the years of 1993-94, 1996-97 and 1998-99 at the three levels that are overall, urban and rural. They show that poverty has increased from 27 percent in 1993-94 to about 30 percent in 1996-97; it increased further to 35 percent in 1998-99. Consequently, they concluded that at the end of the last decade more than one-third of the total households in the country were below the poverty line, while for the rural areas this figure was about 40 percent (table 2).

In sum, the results of all the four studies discussed above indicate that the trends in poverty during the 1990s move in the same direction. The only difference among them is that of the timings of poverty increase. Amjad and Kemal, and Ali and Tahir show an increase in poverty since the late 1980s, while Jafri shows that this increase has occurred since the early 1990s. Arif et al. indicate that this increasing trend continued at the end of the last

[2]Arif et al. (2001) have extended the earlier work carried out by Qureshi and Arif (2001).

[3]However, these studies differ markedly in their methodologies used to compute poverty lines. These methodologies have been discussed by Arif (2001).

Table 2.Poverty trends in the 1990s by rural and urban areas in Pakistan.

Period	Rural-urban areas	Poverty incidence (P_0)	Poverty gap (P_1)	Poverty severity (P_2)
1993-94				
	Total	27.4	5.31	1.6
	Rural	29.9	6.67	1.8
	Urban	23.1	4.82	1.4
1996-97				
	Total	29.6	5.8	1.7
	Rural	31.6	6	2.1
	Urban	27.4	5.9	1.1
1998-99				
	Total	35.2	7.58	2.47
	Rural	39.8	8.39	2.6
	Urban	31.7	9.67	3.5

Source: Computed from the 1993-94 and 1996-97 HIES data sets; for 1998-99, Qureshi and Arif (1999)

decade.[4] Therefore, it can be concluded that poverty, which declined rapidly in the 1970s and 1980s, has returned in Pakistan in the 1990s. This rise in poverty can be explained through macro-level factors such as demographic dynamics that affect the labour force and dependency ratio, employment levels, real wage rates, workers' remittances, assets ownership and access, and inflationary impact on food availability.

Despite the general consensus regarding the rise in poverty in the 1990s, it is however not an easy task to determine the precise estimates regarding the current level of poverty in the country. Only few studies have estimated the incidence of poverty for the late 1990s. Jamall and Ghaus-Pasha (2000) estimated the incidence of poverty, based on the basic needs approach, at 31 percent in 1996-97, while the level of poverty for this year, according to Arif et al. (2001), was about 30 percent. As noted above, for the 1998-99 period, first Qureshi and Arif (2001) and then Arif et al. (2001) have shown the incidence of poverty at 35 percent. According to the Government of Pakistan's Three Year Poverty Reduction Programme 2001-2004, 29 percent of the total population was below the poverty line in 1999-2000. However, this estimate appears to be on a lower side for two reasons. First, it takes into account only one component of the basic needs, that is food; and second, it uses a relatively lower threshold for calorie-intake (2150). The level of poverty would be certainly higher than 29 percent if the basic needs approach is used to determine the poverty line. Based on the available

[4]However, results of these four studies are different from the results of the World Bank study, which shows almost a continuous declining trend in poverty since the late 1980s. The World Bank study shows a continuous decline in poverty between the 1987-88 and 1992-93 periods. In urban areas, this declining trend continued till 1996-97 period. At the national level as well as in rural areas, after a modest increase in 1993-94, poverty declined again in 1996-97.

estimates it can be said that 30- 35 percent of the total population was poor in the late 1990s, suggesting that 40-47 million people were living below the poverty line.

RURAL-URBAN DIFFERENTIALS

As noted earlier, poverty in Pakistan has historically been higher in rural areas than in urban areas. Table 2 highlights some of the interesting points concerning the poverty trend in the 1990s. First, poverty increased overall in rural as well as in urban areas of the country between the 1993-94 and 1998-99 periods. As noted earlier, at the end of the last decade, more than one-third of the households in the country was below the poverty line; while, this level is about 40 percent for the rural areas. Second, the rise in poverty in the 1990s was relatively higher in the rural sector than that in the urban sector. As a result, the rural-urban gap in poverty levels increased modestly from about 6 percent in 1993-94 to 8 percent in 1998-99. Third, more than 70 percent of all poor people in the country live in rural areas (Arif et al. 2001).

POVERTY ACROSS THE AGRO-CLIMATIC ZONES

Incidence of poverty for the nine agro-ecological zones for 1993-94 and 1998-99 is presented in table 3. These estimates show that the rural poverty in 1993-94 was highest, i.e., 34 percent, in cotton-wheat zone of Sindh followed by rice-wheat zone of Punjab and other NWFP. Rural poverty was observed to be the lowest, i.e., only 14 percent, in the *barani* Punjab. In 1998-99, rural poverty was highest in Balochistan, i.e., 54 percent, followed by rice-wheat Punjab, cotton-wheat Sindh, low intensity Punjab and cotton-wheat Punjab. However, the *barani* Punjab again shows the lowest level of poverty.

Table 3.Incidence of food poverty (head-count ratios) by agro-climatic zones (rural only), 1993-94 and 1998-99.

Agro-climatic Zonesa	1993-94	1998-99
Rice/wheat Punjab	33.1	47.7
Mixed Punjab	21.0	31.4
Cotton/wheat Punjab	25.4	36.5
Low intensity Punjab	24.2	32.6
Barani Punjab	13.8	27.5
Cotton/wheat Sindh	34.1	39.4
Rice/other Sindh	26.9	36.8
Other NWFP except D.I.Khan	28.7	28.2
Balochistan except Nasirabad	21.9	54.4

Source: Qureshi and Arif (1999).

The results of Qureshi and Arif study support some of the results and contradict other findings of a study by Malik (1992) for the years of 1984-85 and 1987-88. In both studies poverty was the lowest in *barani* Punjab. But the two studies differ in the highest level of poverty. According to Malik, rural poverty was observed highest in the cotton-wheat zone of the Punjab followed by the low intensity zone during 1984-85; while, the pattern was same for the 1987-88 year. On the other hand, the results of Qureshi and Arif (1999) study indicate that the rural poverty in 1998-99 was highest in Balochistan followed by cotton-wheat zone of Sindh, low intensity Punjab and cotton-wheat Punjab.

Despite these differences both of these studies lead to the same conclusion: rural poverty was relatively low in those areas where people had opportunities to support their income from nonagricultural sources like *barani* districts—Attock, Jhelum, Chakwal and Rawalpindi/Islamabad, which are closely integrated with their urban sectors and have strong linkages with the services sector (Malik 1992). These districts are considered among the most developed in the country. Moreover, migration, particularly overseas, might have played an important role in controlling poverty in *barani* areas, which had a long history in sending its workers abroad. Results of the study carried out by Gazder et al. (1995) based on the two data sets, 1990/91 HIES and 1991 PIHS also support this view. They desegregated rural Punjab into North and South and indicated that rural South Punjab had an extremely high incidence of poverty of close to 50 percent. The incidence of poverty in rural South Punjab was statistically significantly higher than in both rural north Punjab and rural Sindh.

POVERTY IN ECOLOGICAL ZONES AND STATUS OF FARM HOUSEHOLDS

Qureshi and Arif (1999) have classified the households covered in the 1993-94 HIES and 1998-99 PSES data into two categories— farm and non-farm. This classification was based on the reported ‘industrial status’ of the head of household. If the status was agriculture, a household was considered as a farm household. The rest of the households in the two samples were grouped into the non-farm category, including those, whose industrial status was not reported. The results are presented in tables 4 and 5. In table 4, farm and non-farm households were separated into rural and urban areas and the reported estimates refer to food poverty. Table 5 focuses on rural areas and shows the estimates of incidence of poverty for the years 1993-94 and 1998-99 for farm and non-farm households, using the basic needs approach. One can draw four main conclusions from the results presented in tables 4 and 5:

1. In 1993-94 non-farm households were poorer than the farm households in rural areas;

2. In 7 out of the 9 agro-climatic zones farm households were better off than the non-farm households;

3. The differences in the incidence of poverty between the farm and non-farm households were particularly higher in the Punjab and NWFP— for example, as compared to 22 percent of head-count ratio for farm households, 40 percent of non-farm households in rice-wheat zone of Punjab were below the poverty line in 1993-94, and similarly in cotton-wheat zone of Punjab incidence of poverty was 11 percent higher in non-farm households than in farm households;

4. In 1993-94 non-farm households were less poor than the farm households only in two zones: barani Punjab and Balochistan (excluding Nasirabad). Estimates of poverty based on the 1998-99 PSES data set had similarities as well as differences with the results based on the 1993-94 HIES data set. In both data sets non-farm rural households were relatively poorer than the farm households in three provinces—Punjab, Sindh and NWFP. According to the 1998-99 PSES, rural farm households were also better off in Balochistan. It can be concluded that farm households were generally better off than non-farm households.

Table 4. Incidence of food poverty (head-count ratios) by province, rural/urban area and farm status of households in Pakistan.

Province/rural/urban		1993-94		1998-99	
		Farm households	Non-farm households	Farm households	Non-farm households
Pakistan	Rural	23.3	28.6	27.5	40.3
	Urban	18.8	19.4	23.1	26.1

Source: Computed from the 1993-94 HIES and 1998-99 PSES primary data sets.

Table 5. Incidence of food poverty by agro-climatic zones and farm status in Pakistan.

Agro-climatic zones	1993-94		1998-99	
	Farm household	Non-farm household	Farm household	Non-farm household
Rice/wheat Punjab	21.6	39.9	22.3	33.1
Mixed Punjab	16.9	25.8	30.5	34.6
Cotton/wheat Punjab	19.9	31.4	35.2	44.7
Low intensity Punjab	15.3	28.3	40.2	63.4
Barani Punjab	15.7	12.5	3.9	10.1
Cotton/wheat Sindh	33.4	34.2	20.4	32.2
Rice/other Sindh	25.7	27.1	19.5	14.6
Other NWFP	23.0	32.3	31.7	31.1
Balochistan	33.0	21.1	31.3	26.7

Source: The 1993-94 HIES and 1998-99 PSES primary data sets.

RURAL POVERTY: A REAL CHALLENGE

The persistence of high level of poverty in rural areas is considered to be one of the major causes of migration of people from rural to urban areas. The urban informal sector acts as a sponge for the rural labor that cannot find jobs in the formal sector of urban areas. The informal sector is characterized by lower wages and poor working conditions. The rural people who move to large urban centers usually live in slum areas, where according to some estimates, more than 35 percent of the total urban population reside in unhealthy and poor living conditions. In this way urban poverty is largely a reflection of rural poverty. The growth of urban areas in the absence of sustained rural growth will reinforce the rural-urban disparities and would not benefit the poor.

Agricultural growth in rural Pakistan also does not benefit effectively the large majority of the farming communities because of the extremely uneven distribution of land and a large number of people even lack access to land. In such a situation it appears difficult to eliminate rural poverty only targeting the higher growth in the agricultural sector. Effective agrarian reforms would potentially be an important solution, but one should not underestimate the political difficulties involved in this process. Mass migration to urban areas is also an unappealing prospect; it would probably result in simply shifting the poor from rural to urban sector. A dynamic labor-intensive agriculture combined with a modernized nonagriculture sector can only lead to reduction in rural poverty through better employment and income opportunities and a resulting growth, and its egalitarian distribution.

CONCLUSIONS

The major objective of this paper was to review the studies relating to poverty analysis in Pakistan. The results of these have shown that the poverty has increased during the 90s—overall as well as in rural and urban areas, after experiencing downward trends during the 80s. Besides, the gap between rural and urban poverty has also widened. The recent estimates show that more than one-third of our population lives in extreme poverty, and around 70 percent of these unfortunate people reside in rural areas. The results based on agro-ecological divisions of the country indicate that poverty is lowest in the *barani* areas of the Punjab because of better opportunities in terms of employment in other sectors, particularly, the services sector as well as overseas migration. The highest is observed in Balochistan may be due to nonavailability of irrigation water and low rainfall making dwellers more vulnerable to droughts seriously affecting the crops and the livestock which are the main sources of their livelihood.

Poverty is widely spread in irrigated areas of the country particularly in Southern Punjab and Sindh where feudal system still prevails. Job opportunities outside agriculture are limited and migration within the country or overseas is not a common phenomenon in these areas of the country. On the one hand there is a need to carry out more research to understand better the phenomenon of poverty across the agro-ecological zones, and on the other, poverty alleviation programs should focus on those areas where the incidence of poverty is alarmingly high.

Appendix table 1.Distribution of districts covered in the 1993-94 HIES and 1998-99 MIMAP survey according to agro-climatic zones.

Zone No.	Agro-climatic zones	Districts
1.	Rice/wheat Punjab	Sialkot, Gujrat, Gujranwala, Sheikhupura, Lahore and Kasur
2.	Mixed Punjab	Sargodha, Khushab, Jhang, Faisalabad, Okara and Toba Tek Singh
3.	Cotton/wheat Punjab	Sahiwal, Bahawalpur, Bahawalnagar, Rahim Yar Khan, Multan,. Vehari and Khanewal
4.	Low intensity Punjab	Dera Ghazi Khan, Rajanpur, Muzaffargarh, Leiah, Mianwali, Bhakkar and Dera Ismail Khan
5.	Barani Punjab	Attock, Jhelum, Chakwal, Rawalpindi and Islamabad
6.	Cotton/wheat Sindh	Sukkur, Khairpur, Nawabshah, Hyderabad, Tharparkar and Sanghar
7.	Rice/other Sindh	Jacobabad, Larkana, Dadu, Thatta, Badin, Shikarpur, Nasirabad and Karachi
8.	Other NWFP (Except D.I.Khan)	Swat, Dir, Peshawar, Kohat, Karak, Mansehra, Abbottabad, Kohistan, Mardan and Bannu
9.	Other Balochistan (Except Nasirabad)	Quetta, Sibi, Kalat and Mekran

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Social Mobilization for Poverty Alleviation: Experience and Lessons from Small Dam Areas in Pakistan

Muhammad Asghar Cheema *

Today, almost one-third of the population in Pakistan is poor. This translates into 46 million people currently living below the poverty line. At the beginning of the 1990s, one in five families was living in poverty, however, this proportion has increased to one in three in late 1990s. Overall, the incidence of poverty has increased in the last decade. The incidence of poverty varies substantially across Pakistan, with poverty being significantly higher in rural areas. Pockets of extreme poverty, in which over half of the population lives, exist in rural Sindh and Baluchistan. Poverty tends to be concentrated in large families that have few earners and high dependency ratios; households in which the head of the household is illiterate or has only primary education and is under employed; and households that do not own assets.

BACKGROUND OF THE PROJECT

The Pothwar area is characterized by deteriorating land resources and fragmented landholdings with limited water resources. The land tenure system in the area is mainly dominated by small owner-operated units with the average farm size between 3.5 and 4.5 hectares which is further declining on account of population pressure and inheritance customs. The rain-fed farmers in Pothwar area are under great income stress as yields are very low on account of shortage of water and age-old agricultural practices.

The International Water Management Institute (IWMI, formerly IIMI), in collaboration with the Water Resources Research Institute (WRRI) of the National Agricultural Research Center (NARC) of Pakistan and the Small Dams Organization of the Punjab Irrigation and Power Department, conducted an action research program on "Social Organization for Improved System Management and Sustainable Irrigated Agriculture in Small Dams" from April 1996 to March 1999. The project was funded by the Department for International Development (formerly ODA) of the UK through its Competitive Research Facility (formerly Holdback Facility). The program aimed to test the potential for improved irrigation systems management and command area development in small dams in the Punjab Province through the involvement of water user organizations at two pilot sites.

IWMI's social organization program in the small dams area was motivated by two considerations. First, the 31 dams systems in the Punjab Province experience significant constraints, which impede the successful establishment of irrigated agriculture in the rain-fed tract.

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- After the construction of the dams and irrigation channels, further physical improvement, command area development or institutional development activities were not carried out.
- Farmers were not successfully adopting adequate irrigation practices.
- A system of rules for the coordinated allocation and distribution of water was not developed.
- Less than 30 percent of the total command area was irrigated.
- Erosion in the catchment area causes deteriorating storage capacity of the reservoirs due to heavy sediment load.

Second, Pakistan currently seeks to implement a comprehensive institutional reform of the irrigation and drainage sector, and the small dams systems were identified as suitable sites to test new institutional arrangements.

Pakistan's irrigation system is characterized by a persistently low return in investment (World Bank 1994). The deterioration of physical infrastructure, environmental decline, an unfavorable ratio of costs to revenues, and unreliable, inefficient water delivery are considered typical problems. As in the case of small dams, the performance of irrigation systems generally remains low, despite major technical development efforts. The causes of such performance deficits are identified as institutional in nature. For that reason, solutions are sought through institutional reforms.

The participatory management of water resources is a central component of globally tested reform models, where rights and responsibilities for the management of local water supply subsystems are transferred to organized water users. Participatory irrigation management is being promoted by irrigation management experts, research institutes and non-governmental organizations worldwide, and has been adopted by several countries in their institutional reforms.

The major basic research questions were:

- What are the causes of the present low level of performance of the small dams in the Punjab Province of Pakistan?
- Can this situation be remedied and the performance improved by organizing water users so that they would assume greater responsibilities for the operation and maintenance of the small dam systems?
- To what extent can this strategy improve agricultural production in the small dam command area?
- What is the most appropriate method of organizing water users under the conditions prevailing in the small dam command area?

Following the conceptual logic of action research, these keys research questions were translated into five specific project objectives, the implementation of which would yield comprehensive data to answer the key research questions. The projective objectives were as follows:

1. Identify the extent of current problems related to the system of management and command area development.

2. Facilitate the formation of appropriate water user organization in each of the selected small dam pilot area.

3. Assist the organizations to become as functional as possible in the management of operation and maintenance, as well as in command area development, with an emphasis on improved irrigated agricultural practices.

4. Develop methodologies for water user organizations under the given technical, socioeconomic and institutional conditions.

5. Assess the viability of these chosen social organization strategies and their short-term effects on the operation and maintenance of small dams systems and on their command area development.

APPROACH

The approach of the IWMI project team to the task of the social organization of water users at the small dams entailed the following salient components.

- The organizing process itself is participatory, as the water users themselves decide on the form, structure and functions of their organizations. All decisions regarding activities are to be taken by the members.

- The process of organization needs to be slow and follow a series of steps in order to establish rapport between farmers and facilitators. Farmers tend to be suspicious of outside interventions as a result of difficult experiences with government agency personnel and previous development projects. The step-wise iterative process strives to develop mutual trust, information change, consultation for consensus, development of options and implementation of an appropriate organization design.

- The incentives for social organization would be primarily non-physical and non-monetary. The project experiences in the past show that monetary or material incentives are merely temporary and fail to generate sustained organizational efforts among project beneficiaries. The action research approach seeks to motivate farmer participation by convincing them of the benefits of organized

collective action, such as improved water delivery, equitable distribution, improved agriculture, and empowerment.

During a detailed socioeconomic survey of the project followings problems were identified (Cheema and Bandaragoda 1997).

- Some services essential to mobilization activity, such as communication, transport and banking are restricted.
- Predominance of smallholders and lack of experience with irrigated agriculture may limit motivation to use innovative agricultural practices.
- The relatively low level of education and high number of illiterate farmers may constrain their ability to manage a water user organization.
- Experience among farmers in collective action was low and culture of organizational behavior for management of resources was scarcely developed, except in the religious sphere.
- The majority of farmers favored traditional crops, such as wheat, as a means of basic food security. They were relatively unfamiliar with irrigated agricultural practices. If reliable water supply could be assured, farmers showed an interest in combined subsistence and cash crops.
- Crop yields were generally below national average.
- The actual irrigated area was far below the anticipated culturable command area due to insufficient command area development, as well as lack of rational and equitable distribution of water.
- Design, construction, operation and maintenance of the small dam irrigation systems were deficient. The small dam systems were not managed through collective action i.e., participatory irrigation management.

METHODOLOGY AND PRACTICE OF SOCIAL MOBILIZATION

The following were the main features of the methodology used in the project.

- Participatory approach;
- Slow step-wise process;
- Small field team of social organizers;
- Involvement of community based volunteers; and
- Non-physical incentive.

PHASES OF STEP-WISE PROCESS

Support Mobilization Phase

Step-wise process used in the project was originally provided in the article by Skobergoe and his associates (1993). Support mobilization phase refers to the establishment of institutional arrangements and methods in project activities in collaboration with the partners. This includes site selection, training and deployment of social organizers, start of project implementation coordination committee (PICC). Based on the criteria laid down in the Inception Report, three sites were chosen at Mirwal, Shahpur and Kot Raja Dams.

Three social organizers, recruited for the project, were trained at the IWMI's office in Lahore and Field Station in Haroonabad, where social organization activities are carried out. Initial meetings between IWMI staff and representatives from WRRI, OFWM, SDO, ABAD and Agricultural Extension Directorate (AED) took place during this phase to discuss project concepts, site selection and potential areas of collaboration.

The project implementation coordination committee (PICC) was constituted in 1998 with the participation of WRRI, ABAD, OFWM, SDO, AED and the water user organizations of Mirwal and Shahpur small dams.

DIAGNOSTIC ANALYSIS PHASE

This involves collection of detailed socioeconomic and technical information through the participation of key informants. WRRI and IWMI staff conducted a detail problem analysis using various research methods, such as walk-through surveys, socioeconomic and technical baseline surveys (WRRI 1997), and informal meetings with key informants. During this phase community based Social Organization Volunteers (SOVs) were sought and trained. These members of the communities were found to be valuable links with the farmers. Most SOVs were farmers with small to medium-size holdings, and school teachers or unemployed educated youth willing to gain experience in a social organization. A training need assessment was commissioned from ActionAid Pakistan (1998), which identified needs in areas of health, agriculture, livestock, income generation, insfrastructure and education.

THE ORGANIZATIONAL DEVELOPMENT PHASE

This follows five dialogic steps involving various types of meetings, which progressively intensify interactions with and among farmers, involving increasingly large number of participants. In this phase of social organization, five dialogic steps were followed.

- Familiarization meetings;
- Rapport building meetings;
- Consultation meeting;
- Selection meeting; and
- Selection of WUO office bearers.

THE ORGANIZATIONAL PHASE

This involves further training and development of plans of operation and maintenance as well as command area development, based on a detailed assessment of the problems on the ground. Collaborative activities with partners in the irrigation and agriculture sectors were initiated and carried out. In the course of organizational activities, the WUOs established their offices, opened bank accounts, raised funds from among their membership, held monthly meetings and kept minutes as well as other organizational records. IWMI staff assisted the leadership in the WUOs in all these activities. The WUOs drafted their bylaws with the assistance of IWMI staff.

Most importantly, the WUOs in Mirwal and Shahpur dams undertook a number of collaborative activities with government agencies to improve the operation and maintenance of the irrigation systems and to develop their command areas.

Farmers' organizations were successfully established by the IWMI staff with the active collaboration of WRRI and SDO staff. Besides training of farmers and the office bearers, the collaboration activities in operation and maintenance of irrigation systems and in command area development were undertaken successfully. This resulted in equitable water distribution among farmers, more cropped area under irrigation, improved cropping pattern (more cash crops), higher yield of wheat crop, reduction in water disputes etc.

PROJECT INTERVENTIONS AND EXPECTED IMPACTS

The project inception report (IIMI 1996) provides a framework for the analysis of key project interventions and expected impacts.

CONFLICT RESOLUTION

Agreed farmer-run mechanisms for discussion of land and water related issues and conflicts were agreed under the project. Total number of disputes appeared during the project period was 39. The proportion of disputes resolved through agreed mechanism was 26 i.e., 66 percent.

The conflict on water share at the distribution point of the main channel of Shahpur Dam was resolved amicably by the timely intervention of IWMI staff that saved farmers from both sides of the channel, that is RBC and LBC, from a possible blood shed. Depending upon the land on RBC, the share of water was 60 percent, while LBC has a share of water equivalent to 40 percent. But the situation on March 30, 1998 was just the opposite. After farmers from both command areas were satisfied with the sufficiency of the new distribution regime, a permanent weir was installed. IWMI provided the equipment, expertise and financial resources, while SDO sanctioned the process and provided a mason to construct the permanent weir. Measured channel flows have been changed from 2.67 cusecs for RBC and 4.01 cusecs for LBC before March 31, 1998 to 4.08 cusecs for RBC and 2.60 cusecs for LBC from April 1, 1998. For details see table 1.

Table 1.Water distribution (cfs) between RBC and LBC at Shahpur Dam.

Channel	Before (March 30, 1998)	After (April 1, 1998)
RBC	2.67	4.08
LBC	4.01	2.60

OPERATION AND MAINTENANCE

IWMI agreed to finance the essential outstanding repairs of the LBC and some watercourses with the labor power contributed by WUO members. Although IWMI generally avoid the provision of material incentives for organizing farmers, the exception was considered vital for the success of the project. The alterations of the flow regime accepted by LBC cultivators reduced their apportionment, and therefore, required that their subsystem be well maintained to ensure reliable water delivery throughout the branch canal. The rehabilitation of the irrigation systems at Shahpur Dam during 1998 cost the government Rs. 122,000. IWMI contributed Rs. 57,814 and farmers contributed Rs.52,650 as labor cost. Farmers also received training in operation and maintenance of irrigation facilities.

LAND USE PATTERN

The water user organization attended to land preparation in the command area. This resulted in increasing the area under irrigation. Area under irrigation during rabi seasons of 1997/98 and 1998/1999 increased from 140 to 220 acres in the Shahpur Dam command area i.e., 57 percent. For the Mirwal Dam command area the increase was from 180 to 331 acres i.e., 64 percent. A comparison of the 1997 and 1998 kharif seasons showed a slight decline of 5-6.5 percent, respectively (table 2). As a result, the actual irrigated area, when compared to CCA, has overall increased from 11 to 18 percent in Shahpur Dam and from 17 to 26 percent

in Mirwal Dam. Although it still falls short of the assumed irrigation potential, gains were considerable. Further increases in irrigated area were mainly dependent on land leveling and the extension of the existing irrigation system network, both of which are costly and dependent on sufficient support services from government agencies.

Table 2. Comparison of pre- and post-improvement cropped areas (acres).

	Kharif			Rabi		
	1997	1998	Trend	1997-98	1998-99	Trend
Shahpur (CCA=1231)	140	133	-5%	140	220	57%
Mirwal (CCA=1051)	184	172	-6.52%	180	331	84%

FARMER'S TRAINING IN IRRIGATED AGRICULTURE AND IN AGRICULTURAL PRACTICES

The farmers were trained in irrigated agriculture and agricultural practices to shift their practice from barani land cultivation to irrigated agriculture i.e., use of high yield varieties, fertilizers and pesticides. This resulted in an increase in yield per acre of wheat by 34 percent between 1996/97 and 1997/98. During this period, fertilizer use per acre increased by 14 percent.

EQUITY IN WATER DISTRIBUTION

IWMI staff assisted the WUOs to develop water rights and related allocation rules and shift from adhoc water distribution to area-proportional allocation. This helped in improving equity in water distribution at the branch canal level. Revised warabandi was accepted and partially implemented at the Mirwal and Shahpur pilot sites.

CROPPING PATTERN

With the assistance of IWMI staff, farmers in the project areas changed the cropping pattern from growing traditional crops to cash crops even where dam water was available. With the

availability of reliable dam water, farmers started growing cash crops like, citrus plants, vegetables, sugarcane etc.

CONCLUSIONS

The project lasted for about three years, starting from April 1996 to March 1999. During the project period, with a small team of IWMI staff, the achievements were commendable. The method used in the project was participatory at every phase of the project.

With the successful formation of WUOs at the project sites, not only the water and land conflicts were reduced, it was also possible for farmers to improve their socioeconomic status and increase their financial resources by bringing more acreage under irrigation and improving their cropping pattern. Farmers' training in irrigated agriculture helped in improving distribution of water, in terms of equity and reliability, and in improving operation and maintenance of water channels. Overall, the project had positive impacts in terms of reducing poverty in the project area.

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Pro-Poor Interventions in Rural Areas of the Punjab: Experience from the Punjab Rural Support Program in Pakistan

Mohammad Amjad Saqib *

POVERTY IN PUNJAB

Poverty, a state of deprivation and destitution, is a primitive predicament. People of the Punjab have been suffering from this since time immemorial. Kings, Sultans, Maharajas, Rajas and then the British— whosoever ruled this land of five rivers plundered the poor and made their plight pitiable. Evidence of such extreme exploitations and grave injustices is not difficult to gather. It can easily be found in the books of history or traced from the folk traditions and the Sufi poetry of the previous centuries. This abysmal situation continued unabated till the departure of the British Raj. At the dawn of independence, people dreamed that this state of poverty, which reflects in hunger, disease, ignorance and vulnerability, would whither away and an era of prosperity will usher henceforth. This however did not happen and the people continued to plunge in deep poverty. Destitution was their destiny and it continued to remain so. Successive regimes whether political or military, claimed to take many initiatives but these hardly made any visible impact and every passing day found hundreds of people falling below the poverty line. This failure to mitigate the plight of the poor can be attributed to many factors like utilitarianism, political patronage, lack of accountability; conventional top-bottom approaches, and perceiving the poor as a liability and failure to harness their potential. Parallel to these state-led development efforts, few development professionals were also busy devising a strategy suited to the local genius and responsive to indigenous needs and aspirations. One such initiative originated in Comilla, now in Bangladesh, under the guidance of an eminent scholar and civil servant Mr. Akhtar Hameed Khan. Benefiting from the principles of Raiffeissen, a German thinker, who worked for the salvation of the poor villagers of Germany, Dr. Akhtar Hameed Khan developed a theoretical framework aiming at rural development and the upliftment of poor farmers. This framework is based on participatory development approach, which seeks to organize the rural poor, around their common interests and felt needs, in small groups and then to serve them through these groups in a permanent and profitable manner. Daudzai in NWFP and Orangi in Karachi followed Comilla. These initiatives cul inated in the emergence of Agha Khan Rural Support Programme (AKRSP) and National Rural Support Programme (NRSP) supported by Agha Khan Foundation and Government of Pakistan, respectively. Both these programs operate on the basis of a time-tested premise that people have the willingness and ability to change their lives and a sincere leadership is also available at the local level to help them come out of poverty. These organizations perceive their role as support entities that are responsible for providing social guidance during this entire process of development.

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PUNJAB RURAL SUPPORT PROGRAM (PRSP)

Inspired by the success of AKRSP and NRSP, the Government of Punjab decided to finance the establishment of an organization based on the same principles. The overarching objective was to reduce poverty and enhance the quality of life of the rural poor in the Province. The organization was named as Punjab Rural Support Programme (PRSP) and it came into existence in June 1998. Government of Punjab donated Rs.500 million as a one-time grant and it was registered under Section 42 of the Companies Ordinance 1984 as an apolitical, nongovernmental private organization. This arrangement has been made to save it from political interference and bureaucratic muddling. There is a board of directors responsible for policy formulation and budgetary allocation. The program implementation is then accomplished through a team of professionals headed by Regional General Managers.

PRSP started operations in eight regions of the Province: Faisalabad, Gujranwala, Lahore, Multan, Muzaffargarh, Narowal, Sahiwal and Sargodha. Together, these regions will cover 19 districts. So far, the program has been launched in 11 districts. Brief description of conceptual and operating principles being followed by PRSP is given hereunder.

GOAL

PRSP's goal is alleviation of poverty and improvement in the quality of life of the rural poor.

STRATEGY

PRSP works on the belief that the poor have the potential to improve their lot. The program strategy is to harness that potential.

PRIORITIES

PRSP puts people before things, children before adults, women before men, the poor before the rich, the weak before the powerful and the vulnerable before the secure.

PRINCIPLES

PRSP believes that the lot of the poor can be improved through self-help. It rejects the traditional concept of self-help synonymous with the poor providing the free labor only.

PRSP considers self-help as the willingness of the poor to organize, to generate their own capital through savings and to take full responsibility for the management of local affairs. Self-help breeds self-reliance which is the key for human progress.

Basic tenets of PRSP are social organization, capital formation, capacity building or skill enhancement of the rural poor and linking them to government agencies, NGOs, donors and private businesses for better service delivery and enhancing their options and opportunities. PRSP does not offer any pre-conceived package of interventions. It is the people who identify and prioritize their needs. Starting point of PRSP interventions is the development of individual household. Focus on individual household is the key for galvanizing the community into a large whole. Once an individual household accomplishes its objectives and realizes its potential the group and community level activities start ensuing swiftly.

ACHIEVEMENTS

Social Mobilization

The starting point for PRSP interventions is social mobilization. Social mobilization paves the way for all subsequent efforts and interventions. It is a process of organizing people into homogenous groups to enable them to utilize their potentials for their own development. Social mobilization is the key to the participatory development approach. Nothing substantial can be achieved unless people are organized and blended into an institutional framework. It is only through organization that people pool their resources, achieve economies of scale, forge common understanding amongst them and resolve internal conflicts by consensus. This process engenders a sense of collective responsibility among the poor to shape their destiny themselves. By organizing the poor into community organizations (COs), PRSP attempts to tap the unexplored potential and reinvigorate the dormant abilities of the poor. PRSP has been able to organize nearly one hundred thousand households in five thousand community organizations (COs). Out of these more than fifteen hundred COs comprise of rural women. Having folded within an organizational network, these COs have started undertaking development activities through mutual consultation and participation.

Micro-Credit

The role of micro-credit in poverty alleviation can never be overemphasized. It has helped millions of people in their struggle against poverty and powerlessness. It is certainly not a panacea but arguably the most effective tool for poverty reduction. Micro-credit has taken the bank to the doorsteps of the poor and exposed the old myth that the poor are not bankable and creditworthy. PRSP extends credit to the rural poor without any physical or economic collateral. These loans are being disbursed to the poor villagers for various purposes like agriculture-inputs, small enterprise, livestock and productive infrastructure development. In

a survey carried out by the PRSP, beneficiaries of Livestock credit reported an average increase of Rs.1,729 in their monthly income while beneficiaries of Enterprise credit reported an average increase of Rs. 3,978 per month. They spent the extra money on food; health and education of their children besides saving some amount for the future need as well. Apart from assisting the rural poor to create their own assets, the micro-credit provided through PRSP helped them to free themselves from the clutches of local moneylenders who charge exorbitant interest rates. The beneficiaries of group lending for the fertilizer succeeded in increasing their farm productivity and hence their income. Similarly, the credit for physical infrastructure schemes like construction of disposal ponds, drains and sewers improved the health standards of the villagers and also gave them a sense of self-confidence to improve the quality of their lives collectively.

CAPACITY BUILDING/SKILL ENHANCEMENT/HUMAN RESOURCE DEVELOPMENT

PRSP believes that upgrading of human skills of the poor is essential to enable them to make best use of available resources. While the poor have skills and a traditional knowledge base, these need to be built upon so that new profitable opportunities can be realized. PRSP attempts to enhance the capabilities of the rural poor by imparting three types of training; managerial or leadership, technical and vocational. So far one thousand training events have been arranged where fourteen thousand men and women have acquired various skills. These skills have harnessed their abilities and enhanced their productivity. The beneficiaries of these trainings are now more confident and committed citizens, and exploit, their potential for individual and collective benefits. This is for the first time that such a large cadre of village activists have been trained and employed gainfully.

NATURAL RESOURCE MANAGEMENT

Inefficient use of water, land, seeds, fertilizers and other agriculture inputs is a common practice in our villages resulting in low productivity and high losses. Livestock and Poultry Management, Fruit and Vegetable Farming and other relevant areas have also suffered due to poor service delivery and wasteful techniques. PRSP aims to increase the income of farmers by helping them overcome such problems. PRSP's operational strategy in this regard includes both palliative as well as preventive measures. It emphasizes a balance between growth and conservation, it also aims to sensitize the government line agencies about the importance of integrating rural community for natural resource management. PRSP also facilitates awareness building among the communities through information dissemination and organizing different activities such as field days and workshop in agriculture, livestock and poultry farming. Establishing Guidance and Demonstration (GD) plots is also part of the strategy to create cognizance and inspiration among the farmers.

LINKAGES

People are poor because they are isolated. Linking the rural poor with the mainstream is the most crucial element for poverty reduction. The major objective of these linkages is to remove the age-old isolation, powerlessness and vulnerability of the poor. PRSP acts like a bridge or a conduit through which goods and services start reaching the far-flung rural areas. Weakness of service delivery mechanism makes these links far more important. Regular contacts with departments like Agriculture, Livestock and Dairy development, and Fishery, Forestry and Poultry management have been established and resulted in the improvement of farmers' productivity. Such links are not confined to the public sector only. Efforts have also been made to bring the private sector in close proximity to the rural population.

SOCIAL SECTOR SERVICES

PRSP is well aware of the indispensability of health and education sectors, which along with the family planning are the major thrust of its social sector services. Health and education are valued not only for their intrinsic worth but also for their positive impacts—direct and indirect—on human capital, productivity and capabilities for participation and social inter-action. These are also inter-linked and inter-dependent. Evidence has shown that higher level of maternal education improves the nutrition status of children. Studies in South Asia revealed that the rate of under nutrition is as much as 20 percent lower among children of women who have gone no further than primary level education. After assessment of needs in the target area, PRSP has been able to set-up one hundred community schools where six thousand students are studying. These girls and boys come from that unfortunate lot that never gets the opportunity to visit a school. Similarly many breakthroughs have been made in the health sector. Arranging health camps, providing family planning and immunization services, imparting first aid and basic health trainings are major interventions that have benefited more than thirty thousand poor people.

FUTURE DIRECTION

There may not be consensus on the ways and means to fight against poverty but everyone believes that the task of poverty alleviation needs a long and committed effort. It is like scaling a high mountain and treading on a tight rope. In a short span of three years PRSP has been able to kindle a light of hope in the hearts of the poor inhabitants of the Punjab. It has demonstrated that the old principle of self-help still holds true. PRSP is not trying to reinvent the wheel. It is just reiterating the time-tested principle of participation and faith in people's potential and abilities. What we are doing is to harness the willingness of the people for alleviating economic and social poverty through participation and mutual support. We believe that this can be achieved only through a sincere and committed local leadership and in the

presence of a support organization. Community based institutional development at village level is not an end in itself. It is a means to the end of bringing about meaningful changes in the quality of lives of the rural poor. The continuing challenge for us is to adapt and innovate our interventions to remain responsive to the changing and dynamic needs of the rural people. It is in fact the people who will make this world a poverty free place, the most cherished goal of every development professional and support organization.

Harnessing People's Potential: Experiences and Lessons from Pakistan

Rashid Bajwa

INTRODUCTION

Highlighting the experiences of the National Rural Support Program (NRSP), this resource paper will concentrate on the efforts of NRSP in surmounting the perceived barriers of "Harnessing People's Potential" to help themselves. Whereas the prime focus of this paper is on the practical issues encountered and catered for within the context of NRSP's Programme Area (PA), the author makes an attempt to highlight other RSPs, more noticeably the Aga Khan Rural Support Programme (AKRSP)—working in the Northern Areas, and Sarhad Rural Support Cooperation (SRSC)—working in seven districts of the North Western Frontier Province (NWFP).

Firstly, we define the meaning of "Harnessing People's Potential" as we perceive it in the context of NRSP's approach. Followed by this, is a brief introduction to NRSP's background, and the Programme Components (PC). The last two sections mainly deal with the impact of Programme Interventions, both short and long -term, the lessons learned from NRSP's (and other RSPs) experience, and the future direction the Programme intends to take.

NRSP's interpretation of "Harnessing People's Potential"

Because NRSP works with the rural households, we define "Harnessing People's Potential" with an assumption that there is a tremendous willingness on the part of the rural poor to undertake many developmental activities that can enable them to come out of poverty. The role of a support organization like NRSP is to identify this potential and harness it for their collective benefit.

Hence "Harnessing People's Potential" entails organization of the rural populace into a network of community level institutions, at the grassroots level, which enable them to plan, manage and implement their own development agendas.

It is these institutions that NRSP has been fostering and working with since its inception in 1991. Like any other rural support organization engaged in similar sort of activities, NRSP realises that meaningful improvements in the quality of standards of living of the rural population can only be brought about if there are institutions at the grassroots committed to sustainable development. Fulfilment of this notion requires integrated efforts both on the support institution, NRSP, as well as its primary partner in development— the grassroots level institutions; more on the latter than the former. The idea of involving communities, and more specifically these NRSP fostered institutions, as equitable partners in development

is not new by any means and takes its roots from the belief that there exists a tremendous potential in the rural people to undertake development initiatives to improve their quality of life.

Experiences of AKRSP and OPP

In Pakistan, cognizant of the immense potential that the people possess and using this approach to harness this latent potential, the Orangi Pilot Project (OPP), which works in the urban slums of Orangi, Karachi, and AKRSP are two famous projects that have succeeded in yielding communities' interest in undertaking their own development, once they were organised into the community level institutions through the process of social mobilisation. The experiences of these projects also show that an investment in these institutions is required to supplement and consolidate the process of social mobilisation; in AKRSP, this was done through investment in the Physical Productive Infrastructure schemes (PPIs) through sharing of communities' and AKRSP resources, whereas in OPP it took the form of a technical advise through research and demonstration in establishing a sanitation system, firstly subsidised by OPP and later only through credit. These projects in Pakistan showed successfully that through a series of interactions with the communities it can be demonstrated to them that when they are organised, by pooling their resources, both human and capital, for any objective—there are not many things which cannot be achieved. This process is called social guidance, which, once shown by AKRSP and OPP to work, prompted the growth of many other support programmes, noticeable ones of which are the SRSC, which started its operations in 1989 in NWFP and later NRSP which was formed in 1991.

NATIONAL RURAL SUPPORT PROGRAMME

Background to NRSP: Salient features of the Programme

Having been convinced of the effectiveness of the approach of social guidance the then Prime Minister of Pakistan in 1991 requested Mr. Shoaib Sultan Khan (SSK),the first General Manager of AKRSP to initiate a programme which would cater to the needs of the rural masses on a nation-wide scale. Proposed by SSK was a non-governmental set-up, which would serve the purpose of apprising and involving people as effective players in their own development needs, for he believed that a programme under the government's control would lack the desired flexibility needed in accomplishment of this task. The government agreed to the proposed set-up, and awarded a sum of, as a first time grant to be followed by another instalment every six months for the next five years, Rs. 500 million for the creation of the National Rural Support Programme (NRSP), a nongovernment organisation, which was entrusted with the responsibility of fostering a country-wide network of community

organisations at the grassroots level, in the 16 proposed districts all over Pakistan, including Azad Jammu Kashmir (AJK). This highlighted the first salient feature of NRSP, wherein the Government of Pakistan, as a part of its own development strategy has entrusted a NGO to undertake development initiatives with the rural communities, using seed capital from Government funds, while maintaining full autonomy in it's operations.

However, after the first instalment of Rs. 500 million which helped initiate operations in the eight districts of the proposed sixteen, future donations to NRSP were discontinued by the Government, due to political instability and resource constraints at the national level. As a result NRSP had to respond to this financial constraint and had to amend its strategy to remain operational. NRSP management decided to convert the grant money into an endowment and invested it in the government securities. Income generated by the endowment fund, thus, has become the primary source of NRSP's operating expenditure and has also responded to programme expansion needs in the past seven years. This strategic move has also relieved NRSP of any potential funding pressure which other RSPs of NRSP stature face and thus, defines the second salient feature of NRSP, the financial sustainability.

Program Philosophy and Objectives

Program Philosophy

The core assumption of NRSP's philosophy is that there exists a tremendous willingness amongst the people to help themselves. However, in order to harness people's potential mobilisation through a support organisation is required. The process through which this potential is realised is through the process of social guidance popularly known as social mobilisation, in which both NRSP and the community members are represented through a democratically elected representative—the community activist.

The idea behind social guidance is to find out what people really want to do themselves and also to assess whether whatever they want to do is possible to do in view of resource constraints. If the mutually identified activity is practicable then the support organization should assist the community in arranging desired resources and overcoming the constraints. Therefore, the guiding tenets of NRSP, following the principles of Social Guidance, as a support organisation are to:

- Organize communities into community organizations for social cohesiont
- Develop a capital base at a local level through savings and credit,
- Upgrade human skills, and,
- Link communities with the government service delivery departments, donors, NGOs and the private sector.

The generic principles of NRSP's philosophy, unlike other RSPs, prevent it from following a preconceived package approach. The whole quest is to identify and support the community activities. The only reliable indicator to assess the community's willingness to achieve a particular end is the intensity of its previous endeavours to accomplish that desire.

Objective

"To foster a countrywide network of community organizations at the grassroots level to enable them to plan manage and implement their own development plans."
The methodology that NRSP employs to achieve this objective is covered in the next section.

NRSP's Programme Area

NRSP is currently working in 23 districts of all of the four provinces of Pakistan, including AJK. Twelve Regional offices, having 45 field Units (FU), governed by the core management at the Head Office in Islamabad, form the operational set-up of the program.

PROGRAM COMPONENTS AND INPUTS

Social Organization

To build institutions representative of rural communities, NRSP employs the services of the cadre of skilled social organizers who have the ability to relate to people and communicate the message of development in the holistic perspective. These Social Organizers are the main frontline workers in NRSP with an objective of introducing NRSP to all the villages in the targeted regions as comprehensively as possible. The time needed to form COs depends entirely upon the responsiveness of the community to improve its quality of life. If the community is not willing to make efforts to improve it's quality of life, no amount of motivation will lead the community to respond to NRSP's message.

Steps in CO Formation

NRSP provides coverage on a union council-wise scale in the districts it plans to establish its operations. Only after the coverage is fully extended on a 100 percent scale in the first union council, will NRSP move to provide coverage to the next union council. Before NRSP SOs take the message to the communities i.e., before the program introduction, the baseline information regarding the selected locality is compiled and consolidated to provide an overview of the context of the targeted area. In this regard two exercises are undertaken—

development of a community development profile (CDP) and identification of the communities' prominent actors of development, the activists.

Community Development Profile (CDP)

CDP requires the compilation of the following two documents.

Village profile

Village Profile is a document prepared primarily in consultation with the community. With an objective of establishing benchmark data for subsequent evaluations and assessments, it also serves as the basis for identification of a community's needs and priorities both on a group and village scale. It encompasses information on: the prevalent socioeconomic and demographic trends, levels of education, health, infrastructure, natural resources; imports and exports of the village; and the communities' perception on the problems of utmost importance confronting them, and past efforts to overcome them. The preparation of village profile is a constant process, and is constantly updated during the CO meeting as a part of regular monitoring and evaluation exercise.

Micro plan, poverty profile or the portfolio of opportunities

In addition to the Village Profile, the community is encouraged to prepare a development profile of each member household. This includes information on the resources, aspirations, gaps in utilization of resources and the type of support each member requires to increase her/his resource base. An assessment of this information provides the basis of creating an income-generation plan of each member. The level of micro-planning exercise is not restricted to individuals but also to groups and cluster-level priorities and needs. The group and cluster-level micro plans are developed to mobilize the collective resources of the entire village to emerge with practical solutions to the identified problems. Focus on both the individuals and the group level ensures that both subsets of community are incorporated in the wider frame of the development agenda and ensures both the interest among the community members to improve their well-being and stimulates them into thinking along the lines of long-term sustainable development for the ultimate objective to improve their quality of life.

Identification of Activists

NRSP believes that within the communities that it works with, there exists a driving force, in the form of an activist, which can define and guide the development vision of the community. Identification of this activist therefore, is a complex and a challenging issue for the field staff, for this activist is the key to shaping the development priorities and the needs of the community. Obviously this identification of this key player is not a one-time event and is subjected to attestation on a continuous basis. In most of the cases the social organisers either seek this activist at the time of development of the CDP or are approached

by the activists themselves to initiate the process of CO formation in their respective communities.

Programme Introduction

It is here that the NRSP Social Organiser holds an event of Programme Introduction or the first dialogue, in which the community members are apprised of the objectives, approach and the principles of development which motivate NRSP. This dialogue leads to the surfacing of a set of community needs and concerns regarding its own development. A set of needs, on individual, group as well as on village levels, that the villagers believe should be addressed, clearly surfaces as a result of the dialogue. The NRSP team explains that under normal circumstances, the last two levels are dependent on the first— individual level, of which the main inhibiting problem is lack of resources, income being the foremost one.

The take-off point for support from NRSP is the threshold of community's capacity and willingness to organize and listen to the NRSP's message. The prerequisite for harnessing this willingness is to organize and start a savings programme to form the basis of capital formation at the local level. The gathering is advised to decide among themselves whether they want to organize and benefit from the NRSP support. In the event of a decision in favour of the organization, the community is told to contact NRSP field staff at the local office to formally initiate the process of forming a Community Organization (CO).

CO Formation

The contact that the community makes with the field office staff through its activist after the first dialogue, serves as an attestation of community's willingness to organise. At a fixed date and time, NRSP staff revisits the specified location to reintroduce its program and to seek a mutual consent for NRSP. When all the gathered members agree upon organization, a formal Terms of Partnership (ToP) is signed between the community and NRSP, to clarify the role of each party in this institution building process.

At this point in time community members are asked to mutually identify and select their President and Manager among themselves who serve as key actors of the partnership between the CO.

Savings and Credit

As stated earlier, that the experiences of OPP and AKRSP show that communities will only gather and organize themselves around economic (tangible) assets such as the Productive Physical Infrastructure (PPIs) in the case of AKRSP and provision of better sanitation facilities within the case of OPP's. This philosophy is completely understandable within the context of both of these programs— one working in an area where the pressing need was to create PPIs in the arid and ecologically challenged zone, and the other where the priority was on development of sanitation facilities. The major source of NRSP's finances is the income it receives from the investment in the endowment capital,which prevents the NRSP from making large-scale investments in creating tangible physical assets. However, what

NRSP has successfully been able to test and then implement is the provision of micro-credit, for income enhancement purposes, which has served the role of an economic asset for the Community Organisation. Another objective of the Savings and Credit Program is on building the local capital base of the communities. As mentioned earlier, NRSP is able to do this in the shape of savings that community members pool together, which is one of the primary tasks that grassroots institutions are encouraged to undertake.

The provision of credit plays an important role in the capital-starved economy of the rural households, especially in NRSP's Program Area. By catering to the needs of communities as per their micro-plan, both on an individual and on a group scale, credit has been able to provide small farmers with the ability to purchase new and improved inputs to increase their agricultural income, provide small entrepreneurs with the working capital they need to start or expand their businesses, promote female entrepreneurs through livestock credit, and enhance the productivity of agricultural land through small- scale infrastructure loans.

Through the savings program, CO are encouraged by the start internal lending for the purpose of

- Relieves them of NRSP credit
- Enhancement of capital base
- Discipline among themselves
- Reliance on their own resource hence leads to sustainable development

Human Resource Development (HRD)

Through this intervention, NRSP aims to enhance the skills of the community members to enable them to utilize their human capital more effectively. A host of training programs ranging from management training of community based development initiatives to vocational and technical trainings in specific fields form the current portfolio of the HRD's interventions. In addition to this, a day or two long subject- specific workshops and the activist conferences—a forum where the community activists have a chance to meet fellow activists in addition to the local body representatives, are also offered to the community under HRD.

Cognizant of the fact that in order to build capacity at the community level, NRSP must make a parallel effort to train its staff for better implementation of the program activities, NRSP also has an active component of subject-specific staff training built into its current portfolio of training events.

Physical Infrastructure and Technology Development (PITD)

The purpose of the PITD section in NRSP is to assist the communities to build and manage physical infrastructure such as the drinking water supply schemes, link roads, bridges, lining

of channels etc. To inculcate an element of ownership, the community is asked to contribute its human, physical and material resources towards the implementation cost of the project it identifies through its community and village level micro-plans. Once the identified infrastructure scheme is completed, the sole responsibility of its operations and maintenance rests with the community.

Natural Resource Management (NRM)

To enhance their agricultural productivity and apprising community members about the sustainable use of natural resources, NRSP regularly holds trainings and arranges demonstration plots for community members. Other activities undertaken in the NRM sector include linking the communities with appropriate departments and bodies for obtaining better and improved varieties of seed, fruits, forest plants and better breed of livestock. To reduce losses, both of crops and livestock, attention is also paid towards imparting training to community members on improved crop, pest and plant management practices and curative and preventive measures for livestock treatment. Resources not permitting, most of these activities are undertaken by linking the communities directly with the government line department.

Social Sector Services (SSS)

NRSP is a firm believer of the notion that investment in human development, especially in the sectors of education, primary health care and population planning are vital to a more effective, equitable and sustainable development at the grassroots level. In this regard the SSS tries to assist the CO members to establish and manage non-formal primary schools. Community members along with NRSP share the cost of implementation. However, NRSP provides teachers' training.

In the primary health sector, NRSP trains the CO members as health workers and fosters linkages between the CO members and the service delivery bodies of the government, private sector and the NGOs for primary health care and reproductive camps.

NRSP believes that all the social and economic interventions that the community members undertake as individuals or as a part of the CO will lead them towards realizing their untapped potential, which lies inert due to the lack of social guidance. The CO platform, serving as a basic unit for governance, enables them to realize this potential and a participatory, equitable, transparent and effective manner by involving them in planning, management and implementation of their own development initiatives. This once achieved qualifies a community to undertake development compliant with the standards of good governance with the assistance of a support mechanism, the NRSP.

CONCLUSION

Institutional development at the grassroots through a demand responsive approach focussed on the household, group and village level activities yet drawing a clear line of roles and responsibilities is the success of NRSP's program. This model is replicable and expandable provided the approach and the message is very clear. The message is simple and talks about the fact that the program can only create partnerships in things people can do themselves but are unable to do because of constraints; both human and capital. It is this simple but very specific message which distinguishes NRSP's program from other rural development program which talk about inputs and targets rather than looking for the potential of the people.

REPORT ON WORKSHOP DISCUSSIONS

INAUGURAL AND TECHNICAL SESSION

A national workshop on the proposed study " Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia: Pakistan" was held at IWMI's regional office for Pakistan and Central Asia, Lahore on 12 march 2001. The workshop was organized by IWMI. It was participated by about 30 professionals, representing a variety of organizations and institutions— including participants from University of Agriculture Faisalabad (UAF), Pakistan Agricultural Research Council (PARC), National Agricultural Research Council (NARC), Pakistan Institute of Development Economics (PIDE), Human development Center (HDC), National Rural Support Program (NRSP) and other government and nongovernment organizations. A list of participants is provided in the Appendix.

The workshop began with the recitation of the Holy Quran, and a brief welcome address by Dr. Hammond Murray-Rust, acting Director of the IWMI's regional office. Dr Murray-rust explained the purpose of the workshop, and invited all the participants to contribute to the workshop. Dr. Waqar A. Jehangir of IWMI made a presentation on the proposed project, its objectives and scope of the activities. Dr Jehangir highlighted the issues to be considered during the discussion session. He elaborated on the different research questions, research hypothesis which gave a flavor to the participants in order to focus their discussion during the discussion session. He asked the participants to focus their discussions at the macro level, meso and micro levels (Farm level) issues, research questions and research hypothesis to focus on irrigation-related interventions that could be developed to help the poor in the project area.

Following the two opening presentations, the technical session began with presentations on a range of topics related to irrigation and poverty issues in Pakistan. Altogether 7 presentations were given in the morning session.

Dr. Rashid Bajwa of NRSP gave a presentation on NRSP's approaches and activities for reducing poverty in Pakistan. He highlighted that poverty in Pakistan is increasing and that it can be witnessed in each of the village and town. He presented the NRSP strategies regarding formation of community beneficiary groups. He suggested that the best strategy to identify poor households in a community is to go in the community and ask the people to define poverty, and with situation analysis the community could be divided into five categories (well-to-do farms, better off farms, poor farms, very poor farm and destitute). He further suggested that poverty reduction efforts should be focused towards the last three categories. He emphasized on the role of policy and institutional interventions to reduce poverty in rural areas of Pakistan.

The next presentation was made by Dr. G. M. Arif from PIDE, a specialist on poverty issues in Pakistan. Dr. Arif began his presentation by explaining the poverty differences across ecological zones in the rural Pakistan. He elaborated on various methods of poverty measurement, and presented a review of past studies comparing results from five major

studies (by Amjad and Kamal, Ali and Tahir, Jafri, World Bank and Arif et al.) analyzing poverty trends for the periods: 1987-88, 1990-91, 1992-93, 1996-97 and 1998-99. According to four of the five studies, except the World Bank's poverty study, the poverty in Pakistan increased during 1987-88 to 1998-99. The World Bank study reveals the opposite trend in poverty, according to Dr Arif. Afterwards he shared the results of his study from 9 ecological zones of Pakistan. According to his study, the poverty incidence was greater in the cotton/wheat zone (in Punjab and Sindh) and low intensity (Thal)zone as compared to the rice/wheat Zone in the Punjab and rice-other zone in Sindh. He showed the relevance of this study with the regional/zonal availability and access to water. He indicated that as one moves from R-W to C-W zone or the low intensity zone the availability of irrigation water decreases, and that this is also reflected in terms of higher incidence of poverty. During the discussion session, participants raised questions and concerns on indicators used for measuring poverty. Dr. Arif raised an issue of incorporating irrigation into poverty indices, given that incidence of poverty is not only on farm households but also on non-farm households. Some of the poverty indices also take into consideration the education among the farm and non-farm household and if the farm households do not send their children to school due to more work on the farm resulting from high cultivation intensity in the irrigated areas, how to tackle such situations while measuring poverty through the use of poverty indices? The participants discussed this issue in detail and a consensus was reached that only those indicators should be used to measure poverty, which are water-sensitive, and it was also suggested to avoid those measures, which are water neutral.

In the third presentation Dr. Asghar Cheema highlighted the role of "Social Mobilization for Poverty Alleviation in the Irrigated Areas." He shared the results of his study in the small dams areas (Shahkot Dam and Mirwal Dam). Dr. Cheema suggested that by adopting the participatory approach and making the water user groups in both the areas it was possible to resolve disputes among the communities which in turn helped the communities to increase the command area on their farms. Dr. Cheema informed the workshop that ABAD and Small Dams organization also played an important role to improve the infrastructure and helped the farmer organizations in these small dam areas.

Next presentation was made by Mr. Faisal Shaheen of the Human Resource Development Center. Mr. Shaheen presented a paper, based on review of literature on irrigation and poverty. He divided his presentation into five parts (a) defining the poverty (b) causes of poverty (c) irrigation linkage with poverty, (d) human development and (e) policy considerations. While elaborating on the incidence of poverty in various regions of Pakistan, he classified the factors responsible for poverty into four categories (i) non-farm factors (ii) credit factors (iii) irrigation factors and (iv) gender factors. Among the irrigation factors he highlighted the farm vs. non-farm activities, livestock vs. agriculture, crop choices due to waterlogging and salinity conditions etc. He stressed that the representation of poor in the water user associations may help the poor communities to reduce the poverty in the rural areas. After discussing the pros and cons of irrigation he raised the question of identifying the areas for the project. What control measures should be used to differentiate between the intervention area and non-intervention areas? Regarding the policy considerations he suggested to look into the spill over effects of the irrigation and also how these spillovers have some impact on landless, nomads and tribesmen. He emphasized the need for incorporating the low technology methods in the interventions with respect to access to

irrigation water, which the poor can easily adopt. During the discussion session, the participants emphasized that poor farmers should be involved in farmer organizations in their day-to-day activities.

Dr. Sultan Ali Adil of UAF made a presentation on "Irrigation: A Weapon for Poverty Alleviation." He elaborated on the role of various small-scale technologies (resource conservation tillage technology including zero tillage and bed and furrow methods) for poverty alleviation in irrigated agriculture. He talked about the scope of introducing the sprinkler and drip irrigation and augmenting irrigation supplies through individual/community tubewells in areas with scarce water supply. He raised questions on regarding determinants of productivity levels of the poor farmers at head, middle and tail reaches off irrigation systems. He also suggested to identify the issues related to the productivity variation among poor farms at various reaches of an irrigation system and identify the factors could be influenced by some irrigation-related interventions. He also pointed out that there are misconceptions about the provision of subsidies to farms in the irrigated areas. Finally, he suggested that the drainage-related interventions should also be given due consideration in this study.

Allah Baksh Sufi of IWASRI presented the paper on "Rural communities Development through Bio-Saline Agriculture." He shared his experiences from the Bio-Saline Agriculture project, which IWASRI is implementing in Rechna Doab and Chaj Doab areas with financial assistance from UNDP and AUSAID. He mentioned that with community mobilization the project was able to form more than 40 Saline Land Users Groups (SLUGs) and about 44 Women Groups (WGs) among the poor households in the salt affected irrigated areas of the project. He informed the workshop that these groups are practicing the Bio-Saline Plantation, Compact and Agro-forestry and are also involved in raising the forest nursery for the project. He indicated that the project is emphasizing on raising of Eucalyptus trees on salt affected areas but farmers are facing problems in marketing Eucalyptus. He also mentioned that the project is providing training to the communities for bio-saline plantation.

Dr. Amjad Saqib made the final presentation on "Pro-Poor Interventions by PRSP." He mentioned that PRSP is focusing on reducing poverty in rural areas. He indicated that incidence of poverty is higher among the landless than among the landholders. Describing PRSP's strategy on poverty alleviation, he mentioned that PRSP 's strategy is a combination of social mobilization, capacity building, skill enhancement, through micro-finance services and through developing linkages between the poor and the line agencies. Among other pro-poor activities, he mentioned about one of their proposals about lining of the watercourses in the brackish zone of the Punjab.

BRAINSTORMING SESSIONS

The brainstorming sessions began with general guidelines provided by IWMI. Participants were divided into three groups for discussions on issues at the irrigation system, distributary, watercourse/farm level levels. They were requested to discuss the major poverty related research issues in irrigated agriculture in Pakistan. The group discussions started before the

lunch break and continued until the afternoon tea break. Afterwards, the group representatives presented views of the groups.

GROUP 1

Issues at Irrigation system level

The group considered the irrigation system as at the canal command level (Area water board level). The following issues emerged from the group discussions.

- Water allocation—equity of irrigation water distribution across canals; scope for reallocation of water across inter/intra canal; scope for reallocation of water across perennial and nonperennial canal;; and reliability of irrigation water.
- Operation and maintenance of irrigation canals; and water losses
- Institutional/management issues—public/private.
- Issues related to water rights—clarity, regulation and implementation.
- Issues related to water charging.

Research Questions

- What is the poverty situation in irrigated areas and what are the factors contributing to poverty ?
- What is the performance level of irrigation system, and what measures could improve the system performance?
- What is the scope for inter/intra canal reallocation of irrigation water and how it should be done?
- What are the implications of alternative irrigation management practices at the canal command level for the poor?
- What are the alternative water charging policies that may help improve O&M cost recovery without negatively affecting the poor.

Research Hypothesis

- Positive correlation exists between equitable distribution of water and poverty alleviation.

- Positive correlation exists between system performance improvement and poverty alleviation (specially at the tail end of the system).
- Positive correlation exists between improved system management, good governance and poverty alleviation.
- Improved inter/intra canal water reallocations may lead to higher productivity and reduce the incidence of poverty

GROUP II

Issues at Distributary/Watercourse level/Farmers' Organization level

- Effectiveness and efficiency of water distribution across head, middle and tail of the distributary (farmers located at head take more water, tail enders suffer).
- Losses from seepage and evaporation.
- What is the relationship between over irrigation and waterlogging at the head reaches?
- Socioeconomic differences at head, middle and tail reaches of distributary.
- Has management transfer been effective in terms of equity, efficiency and reliability of water supplies at the distributary level?
- Irrigation reforms and their implications for farmers/communities at head middle and tail reaches of distributary (Can warabandi start from the tail end?).

Research Questions

- What is the income structure of farming and non-farming communities across head, middle and tail reaches of a distributary?
- How are poor people distributed across various parts of a distributary?
- What is the size of landholdings across various reaches of a distributary?
- What is the profitability of agriculture across various reaches of a distributary?
- Has organization of the farmers taken place in a proper way?
- Is re-evaluation of guidelines (for forming farmer organizations) needed?

- If the guidelines are tilted towards the large owners how to make them pro-poor?
- What is the possibility to involve the poor in the reform process?
- How to analyze reforms process to suggest the pro-poor interventions?
- What are the drainage problems in the area?

GROUP III

Issues at the Micro/Farm level

- Access to surface water at farm level (availability, adequacy and reliability).
- Quality of resources (land- salinity problems; groundwater—fit/unfit for irrigation)
- Assessment of knowledge and skills and abilities of the poor (knowledge of water management practices; knowledge about the resource conservation technologies and access to information about new innovations, etc.)
- Issues related to farm resource management (issues related to the water use pattern, cropping pattern).
- Delivery mechanism (issues related to the functioning of public + private agencies; issues related to the provision of information and technologies; issues related to the compatibility of solutions with the farm situation; and issues related to marketing of inputs and outputs).
- Issues related to organization (issues in mobilization of poor farmers; and issues in organization of poor farmers)

Research Questions

- Can access to irrigation water and its efficient use help alleviate poverty in irrigated farms?
- How improved farm resource management and services delivery mechanism can help to alleviate poverty?
- Can institutional arrangements at the grass root level help to reduce poverty?
- Can farmers' access to improved technological package help to reduce poverty?

Research Hypothesis

- Access to water and its efficient use has a positive correlation with poverty alleviation.
- Poor farm resources management leads to increase poverty.
- Quality of farm land has a direct negative relationship with poverty.
- Quality of groundwater has a direct negative relationship with poverty.
- Equitable distribution of water across farms increases area under crop and reduces incidence of poverty.

The issues emerging from group presentations were discussed at some length. Dr. Murray-Rust cautioned in his concluding remarks that in order to evaluate the role of irrigation in poverty alleviation we should not choose the issues/interventions,which are water neutral. He also warned that the current way of implementing reforms in the country are not pro-poor in true sense. He quoted few examples from IWMI's research in Sindh. The discussion was concluded with a vote of thanks by Dr. Murray-Rust and Dr. Jehangir.

VIETNAM

Country Workshop

14 June 2001

Irrigation Development for Hunger Eradication and Poverty Reduction in Rural Areas of Vietnam

Nguyen Xuan Tiep [*]

INTRODUCTION

Starvation leads to poverty, but poverty does not necessarily mean starvation. However, poverty and starvation are closely related to the socioeconomic and educational development. In recent times, Vietnam has seen dramatic progress regarding economic growth and poverty alleviation. Since 1988, the GDP of the economy increased by 8–10 percent annually, specifically the range of annual increases was 12–14 percent for industry and 4–5 percent for agriculture. The number of households experiencing conditions of starvation and poverty has declined sharply, even though Vietnam's population is growing by 2 percent annually.

Vietnam is one of the world's poorest countries with an average annual per capita income of approximately US$300. Half of Vietnam's population is classified as poor. According to the 1997–1998 Vietnam Living Standard Survey carried out by the General Statistics Office and the World Bank the average income per capita in Vietnam is 3,465,000 Vietnamese Dong (VND) (9,057,000 VND in urban areas, and 2,544,000 VND in rural areas). Considering that 80 percent of the population lives in rural areas, and more than two-thirds of this figure depend on forestry for their livelihoods (48.03–51.57 percent of their income), the income gap between urban and rural areas is quite large. Moreover, there is also a significant difference in income according to age, sex, race, and property.

Poverty and starvation persist as serious problems in the rural areas. The severity tends to increase because of the geographical distance, diseases, natural disasters, and ethnic minority. Hunger eradication and poverty elimination can only be achieved through agricultural development.

Agriculture in Vietnam is primarily concerned with rice production. In the short term, the aim is to stabilize the production of rice through the benefits of a market system economy. Because of the increase in the price of rice, the purchasing power of the rural areas goes up which causes the price of industrial products to increase. From 1995 to 1997, the price of rice increased by 0.6 percent, but the price of industrial goods increased by 8.5 percent and service costs increased by 17.7 percent.

Therefore, it can be seen that agriculture has a positive influence on the development of other sectors, or as a well-known Vietnamese saying goes, "if agriculture fails, so does the rest." It is this positive impact of job creation and increased consumption that helps to ease the problem of poverty and starvation in the rural areas.

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Stabilizing the issue of food is a basic condition for eliminating starvation and reducing poverty. The systematic basis for easing poverty in the countryside is that rural areas move from self-sufficiency in production to production for the market.

IMPACTS OF NATURAL DISASTERS ON AGRICULTURE

Disasters such as floods, storms, pests, and droughts, increase the vulnerability of rural agriculture to potential negative impacts that can cause starvation and poverty.

Storms and floods

In the period of 1971–1990, floods and storms did damage worth 4,289.8 billion VND in many of the areas. The damage to animals and plants accounted for 70.8 percent, while 4.5–6.5 million tons of rice harvests were lost.

Each year from 1988 to 1990, Vietnam experienced large floods and storms. In 1988, flooding left 118,000 people dead and 56,100 ha of cultivated land submerged. Other losses included 169,500 tons of rice, 7,748 million m^2 of houses, schools, and hospitals, with a total of US$35.06 million worth of damage. Total rice losses for the three years measured 1,078 million tons of rice, which was 359,000 tons each year on average.

From 1991 to 1994, annual floods on average left 300 people dead, 157 injured, 379,000 ha of rice and upland crops destroyed, 17,000 livestock and 172,000 poultry destroyed, and 379,000 houses ruined. In 1994 alone, seven provinces in the Cuu Long (Mekong) River Delta suffered property losses totaling 2,284 billion VND (1,295 billion VND for agriculture). The heavy floods persisted for a long time causing many difficulties for farmers. The ultimate outcome was that 81,227 poor households were left in need of food assistance.

According to statistics from the Disaster Prevention, Fighting, and Mitigation Center in the Central Flood Prevention and Irrigation Committee, in 22 years from 1977 to 1999, natural disasters caused 13,000 deaths, an average of 590 deaths each year. The level of socioeconomic losses caused by natural disasters is highly correlated with economic development.

According to official statistics damage from natural disasters included:

In 1997: 788 people dead, 1,142 injured, 2,541 missing.
7,200 billion VND worth of property damage.

In 1998: Total damage: 1,800 billion VND.

In 1999: Total damage: 4,000 billion VND.

The total damage to property caused by storms and floods in recent years was estimated at 2–3 percent of the GDP, putting the stability of rural areas at stake.

Pests

Pests ruin plants with diseases like yellow plant and stem borer. Pest proliferation depends on farming practices used, such as watering and irrigation techniques. From 1988 to 1993, 2,100–3,800 ha of cropped areas are affected each year with estimated losses equaling 163,000 tons of rice. In 1991, the heaviest losses were experienced with 46,330 ha affected and 487,000 tons of rice lost.

Droughts

Droughts are a frequent occurrence in different areas because of exhausted sources of water. This is a result of many factors, however, one reason is that hydraulic structures fell short of the irrigation design capacity.

As reflected in the official statistics, 16 mountainous and northern mid-land provinces now have a total natural area of 10.3 million ha and a population of 10 million people. Because of *El Niño* influenced conditions, rainfall in Vietnam was reduced by 20–40 percent. The vegetation was highly damaged resulting in greater than normal flows in the flood season and smaller flow volumes in the dry season. This resulted in a serious decrease in the capacity to use hydraulic structures to their full design capacity.

There were 11 winter-spring crops struck by droughts from 1980 to 1990. A typical example is the 1997–1998 cropping season when 56,000 ha were affected by drought and production on 1,500 ha was lost completely. The total affected area accounted for about 20 percent of the total area under cultivation and 53,000 people were affected by this water shortage. The cost for drought mitigation measures increased by 38 billion VND (not counting other damages such as crop productivity and complete crop loss).

Effects of droughts in other areas include:

- Hong river delta: 114,000 ha experienced drought out of 513,100 ha. In this case, the cost for electricity used for water pumping rose up to 2.9 billion VND in 1997–1998 for the winter-spring crop.

- Six North Central provinces: in 1998, 62 ha (or 46% of the area under cultivation) of the summer-autumn crop was ruined, 33,000 ha industrial plants' and fruit bearing trees' productivity was reduced. 2.1 million people were in shortage of water for domestic use.

- Four provinces in Western Plateau (Tay Nguyen) with a population of 2.9 million and agriculture as the main source of income (especially, using forest products for long-term industrial trees development) suffered from drought. In the 1997–1998 winter-spring crop, almost 11,000 ha of rice (29%) was hit by drought,

74,000 ha of coffee was affected in which 14,000 ha were completely unusable. Additionally, 777,000 people (26.5%) lacked water for domestic use. Early in 1988, drought was directly responsible for 300 ha of forest fires in Dak Lak.

In summary, the risks involved in droughts have a definite negative impact on agriculture, directly leading to increased starvation and poverty. Those frequently bearing such risks are the farmers, and drought is the major threat to the rural starvation and poverty.

WATER RESOURCES IN THE DEVELOPMENT OF RURAL AREAS

The role of water in irrigated agriculture

As has been affirmed by Vietnamese farmers, "first is water, second manure, third industriousness, fourth variety." Many research papers suggest that together with many other factors (especially high-yield varieties) water contributes 16–35 percent to rice productivity. According to research on maize in Vietnam, good irrigation and care contribute 18 percent to a variety's productivity. A survey showed the irrigated and nonirrigated productivity of some land-based plants with great economic value.

Table 1.

Trees varieties	Nonirrigated (ton/ha)	Irrigated (ton/ha)	
		Normal	Good
Coffee	0.3	30	50-70
Tea	0.8	15	26
Sugar cane	30-50	80	120
Cashew	2	3	120
Litchi	1-1.5	2	3

The role of water resource projects in hunger eradication and poverty elimination

The Government, in collaboration with the local people, has invested in a wide variety of water resources projects. According to a survey, there are now 8,265 projects of different kinds, including: 743 reservoirs of medium and large size, 1,017 dams, 4,712 irrigation and drainage sluices, almost 2,000 pumping stations of medium and large scales. The total value of the investments, measured by the current prices, was estimated at over 100,000 billion VND (exclusive of 5,700 km of river dikes, 2,000 km of sea dikes, together with sewage system and thousands of kilometres of embankments for fighting floods in Cuu Long

(Mekong) River Delta. There are many reasons behind the decision to invest in these projects. These reasons are briefly discussed below.

Providing water for domestic use

Approximately 36 percent of local inhabitants were supplied with fresh and clean water in 1999, excluding 10 million people in the countryside using water from hydraulic structures for everyday living.

Table 2. Providing water for industries.

Year	Industrial water use	Percentage of total
1980	1.5 billion m^3	4%
1990	5.33 billion m^3	9.8%
2000	16 billion m^3	20.2%

Table 3. Providing water for irrigation.

Year	Irrigation water use	Percentage of total water consumed	Hectares irrigated
1980	40.65 billion m^3	89.8%	4 million ha
1990	51 billion m^3	91%	5 million ha
2000	60 billion m^3		6 million ha

There are numerous hydraulic structures serving irrigation and drainage functions, which is helping to increase crop diversification, as well as improve the quality and yield of crops. Statistics from many areas indicate that after irrigation infrastructure was introduced, rice productivity increased by 16–35 percent (particularly in Bac Duong where productivity increased by 33% and output by 44%). Many areas in the Cuu Long River Delta have recorded an increase in yields from 4.5 tons/ha in 1975 to 9.5 tons/ha in 1990 and then to 10–12 tons/ha in 1999. Because of the irrigation and drainage projects, cropping intensity increased from 1.3 to 2 to 2.2. In some areas the figure is 2.4, the 2.7 fold increase which helped boost rice production to 16 million tons in 1986 and 34 million tons in 1999 from 9.5 tons/ha in 1930.

The increase in rice yields and cropping intensity has raised the average per capita food level from 328 kg/person (1930) to 371.8 kg/person (1995), 400 kg/person (1997), and 400-500 kg/person (2000). This occurred even though the population has increased from 20 to 77 million people from 1930 to 2000, which has in turn caused the land area per capita to decrease from 2,548 m^2 in 1930 to 730m^2 in 1997. However, chronic starvation does not occur as before because of the stabilization of rice output.

Benefits for irrigation and water resource projects include mitigating the negative effects of water, reducing the risks from natural calamities, improving the eco-environmental quality, and the sustainable development of rural areas in the lowlands. These are briefly discussed below.

- Easing the negative effects of floods on rural areas through a system of small, medium, and large reservoirs.
- Building a drainage system to prevent inundation of cropping areas because of rains and storms. Creating a clean environment free from chronic diseases.
- Irrigating and draining water for good and timely harvesting. Increasing the planting area, productivity, the number of crops per year, and output, while at the same time fighting diseases caused by pests.
- Forming transportation systems, liberating people from too much labor, and meeting the requirements of agricultural production in rural areas.

Benefits also include the creation of jobs for farmers and helping to increase farmer incomes through an increase in the number of crops possible per year. Additional benefits are derived from a diversification of plants and animals with higher economic values (such as aquaculture or industrial plants). Because of greater water availability, many regions have now yielded four crops, worth of 60–80 million VND, whereas, normally two crops of rice can only yield 10 million VND.

Raising farm workers' income through agricultural production is an extremely effective solution to the issue of starvation and poverty. The increase in the purchasing power of farmers of rural areas then aids the development of other sectors. Typically, in places where the water resources are developed, the standard of life of the local people is also upgraded, social security is assured, and starvation and poverty are reduced.

THE EXISTING STATUS OF IRRIGATION AND DRAINAGE SYSTEMS

The efficiency of hydraulic structures is currently not in line with the amount of the investment. On average, hydraulic works are used at only 50–60 percent of designed potential. Many small works utilize only 25– 30 percent of the designed potential. In some places, the hydraulic works have been destroyed. There are many causes for these conditions, which are discussed below.

Investment

The investment in the hydraulic works is not comprehensive, continuous, and coordinated. Now investments are primarily concentrated on head works and the main channels (the State's

responsibility) but lacking in branches at different levels (local people's responsibility). Therefore, the full potential of irrigation and drainage is not yet secured.

Management

Management organizations have been established, but not properly, especially those at the local level (at town, and inter-town level). For example, the channel network at the local level has not had a genuine manager and, in fact, some places along the channels not ever been completed. The problems of illegal digging of channels, disputes over water, and excessive use of water are still prevailing. Other sectors and levels have paid little attention to investing in construction, management, and proper policies, particularly financial policies. In many places, fees for using such hydraulic works cannot be collected, or minimally collected, so funds are unavailable to maintain and repair projects from degradation.

Now, fewer investments are made in building more hydraulic works, but instead more attention is being paid to the management of existing works (e.g., upgrading, overhaul, and repairing). However, the methods of approach have thus far not been appropriate, therefore, effectiveness has not been high. There is still a widely held idea of dependence on others, so that the responsibilities for exploiting and using hydraulic works have not yet been fully realized.

MANAGING WATER RESOURCES TO ALLEVIATE POVERTY IN RURAL AREAS

In order to manage and make use of the source of water to meet the requirements of effective water use while ensuring a sustainable development, several approaches should be adopted. The management and use of water should be made from an integrated, basin-wide approach. Similarly, management of irrigation schemes should be made according to the irrigation system network and not be divided according to political administrative boundaries.

Water use has to be planned in connection with the protection of the water source, in terms of both quality and quantity. This will protect against exhaustion of the water source to recycle the source for domestic use and for the economy.

In the interest of hunger reduction and poverty alleviation, policies must be formulated that comprehensively address the multi-faceted issues of rural development for each specific location. Only when the issues of starvation and poverty are partially solved can agriculture and water resources exploitation be assured. This will help bridge the income gap between rural and urban areas. Some of the multi-faceted issues are discussed below.

Lowering the population growth rate

Population growth is posing a threat to the nation's security both economically and socially. The agricultural areas are where most of the 1.5 million people born yearly live. If the population continues to grow at over 2 percent a year, then poor rural areas will become

even poorer, and the land area will be reduced on a per capita basis. Too much intensive farming will be practised and the environment will get continually degraded eventually causing incomes from agriculture to decline.

Land use rights

The guaranteed right to land use is a valuable asset of each household. This right can be used as collateral for mortgages and capital mobilization for making investments in water resource projects serving agriculture. Therefore, land use rights are for the sustainable development of water resources.

Infrastructure

Investing in the infrastructure in rural areas is not inclusive of developing such areas. Included in that system are traffic lines and electricity that are related to modern approaches to water resources development.

Cropping patterns

The diversification of crops will lead to a change in the requirement for water supplies. In order to boost production efficiency towards the plants of high economic values based on export potential.

Seafood

In consideration of the benefits of agriculture, aquaculture alters the purpose of water resources and can raise the effectiveness of the production process and raise income.

Developing forestry

Forests are a great resource that can be called “a natural reservoir” that serves as a tool to regulate flows that can result in floods or droughts in lowlands. Forests are necessary to develop the full efficiency of water resources projects (e.g., irrigation and water for domestic use). Reducing poverty is one effective solution to protect forests. It has been suggested that for each ha of irrigated rice in rural areas, 5–15 ha of forests are prevented from being destroyed). Policies to develop forestry (Programme 327) also have an influence on the sustainable development of water resources.

Financial policies

To ensure the equality of contributions, those who benefit from agriculture should take the financial responsibility for the construction, management, operation and maintenance of such

projects. The State should adopt a policy that balances different sectors to provide financial aid for constructing, exploiting, operating, and managing water resources projects. This is a complicated problem at the macro level and is a large obstacle to agricultural development.

Rights and responsibilities of the government, organizations, and every citizen

Rights and responsibilities need to be defined and assigned for the exploitation and protection of hydraulic structures in order to develop water resources, agriculture, and rural areas in a sustainable manner. However, the government and organizations are currently just exercising their rights, not their responsibilities. The local people, especially those directly benefiting from such hydraulic structures, are now lacking in rights (of participation) and responsibilities.

EFFECTIVE MANAGEMENT OF HYDRAULIC STRUCTURES

Politburo Resolution 6 (11/10/1998), *"Some of the problems in the agricultural and rural development,"* affirmed that, "first and foremost is the investment in upgrading management jobs in order to raise the efficiency of the existing hydraulic structures." It further called for, "developing policies to encourage local people to participate in the investment, management, and exploitation of hydraulic structures."

Some possible policies to achieve these goals include diversifying a sector's objectives in order to boost exports—socializing the sector of water resources by promoting internal resources and strengthening integration of the whole society in the development of water resources. It is necessary to mobilize contributions of labor and money from those who gain benefits and organizations related to this sector.

Another approach is the strengthening and consolidation of hydraulics groups with the participation of the farmers. Besides the State-owned companies that manage and exploit hydraulic structures, it is essential to divide into levels the cooperative organizations and the community to develop these structures.

The level of investment between the central government and the local administration should be divided between the State and the inhabitants in order to make comprehensive and coordinated investments in projects and find a balance between construction and management.

Encouraging democracy and social equity must be considered along with the benefits from the hydraulic structures. The investment of the government in developing water resources has to go hand in hand with contributions from the beneficiaries.

SOLUTIONS

There are several options available to address the previously discussed problems and issues. Many of these options have been or being considered. Some of these options are briefly listed below by category.

Policies

- Law on water resources
- State laws on the exploitation and protection of hydraulic works
- Specifying management organisations (the State, and the people)
    - State law on administrative punishment
    - Financial responsibilities (fees)

Trainings for upgrading working capacity

- Raising people's awareness, agreement on actions to be taken
- Methods and skills
- On-the-job training and propaganda

Cadres

People play an important role in a country's development. In other words, cadres have to be trained to be able to perform jobs properly. Cadres are those people responsible for guiding local people to carry out policies. The local people will be unable to fully understand the law, unless the cadre understands it.

Finance

Financial policies are necessary to build the infrastructure required for the development of water resources. These policies have been in the direction of decentralizing management (IMT) and encouraging farmer participation (PIM).

Models

- Drawing on experience for practical application
- Promoting persuasiveness on the basis of new models
- Developing the organisation under models

Proper mobilization method

From the bottom up (local people's volunteering)
From the top down (guidelines of the government)

Farmers will be able to manage and exploit the full potential of a project in an effective way once they are enabled with the right to manage them. They must also be trained to use any techniques required for the management. Many organizational models in Vietnam assert that the State cannot control hydraulic structures properly without the participation of the local people.

Role of Sustainable Irrigation Development and Management in Hunger Eradication and Poverty Reduction in Vietnam: Some Issues and Options

Nguyen The Ba *

INTRODUCTION

Vietnam is an agricultural country with 80 percent of the population living in rural areas, and 80 percent of the rural working people engaged in agricultural production, especially in growing wet rice. Based on the practical experience in agricultural production in Vietnam, four essential factors are water, manure, work, and variety, in the order of importance. Importantly, water is in the first position. This is true, because water is needed for all living things, fauna and flora alike. Furthermore, water holds the highest priority in agriculture, forestry, and fishery development for a tropical country such as Vietnam.

For this reason, the Party Congress and the State have given irrigation activities the highest priority in their outlook, plans, and guidelines for agricultural development. Thus, all resources available have to be especially devoted to the investment in irrigation development throughout the country in order to continually increase the production of crops and animals in order to meet the consumption needs domestically and internationally.

IRRIGATION DEVELOPMENT IN VIETNAM IN RECENT YEARS

Achievements

Due to the above facts, the State has mobilized substantial resources to develop irrigation in Vietnam. In particular, areas such as the Northern mountainous and midland regions, Central coastal region, Central highland region, South Eastern region, and Cuu Long river delta to live up to the irrigation and drainage requirements for agricultural areas devoted to rice and short-term and long-term industrial crops. It is especially the case with rice. Thanks to such efforts, the solution to crop and seed structures has been found. Consequently, rice productivity and output have continually increased in the past years, which transformed Vietnam from a food-deficient country into a country with food security and particularly into the world's second largest rice exporter (current rice per capita is 400 kg). Many Northern

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mountainous and Midland region, the old fourth region, Central coastal region, and Central highlands, which experienced serious food shortages before the 1970s, have now balanced the import and the export of rice in their areas.

The State budget for investment in irrigation development from 1996 to 2000 was 14.1 trillion VND. As a result in 2000, the irrigated area rose to 3.3 million ha, drainage area rose to 1.4 million ha, salinity prevention rose to 700,000 ha, and water supply for industrial and domestic use rose to 5 billion m^3 of water. The annual irrigated rice area is 6.870 million ha (accounting for 89.8% the total planted area annually). The area of irrigated upland and industrial crops amounted to 808,000 ha.

According to a report of the Ministry of Agriculture and Rural Development (MARD), among the national programmes on Hunger Eradication and Poverty Reduction in the period 1999-2000, there were several projects on immigration to develop new economic zones (including 534 sedentarisation projects, 12 new economic zones immigration projects, 91 free immigration stabilization arrangement projects). Total investment capital from the State budget amounted to 690.2 billion VND. Irrigation activities alone have successfully built 240 hydraulic structures, large and small, which include 123 km of inner-field channels, 24 pumping stations, 61 irrigation and drainage gates, and 3 systems of reservoirs. Additionally, these irrigation projects have successfully developed 14,670 ha in the wild for developing production, and have stabilized the local people's everyday life, helping eradicate starvation and reducing poverty in their areas. The investment in irrigation was a prioritized target in the period 1999–2000. The Ministry of Agriculture and Rural Development has spent 470.7 billion VND (257.4 billion VND in 1999 and 313.3 billion VND in 2000) on building hydraulic works that help ensure the stability of 368,000 ha of winter crop. There efforts have also helped to solve the problem of domestic water shortage of more than 1 million inhabitants, especially of more than 300,000 people in Ha Giang, Cao Bang, Lai Cai, Son La, Lai Chau. Moreover, MARD's efforts have helped build 390 small and medium-sized hydropower stations to supply 32,200 kw of electricity to the mountainous areas where the national power grid has not yet been extended.

Shortcomings

However, there still remain many problems in irrigation activities, such as failing to utilize the full capacity of existing hydraulic structures, large and medium alike and failing to maintain adequate investment in the building of channel networks stretching to the areas in dire need of water. The problem still exists of "lacking" and "too much" local water happening at the same time in the same place, especially in areas with complex geographical positions. There are high levels of investment, but efforts still fail to find a proper solution technologically, so farmers can only harvest once a year because of inundated soil or lack of water. Policies on managing and using irrigation and drainage structures still contain in themselves many problems causing low usage efficiency, waste, and improper water use, etc.

Solutions

Strong efforts have to be exerted to take full advantage of the existing hydraulic structures. Research needs to be done on small hydraulic structures in terms of combining those with small hydropower plants and/or with aquaculture. This is especially true in the Northern mountainous and midland region, old four regions, Central coastal areas, and Central highlands in order to meet the requirements of the new land exploration, together with suitable crop diversification, productivity of rice, as well as other short-term and long-term industrial crops. Last, to help eradicate starvation and reduce poverty, farm production has to be increased in terms of both quality and quantity, which enables farm workers to have higher incomes and better standard of living.

SUSTAINABLE IRRIGATION DEVELOPMENT—ITS ROLE IN HUNGER ERADICATION AND POVERTY REDUCTION

Objectives

- Making the fullest use of the existing large and medium-sized hydraulic structures in every area.
- Increasing the ratio of irrigated land areas used for crops, raising animals, aquaculture development, and for domestic use of water in each specific area.

Targeted land

Targeted areas include areas now lacking small hydraulic structures, such as those far from large and medium-sized structures, far from river networks, near the coast, or situated in low-lying areas frequently inundated with water. These areas tend to be characterized by unstable agriculture, low incomes, and poor population.

Targeted beneficiaries

Targeted beneficiaries are primarily farmers working on rice fields, raising animals and aquaculture in the above-mentioned lands. If the currently existing problems of water resources are solved, there will be substantial changes in their lives, materially and spiritually, which is a great tool in hunger eradication and poverty reduction, and also in their community integration.

Policies

- Central and local governments need to undertake research before establishing policies appropriate for the effective management and exploitation of existing hydraulic structures.
- Mobilizing resources available for irrigation development.
- Developing the spirit of self-reliance, and the participation of local people in managing, using, and building new hydraulic structures, especially small-scale ones.
- Socializing irrigation activities.

Technical solutions: Magnitude, models of development

In the years to come, in addition to increasing the efficiency of the existing hydraulic structures, special attention will need to be paid on building small hydraulic structure models managed by the local people, especially in the areas located far from larger hydraulic structures. The small hydraulic works in new economic zones are a prerequisite for further expanding rice planting areas in mountainous and midland areas in Vietnam to ensure the stability of rice output on their own lands. At the same time, it is necessary to combine the development of small hydraulic structures with small hydropower plants to meet the local people's day-to-day domestic life in the areas where the national power grid has not yet reached or where the cost of using electricity is too high. If all of these schemes are realized, then the material and spiritual life of many people in such difficult areas will be greatly improved.

Irrigation benefits

Socially and economically speaking, irrigation development, particularly small-scale irrigation, for the country's unique conditions has brought about great achievements to Vietnam's economy as a whole and to the agricultural sector in particular. It has created momentum for the whole economy and society to develop strongly, improve the issues of hunger eradication and poverty reduction, stabilize politics, and improve social security order. These will help to build Vietnam into a prosperous, equitable, and civilized society.

CONCLUSIONS

As mentioned above, we continue to emphasize the importance of developing irrigation. Irrigation development is the most important factor in the development of agriculture of our

country. It will definitely create favorable conditions for the modernization and industrialization currently taking place in Vietnam. This is also of paramount significance in helping realize the hunger eradication and poverty reduction goals, lifting Vietnam out of extreme poverty and helping it to integrate into the region and the world.

Irrigation Intervention Strategies for Poverty Alleviation: Lessons from Experience

Dr. Nguyen Hai Huu [*]

IRRIGATION AGAINST POVERTY

Poverty can be defined as a state of existence where one lacks the capacity to meet the basic human needs. These needs are based on socioeconomic development conditions, as well as a range of customs and habits that are accepted by the society. In the above context, the poverty line may be defined differently by each country and region. In accordance with the definition of poverty held by the United Nations, if the poverty line is defined as US$1 per person per day, then the world has around 1–2 billion people living in poverty of which, 90 percent are living in the Asian region. If the poverty line is set at US$3 per person per day, then about 50 percent of the world's population is living in poverty. Based on these facts, the international community has pledged a campaign launching an "attack on poverty."

The first decade of the twenty-first century is the decade dedicated to seeking poverty alleviation in the world. Strengthening the fight against poverty is motivated by the morals, values, politics and economy of the society. The international community has set a goal to reduce by half the number of poor people in the world by 2015. This ambitious goal depends on the determination of every poor country and the effective assistance from the international community. In accordance with the World Bank and Asian Development Bank's assessment, if poverty alleviation is not improved actively in the next decade, the speed of poverty alleviation will remain the same as in the past decade. By the year 2015, the world is forecast to still have 950 million poor who earn less than US$1 per person per day.

Four key goals in the poverty alleviation program in rural areas that the international community pledges actively to address include:

- Attaching special importance to the production of basic foods such as rice and potatoes.
- Improving irrigation and drainage systems to increase the effectiveness and quality of using water in agriculture.
- Looking beyond general economic development, to concentrate on an equitable distribution of social property that is beneficial for the poor.
- Paying special attention to traditionally disadvantaged groups, such as women, ethnic minorities, and inhabitants living with degraded resources, such as land.

Vietnam is one of the poorest countries in the world. In 2000, the per capita GDP was about US$400. According to the national poverty line that was defined in November 2000,

Vietnam currently has about 17 percent of the population living in poverty. By the World Bank's poverty line, Vietnam has more than 30 percent of the population living in poverty. Moreover, about 90 percent of the poor people live in rural areas, which are primarily characterized as mountainous areas lacking sufficient water resources to develop agricultural production. Most of the high mountainous areas have adequate water resources for living activities and production for only for 6 months a year. Poverty in Vietnam is caused by various reasons that can be classified into 3 main groups:

i Harsh natural conditions (e.g., irregular rain and sun patterns, floods and other natural calamities, divided terrain, difficult access to transport network, lack/overabundance of water for production during the year).

ii The education/knowledge level of the poor people is low, backward customs and habits, the communities lack adequate management capacity to use water effectively.

iii The State policy mechanism is slow to reform, especially, mechanisms and policies for the development of infrastructure for rural areas and agriculture, including irrigation.

The above conclusions show that irrigation can have a strong impact on poverty alleviation in agricultural countries, such as Vietnam. However, irrigation development is not only dependent on the State invested capital, but it is also dependent on appropriate mechanisms to encourage investment, management, as well as the exploitation and use of water resources at the macro and micro levels. Since the State budget is limited, it is essential to mobilize communities, people, and the private sector to participate in irrigation development. The community has the responsibility to manage, exploit, and use water resources effectively, as well as to regularly maintain irrigation works.

The voices of people—lessons drawn of irrigation intervention for poverty alleviation in agriculture

Vietnam is an agricultural country with approximately 77 percent of the population living in rural areas and engaged in agriculture. This rural population accounts for 90 percent of the poor people in the country. The urban population accounts for 23 percent of the population, but urban poor only account for 10 percent of the total poor. In the 1950s, 90 percent of the population was living in rural areas. This gave rise to a Vietnamese folk-song with the following lyric: ***first, is water, second is manure, third is work, and fourth is seed***. It is unknown exactly when this folk-song originated, but we can see that farmers have long realized the importance of water: it is irrigation for agriculture.

Since feudalism, Vietnamese had recognized the importance of irrigation for agricultural development. Many doctors' theses written during the period 1446–1778 dealt with economic and agricultural development. Irrigation was always given priority. The doctorate thesis of Nguyen Khuyen was given special attention. In the 1960s, some important irrigation works

were built in Vietnam such as Bac Hung Hai irrigation system to irrigate 300 thousand lands ha in Hung Yen province and a thousands land of ha in Hai Duong and Thai Binh. In the late 1980s, the Vietnamese people have paid special attention to the development of irrigation systems, including at the macro and micro levels.

Recently, there have been changes to the way in which irrigation is managed. Previously, the State and the cooperatives had the responsibility to manage irrigation, but now the management has been transferred to local residents and the State only partially assists in management duties. The poor have accepted these changes and they are ready to participate in water management, devising plans for further development in the irrigation building program, and increasing benefits for people, especially the poor.

Another experience concerns the Song Quao irrigation, a series of small-scale irrigation constructions under international projects that aimed to support localities with a high incidence of poverty. In the past, there were no irrigation works. Between 30 and 35 percent of the population in Song Quao lacked food for 2–3 months each year. Local authorities regularly had to provide relief assistance in the period between crop harvesting and traditional Tet. Two years after the irrigation schemes came into use, the poverty incidence has gone decreased by more than a half. There are no longer persons lacking food for 1–2 months each year. As a result, the local authorities do not have to provide relief every year. The poor realize that these benefits are caused by the effective development of the irrigation works.

From the experiences gained during the 1992–1997 period, it was resolved to address the poverty problem. By 1998, the Prime Minister approved the "National Target Program on Hunger Elimination and Poverty Alleviation," a program on socioeconomic development in mountainous and remote communes with extreme difficulties. The "National Target Program for Hunger Elimination and Poverty Alleviation" incorporates nine fundamental approaches. One of the important approaches involves helping poor communes develop basic infrastructure, such as micro irrigation works, schools, clinics, roads, safety water, power, and markets. Importantly, micro irrigation is defined as a priority. Under the project, the State has spent trillions of Vietnamese Dong (VND) in poor communes[1]; people have contributed millions of working days and hundreds of billion VND to build 6000 irrigation works. Due to heavy activity in numerous poverty alleviation programs and projects, the poverty rate was reduced from 30 percent in 1992 to 10 percent in the year 2000 (using the official Vietnamese poverty line definition). This Poverty Alleviation program is seen as the most effective one in the renovation process of all the national programs. The international community has also recognized Vietnam as a bright point on poverty alleviation efforts worldwide. This good result has been realized partially through the important contribution of irrigation development in agricultural development and poverty alleviation.

[1]The exchange rate for the Vietnamese Dong was approximately US$1 = VND 14,800 on 6 June 2001, which reflects a steady increase since 1998.

SUGGESTIONS ON MECHANISMS AND POLICIES AS IRRIGATION INTERVENTION STRATEGIES IN AGRICULTURE

From the experience of the past several decades, the impact of irrigation on poverty alleviation needs to be oriented clearly across the macro and micro levels, from village, commune, district, and province levels up to the national level, even to the international level. Every level needs to be oriented specifically:

1. Identify development needs founded on participation of residents, particularly, the needs of poor households, poor areas, women and ethnic minorities in mountainous and remote areas. To do this effectively it is required to propagate, educate and increase residents' awareness. Suitable techniques and tools for residents to identify their real needs should be developed.

2. Identify investment mechanisms for the development of irrigation works from district to national levels funded by the State budget. However, it is necessary to focus on various levels more concretely, to make clear the relative contributions from the Central budget and the local budget. Regarding small-scale irrigation works in communes and villages, the State plays a role to create proper mechanisms, while the local people contribute budget, working days, and monitoring. Communes and villages can organize the implementation of management plans. Regarding poor communes, the State assists from 30–50 percent of the required budget. Regarding extremely difficult communes, the State assists by providing between 70 and 80 percent of the budget and the local people contribute required working days. To ensure the desired outcome that communes have constructions and local people have work to increase incomes, there is a priority to use poor laborers with payment.

3. Define clear administrative mechanisms and use for every irrigation construction, within the context of strengthening the administrative reform. It is necessary to strengthen decentralization for localities. The responsibility to manage and maintain small-scale irrigation is assigned to local people by formulating groups for water management and use (i.e., a community organization of local people).

4. Every administrative management level has to steer overall irrigation system to provide for agricultural production, including drainage concerns. In a few areas, administration only pays attention to irrigation not drainage, thus causing flood; mainly in Cuu Long (Mekong) Delta and Northern mountainous provinces. The floods in nine central coastal areas in 1999 and seven Cuu Long provinces in the year 2000 caused over 70,000 households to fall into poverty and thousands of households to nearly fall into poverty.

5. To encourage private sector mechanisms to participate in developing irrigation systems, especially small-scale water conservancy projects. Water conservancy projects

contribute to increase agricultural production to ensure food for household and commune levels.

6. Irrigation systems can be only brought into play effectively when natural water resources are protected. This is closely related to environment protection, mainly forest protection. Therefore, irrigation development strategies should be joined with forest protection and hydroelectric strategies. Vietnam has lessons drawn on this issue, in the northern mountainous provinces, because of widespread forest destruction, some irrigation works lack water in the dry season that would not occur if forests are protected and covered.

Implementation of Modeling Techniques to Resolve the Economic and Managerial Problems in Irrigation Practices in Dinh Hoa District Schemes in Vietnam

Dao Van Khiem *

BACKGROUND

Poverty alleviation is one of the most important components of the economic development process in developing countries. However, this concept is often widely misunderstood. In the developed countries, economic efficiency is a desired goal as it helps the entire economy gain a higher aggregate income, which the government can redistribute among the people by various measures such as taxation and transfer. This argument is based on the concept that the rich usually use their incomes to consume or to invest, and through these activities, they can stimulate the economy of the whole country.

However, in developing countries the situation is quite different. The rich in these countries usually buy luxury goods from developed countries or send their money to foreign countries; consequently, their activities do not encourage economic development in their own countries. For this reason, poverty alleviation can increase incomes for the poor people, who usually use their income to consume domestic goods. Therefore, the poor's consumption activities can encourage the domestic economy. Thus, the poverty alleviation is not only a fair action, but also helps to promote economic efficiency.

Most poor people live in rural areas, so we can help them with measures that promote agricultural production. Many development economists show that in order to meet this goal we must implement unimodal technology to agriculture. Irrigation is one type, in addition to fertilizer and seed, in the "green revolution."

However, irrigation services are often considered as commodities that have many characteristics of "market failure"; thus, the supply of these goods usually falls upon the public sector. In order to have effective control, we must estimate the price of these services, but this task is not simple. In our case study, available data collected through an investigation project is used to estimate a demand curve and the marginal cost of irrigation supply, from which the price of these services can be established.

In general, estimating the price of water is quite difficult because of the transaction costs, and data limitations prevent efficient management of the irrigation supply. Therefore, we must develop water price estimation techniques together with institutional arrangements. There are many studies trying to estimate the influence of the performance of water

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institutions on water sector performance. However, this case study contributes to solving a small portion of the larger problem.

The problem consists of conflicts between different farmers who have lived in the same area irrigated by a reservoir. After the failure of the cooperative mechanism in 1990, cultivated land was divided among various individuals, some of whom have inherited areas in the reservoir bed. Due to the poor performance of the local managers, the farmers have encroached upon the reservoir and now consider it as their own property. This situation has persisted for more than ten years from 1990 until the present. In this study, in order to model and solve the problem, a Games Theory approach is introduced with suggestions of various alternatives to help the policymakers make better formulate their decisions.

DEMAND-SUPPLY MODEL FOR IRRIGATION SCHEMES IN DINH HOA DISTRICT

Production function of agricultural production in the district

The primary agricultural output in the district is rice. For this study, a seasonal model considering only the winter-spring paddy crop was chosen, because paddy productivity of the summer-autumn crop is not clearly influenced by irrigation. It can be illustrated by the relative paddy productivities of various irrigation systems in the district of winter-spring and summer-autumn crops (figures 1 and 2).

Figure 1.Relative productivity of winter-spring paddy crop in the Dinh Hoa District.

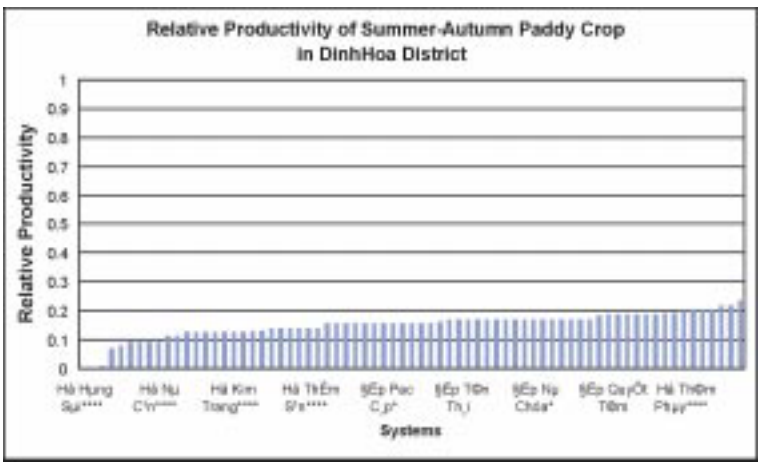
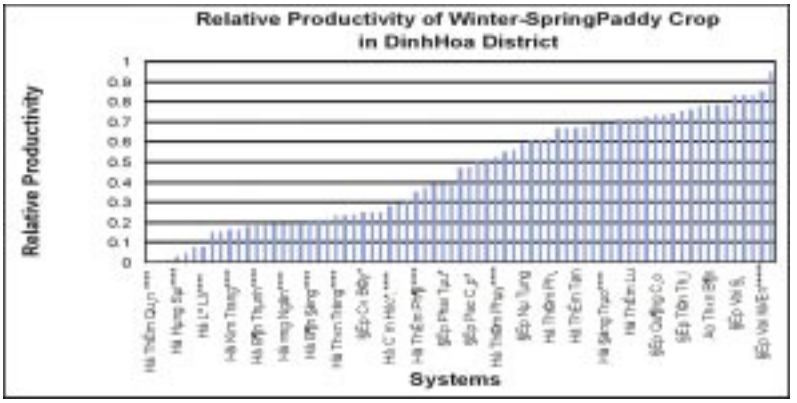


Figure 2. Relative productivity of summer-autumn paddy crop in the Dinh Hoa District.



The production function for agricultural production is:

$$Y = f(K, L, R, W, P_{PH}, ...)$$

where, Y is paddy productivity,
K is capital,
L is labor,
R is land, and,
P_{PH} is fertilizer.

Because most inputs, except irrigation, are supplied in relatively competitive markets, they are in balance and their integrated impacts can be expressed by the constant term in our model. Then the relation between the crop output and production inputs can be specified as follows:

$$Y = AW^2 + BW + C$$

where, W is irrigation service and this form of production function satisfies the following constraints:

$$\frac{\partial Y(W)}{\partial W} > 0 \text{ and, } \frac{\partial Y^2(W)}{\partial W^2} < 0$$

Profit maximization problem of individual farmer

Profit maximization problem of individual farmer is given by the following equation:

$$\max \pi = \max_{W} \left(P_Y Y(W) - F - P_W . W \right)$$

where, P is price of crop output per hectare,
Y(W) is agricultural production function,
F is production costs (except irrigation costs) per hectare,
P is price of irrigation service per hectare, and,
W is irrigation service.

The first condition for profit maximization problem is:

$$P_Y \frac{\partial Y(W)}{\partial W} = P_W$$

or:

This equation is the demand curve for the irrigation service.

Marginal and average costs curves of irrigation suppliers

The total cost of irrigation supply consists of three components: capital, upgrading costs, and operations and maintenance (O&M) costs. However, capital is a sunk cost and O&M costs are estimated approximately as 8 percent of the value of paddy production in an area unit. Therefore, the marginal upgrading cost component is the relationship between the percent of irrigated area and the increased cost for upgrading at this percent, i.e., W ~ ΔK/DW, where ΔK is the increased cost for upgrading and ΔW is increased percentages of irrigated area. The marginal cost function for irrigation supply is specified as follows:

$$MC = \alpha W^2 + \alpha W + \gamma \ + MC_{O\&M}$$

From the marginal cost function, the average cost equation is derived as follows:

$$AC = \alpha \frac{W^2}{3} + \alpha \frac{W}{2} + \gamma \ + MC_{O\&M} + \frac{C_{O\&M}}{W}$$

ESTIMATIONS

For the estimation of the regression, data collected for the “Investigation on Current Situation of Irrigation Schemes in Dinh Hoa” Project was used. The project was funded by the Thai Nguyen Agricultural and Rural Development Department (December, 2000).

Regression results are:

$$A = -2.45857$$
$$B = 5.402239$$
$$C = 0.778226$$

The estimated regression equation for the production function is:

$$Y = -2.45857.W^2 + 5.402239.W + 0.778226$$

This production curve is shown in figure 3.

The demand equation is:

$$P_W / P_Y = 2AW+B$$

or,

$$P_W / P_Y = -2.45858.2W + 5.402239$$
$$= -4.91714.W + 5.402239$$

The graph of this function is depicted in figure 4.

Figure 3. Paddy production function.

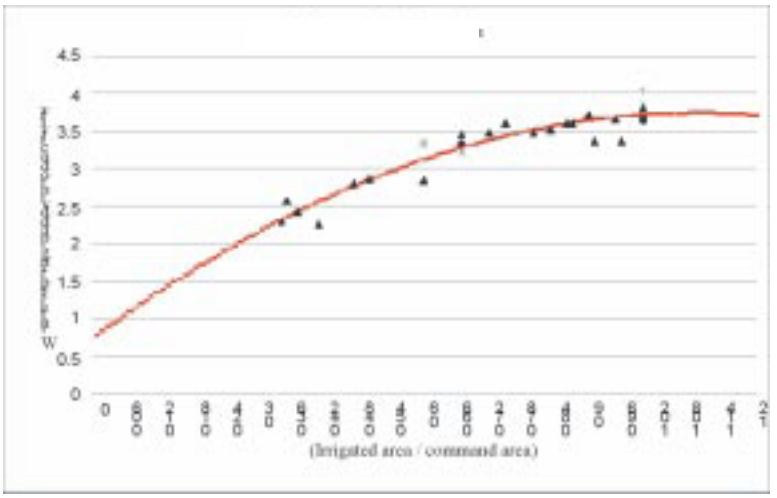
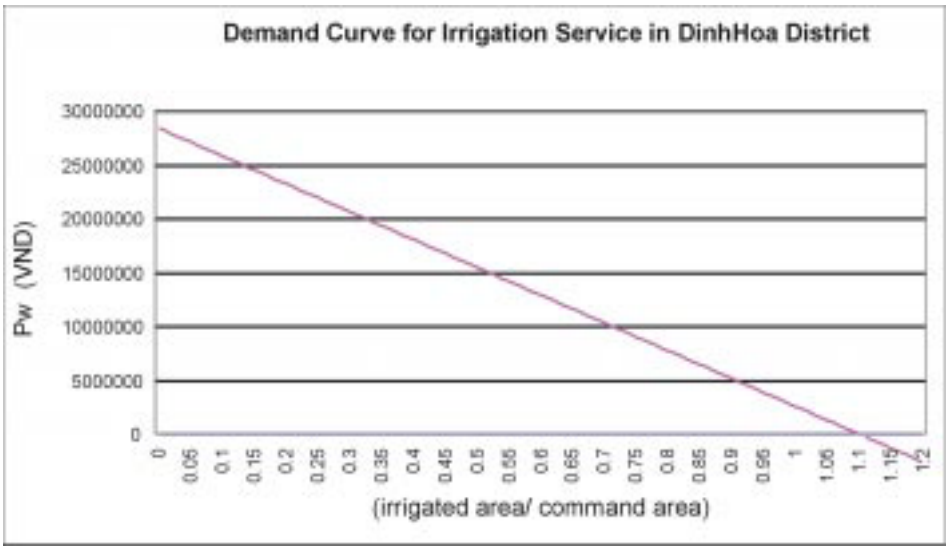


Figure 4. Demand curve for irrigation service in the Dinh Hoa District.



For the marginal cost curve, the estimated parameters from the regression analysis are:

The estimated regression function for marginal cost is:

$$MC = 9641026\ W^2 + 219784\ W + 2537221$$

From the marginal cost function, the average cost function can be derived and is given by:

where, $C_{O\&M}$ is considered at 5.10^6 VND, for example. The plot is presented in figure 5. The combination of the demand and marginal cost curves is depicted in figure 6.

Figure 5. Marginal cost curve for water supply in the Dinh Hoa District.

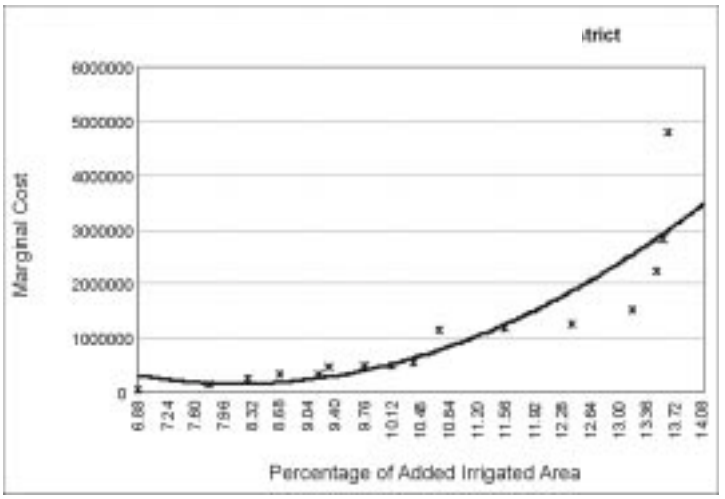
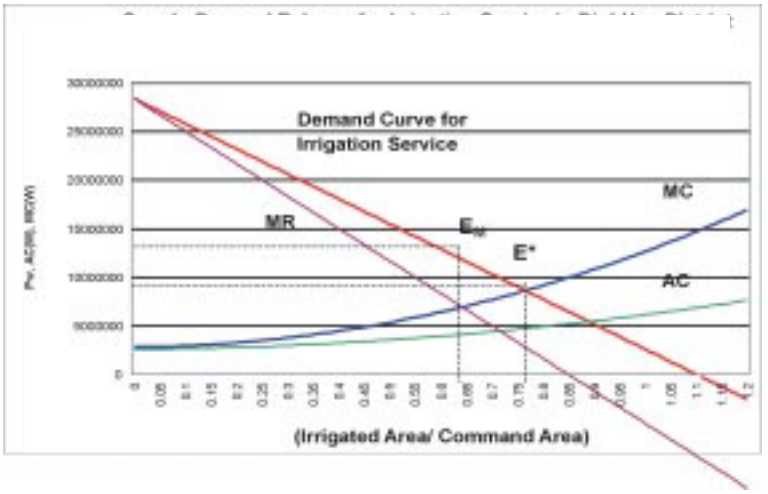


Figure 6. Demand - supply balance for irrigation in the Dinh Hoa District.



ANALYSIS

In equilibrium, W = 76 percent, Pw = $8.7x10^6$ VND(» $621) per ha. Currently, it is not realizable because paddy productivity in the district averages about 3.8 t/ha, which is about (3.8 tons per hectare x 1550.10^6 VND) » 5,890,000 VND (» $421) per hectare in which other production costs make up approximately $4x10^6$ VND (» $286 per hectare). However, if local farmers apply new high-yield variety seed, they can produce about 10 tons per hectare under similar production conditions, which is about 10t x 1550.10^6 VND » 15,500,000 VND » $1100 and the individual farmer can almost afford to pay all production costs, even irrigation costs.

Alternatively, if the government only requires payment of O&M costs (8% of income in area unit), the local individual farmer is able to pay all production costs, although the farmer is still very poor. We must notice that under these conditions, the individual farmer is not encouraged to use irrigation water economically. If achieving economic efficiency for water use is a desired goal, then water fees must be increased considerably.

If a bidding mechanism is implemented, then upgrading costs would decline and the marginal cost curve will shift rightwards and the price of irrigation will decrease while the desired level of water use will increase. In our example, marginal costs were assumed to decrease by 30 percent, so that the equilibrium price will be 7.10^6 VND (»$500) per hectare (a decrease of 22%) and the equilibrium level of water use will be about 83 percent, (an increase of 7%). The current situation is improved markedly because the gap between the ability to pay and willingness to pay decline considerably.

A practical solution that can be implemented is “tiered” pricing. It can improve the cost recovery situation for irrigation suppliers and efficiency in water use for individual farmers. However, there is an increase in the costs required for data collection and analysis. Finally, because of the scarcity of water resources, the price of irrigation services is raised considerably. Therefore, the rational farmers usually do alter cultivated cropping patterns. Additionally, several crops can be successfully grown that do not require as much water as the paddy.

MODELING THE “RESERVOIR” CONFLICT IN DINH HOA DISTRICT

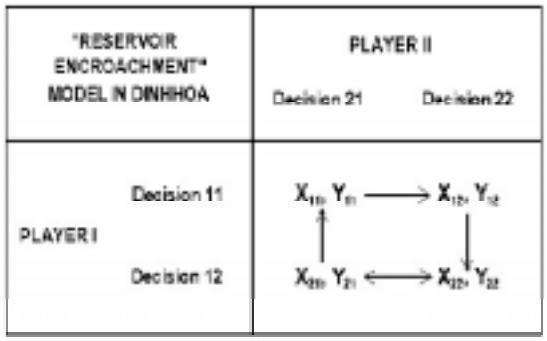
There are many typical problems in irrigation management in Dinh Hoa, such as poor operation and maintenance, lack of clear accountability, and weak functional capacity. However, of particular note in Dinh Hoa district is the “reservoir encroachment” described before. Many farmers have encroached upon the areas in the reservoir bed for two purposes. First, they use these areas to plant rice. Second, the farmers try to take full advantage of the property rights and expect the government to buy these areas with compensation.

Moreover, this situation is spreading throughout the whole district and this process has existed for more than 10 years. In other words, "reservoir encroachment" is not a specific problem of Dinh Hoa district; it is only a symbol of the underlying dilemma, the non-cooperative dilemma, which is one of the most complicated problems in various regions and sectors such as law, economics, management in general and water sector in particular.

MODELING

In order to analyze the problem and to suggest different alternatives for resolutions, a Games Theory modeling approach was chosen. The first step in the modeling process is to decompose the entire conflict into component "games." For simplicity, only one of these games will be introduced. The other games were constructed in a similar manner. The game introduced here is described as a conflict between the government and the farmers cultivating in the reservoir bed (i.e., the "reservoir encroachment" farmers). Each of these "players" has two decisions: the government (player I) can bargain (decision 11) or abandon (decision 12); the "reservoir encroachment" farmers (player II) can bargain (decision 21) or make a nuisance (decision II). The game is described with a "payment matrix" as in figure 7.

Figure 7. Reservoir encroachment game.



As can be seen from this model, the game has two equilibriums: one of them is a mixed equilibrium and the other is a weak one (East-South outcome). The East-South outcome is undesirable because in this case both players do not cooperate with each other. On the other hand, if it is desirable to achieve any other equilibrium, then an investment in some resources is required to reverse the directions of certain arrows described in figure 7. Concretely, West-

North outcome is the most desired outcome and in order to achieve it, the arrow directed from West-South to West-North needs to be strengthened, as well as, the arrow directed from East-North to West-North outcome. It means that we have to strengthen working capacity of the local government staff to help the “reservoir encroachment” farmers to understand that their profit maximization behavior in these conditions can damage all the benefits. In a similar way, we can explore all possible situations described in our game according to social preferences and then costs can be estimated for various resolution-alternatives.

RECOMMENDATIONS

a. Establish training courses to promote knowledge and skills of individual farmers in the district.
b. Establish training courses for local authorities to promote managerial capacity.
c. Select appropriate organization, which can internalize all the possible externalities in order to negotiate with the “reservoir encroachment” farmers to exchange land use rights with water rights.

Some Methodological Issues in Studying Rural Poverty in Vietnam Today

Dr. Le Ngoc Hung[*]

BACKGROUND

It has been noted that the early period of economic growth involved social stratification, poverty and social inequality. However, development theories and experiences of poor countries show that social equality and opportunities for poverty alleviation will increase with economic growth. Although there are different arguments about development models, modern theories of socioeconomic change are identical claiming that economic growth plays an important role in solving development problems, especially famine. The issue is how to identify and deal with the causes and determinants of poverty where slow agricultural economic development occurs and people are seeking ways for economic growth. Poverty and low growth should be looked at in a scientific manner and at different levels of the economy. Interdisciplinary and intersectoral approaches require the consideration and solving of problems at the individual, household, community and policymaking levels, as well as, from the point of view of production of farmers, the organization of socioeconomic activities of a community, and the use and protection of resources, including land and water.

ECONOMIC GROWTH AND POVERTY ALLEVIATION—ISSUES IN APPROACHES

The classic study of Arthur Lewis (1955) worked out a theory that economic growth is linked to profit maximization, commercialization, specialization, economic freedom, savings, capital accumulation, and investment promotion. Based on this theory, several development models were developed to determine the key to development. However, efforts did not bring about the expected outcomes as they ignored many non-economic factors.

Development theories from the late 1960s emphasized the role of the State/Government and the importance of different types of economic capital (finance, land, production means) and non-economic capital (including man, social capital, cultural capital) as causes of poverty. International scientists have argued this point and important ideas of defining appropriate approaches to poverty have been suggested for the economic restructuring of developing countries.

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An important idea is that economic growth is not seen as an objective itself, but the result of a development process to create more choices, opportunities for individuals, families and regions in the country. Sustainable development may then be assured by providing more opportunities for the people. Amartya Sen suggested that poverty occurs to only those who lack employment opportunities, production conditions, possible choices, and cannot participate in the decision-making process for the community level socioeconomic institutions. At the macro level, Amartya Sen has commented that policy makers, politicians, and managers in less developed countries are not concerned with "poverty alleviation" as they lack proper information and, unless they are pressed by the public opinion for being responsible for famine, radical poverty alleviation remain only utopian ideal. Therefore, a conclusion was made that effective rural poverty alleviation requires precise information, data, and knowledge that may be available only through objective, scientific and systematical methods. Scientific intersectoral and multi-level studies should be done on poverty incidence to analyze the circumstances and reasons to determine appropriate mechanisms for affecting them through general economic growth and rural and agricultural development.

DEFINING POVERTY IN VIETNAM

The socioeconomic reforms launched by the Communist party and Government of Vietnam during the last decade have achieved significant results that revealed indicators of increased economic growth rates and decreased poverty incidence. Despite different methods of defining poverty among the different agencies, the data analyzed by all of the internal and external agencies show a decreasing trend in the incidence of poverty in Vietnam over the last decade (tables 1, 2 and 3).

Table 1. Poverty rates in Vietnam by several agencies[1] (in percentage).

Agency	Poverty standard	1992-93	1997-98
MOLISA	Starving (< 15kg/person)	5.0	2.0
	Poor (< 25kg/person)	30.0	15.7
The World Bank			15.0
General statistical office	Food poverty (50-70,000	-	
	VND/month/person)	24.9	-
-			
The World Bank	Poor (US$100/person/year)	58.1	37.4
UNDP	Human poor	-	28.7

[1]UNDP Report of Vietnam Situation: *Looking toward future*. Hanoi - 12/1999. Tr. 28.

Table 2. Poverty incidence by region in Vietnam (1993-1998).

Regions	% of poor of the total population		% of the poor of the total population		Population of 1998	
	1993	1998	1993	1998	Million	%
1. Northern mountain	21	28	79	59	13.5	18
2. Red River Delta	23	15	63	29	14.9	20
3. North of central part	16	18	75	48	10.5	14
4. Central sea coastal	10	10	50	35	8.1	11
5. The Highland	4	5	70	52	2.8	4
6. East of the South	7	3	33	8	9.7	13
7. Mekong Delta	18	21	47	37	16.3	21
National	100.0	100.0	58	37	75.8	100

Note: Poverty level = Expenditure per capita; in 1993 is 1.2 million Dong (83 USD)/person/year; in 1998 is 1.8 million dong (128 USD)/person/year

Source: Vietnam Development Report 2001 – Attacking poverty. p. 4, 16, 18

Table 3. Per capita income by source and region, at current price, 1998 (000 VND).

	All	Seven regions						
		1	2	3	4	5	6	7
All	3,389	2,155	3,264	2,325	2,723	2,796	7,423	3,040
Farming	1,051	1,246	804	885	933	2,051	567	1,437
Off-farm	893	367	970	493	722	317	2,437	711
Wages/salaries	754	203	666	386	685	249	2,479	549
Pension, support	114	106	201	181	52	31	93	42
Other sources	577	233	624	380	332	148	1,47	301

Source: GSO. Vietnam Living Standard Survey 1997-1998. Statistical Publishing House. Hanoi 2000. p. 306.

The definition used for poverty is important for determining the objectives of the socioeconomic development policies. One example involves when a new poverty standard is applied, then the poverty rate and incidence will change. Thus, the urgency of the poverty situation depends on the definition used for poverty. Therefore, studies on poverty in Vietnam should not be limited to only using income levels as a poverty threshold to define the rate of the poor and the number of poor households, but should also use qualitative methods and indicators to determine the reasons for poverty and measures to deal with them.

RICH-POOR POLARIZATION: PERCEPTION AND RESEARCH METHODS

Some of the most recent studies of poverty incidence in Vietnam used greater ranges of information collection and processing methods, using both quantitative and qualitative indicators. The development report in 2001 for Vietnam: "attack on poverty" is an example. The effectiveness and success of any poverty alleviation strategy is dependent on the quality of information of human, social, physical factors, management policies, development policies and the governance of a country.[2] This again confirms the significance of scientific research concerning poverty in our country.

Along with economic indicators, poverty studies often use sociological surveys, including interviews with individuals, questionnaires, participatory observations, PRA, and RRA. Collected quantitative and qualitative information is processed by modern methods. Consequently, the poverty profile contains more details, is clearer, and more comprehensive.

However, studies of rural poverty have not taken into account the perception of people concerning their poor situation, especially their ways of work and life. Thus, future studies should seek and record information concerning these often-neglected areas, in addition to the typical collection of technically quantitative data.

Income and expenditure of a family in the Northern Delta indicators

Income structure:	
From rice: 1.6 sao x 4 persons x 390kg (2crops x 1500VND/kg	3,744,000 VND
Pigs: 200 kg x 800.000 VND /t[1]	1,600,000 VND
Vegetables, poultry (estimated)	1,500,000 VND
Total income	6,844,000 VND
Expenditure structure:	
Tax	180,000 VND
Seeds	200,000 VND
Fertilizer, pesticide	480,000 VND
Piglets, chicken, feed	1,200,000 VND
Buying production means, tools	200,000 VND
Rice for consumption: 200kg x 4 persons x 1500 VND /kg	1,200,000 VND
Food: 1500 VND /person x 6 persons x 365 days	219,000 VND
Cloth, electricity, etc.	400,000 VND
Children's education: 20.000 VND x 2children 10 months	200,000 VND
Donations, wedding, etc.	200,000 VND
Other fees (Road toll, irrigation fees)	200,000 VND
Total	7,150,000 VND

[2]Vietnam Development Report 2001 – Attacking poverty. Page 129-131.

An average couple has two children and they live in a tiled-roof, brick-wall house. They have a garden, a fishpond and 6.4 sao (.23 ha) of rice land and 240 square meters of residential land. In 2000, they faced a shortfall of income for spending 300,000 VND. Still, the general trend is an improvement in lives. This example shows a potential factor affecting rural poverty. That is, the low agricultural productivity of labor and decreasing prices become a danger for the socioeconomic stability and the development in rural sector.

Perceptions about poverty and well-being are different. This can be seen from the perspection of the poor themselves. For example, when asked how many billion VND make a person rich in the mountainous areas of Vietnam, a 41-year-old E De man had an unusual answer. This man, who holds 3 billion VND and had the honor to be present at the conference of Excellent Farmers of 2000, said "having 50 to 70 million VND or even a dozen million, one can see himself a rich if his children study well at school, behave well at home and outside door, they can go to university. Children are valuable assets. I have billions but I am not rich because I have four children, two of them finished secondary school but were not admitted to university. What to do to have all four go to university? They must have knowledge, be good, and know how to work so that, at least, they know how to keep what their parents created for them. I see children's education as the objective of the family, as the foundation for a family's economic development… I came from a poor family, stopped at grade 8. I understand the situation of less-educated people. They look like one-eye blind ones, one ear-deaf.. A moneyed rich man without education is only half rich".[3]

An important aspect of the methodology used for rural poverty studies that are closely linked with the use and protection of resources is in the clear identification of the independent, dependent, and intermediary variables in the questionnaire (figure 1). These variables should encompass all features from individual to household to community levels, from household economy to water resource use and protection to policy decision making. Another issue is to organize and conduct the survey according to established scientific procedure that needs to involve consultants and policy makers at the central level and leaders and officers at the local level (figure 2).

[3]Dang Ba Tien. "Will billions Vietnam Dong is not rich…" Labor Newspaper. No. 205/2000. Friday, 13/10/2000. Tr. 3.

Figure 1. Types of questions by variables in the agro-economic survey.

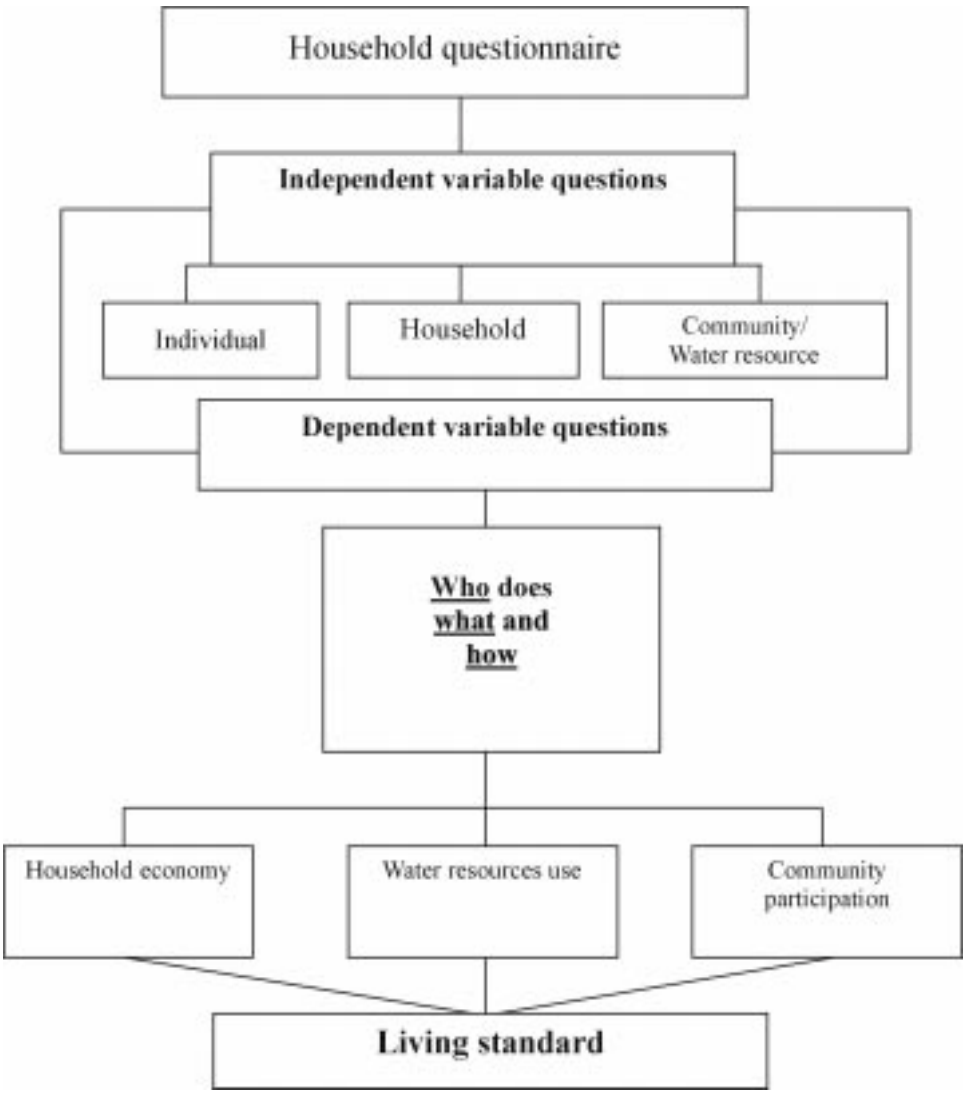
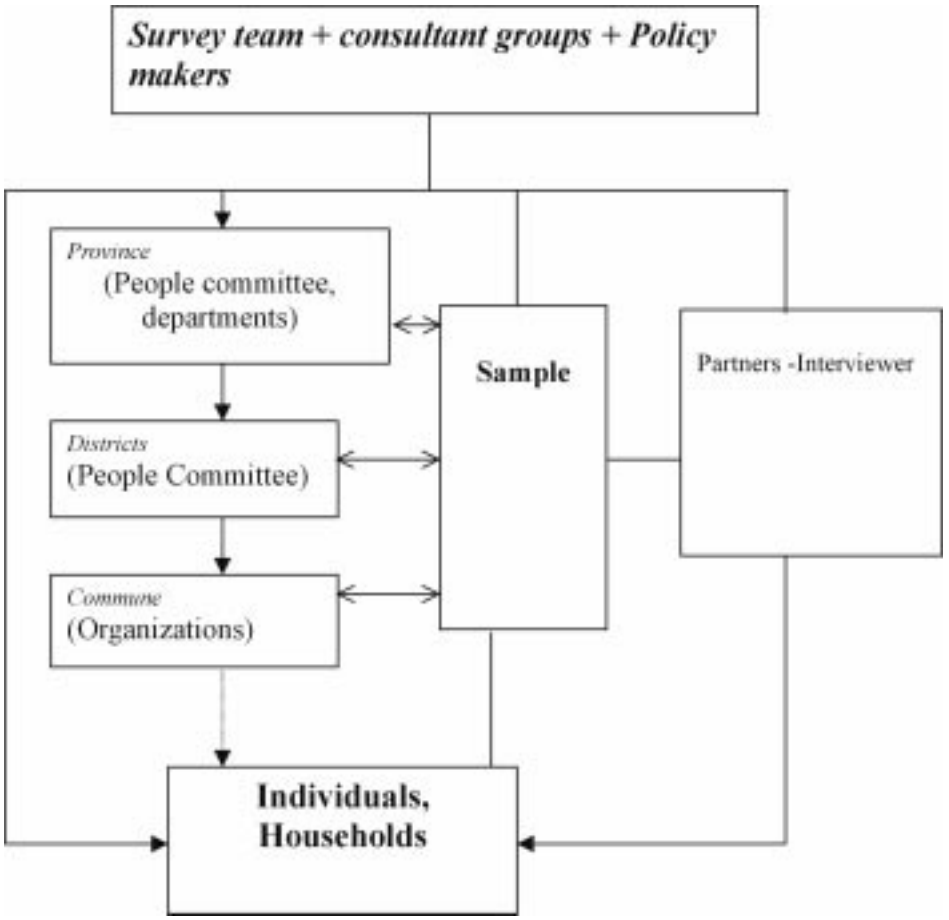


Figure 2. Procedure of Surveying rural poverty in Vietnam.



REPORT AND WORKSHOP DISCUSSIONS

INAUGURAL AND TECHNICAL SESSION

The Vietnamese national workshop for the proposed "Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia: Vietnam" was held on 14 June 2001 in Hanoi, Vietnam. The workshop was organized by the Vietnam Institute for Water Resources Research (VIWRR) in collaboration with the International Water Management Institute (IWMI). The workshop was conducted in the Conference Hall at the Vietnam Institute for Water Resources Research. Attendance included a wide range of experts from government, academic, and nongovernmental organizations. Co-chairs for the workshop were Dr. Prof. Tran Dinh Hoi from VIWRR and Dr. Intizar Hussain from IWMI.

The opening speech was made by the Hon. Vice-Minister, Dr. Prof. P. H. Giang from the Ministry of Agricultural and Rural Development (MARD). Dr. Giang placed emphasis on the importance of successful formulation of intervention strategies in irrigated agriculture as a means to combat poverty. He then expressed the supportive attitude of MARD and the Center for Irrigation and Water Supply Research within the VIWRR toward the project. Assurances were given for cooperation with IWMI and other participating institutions.

Dr. Intizar Hussain made the first presentation giving the broad background of the proposed project. His presentation was entitled "Study on Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia." The presentation began with a brief introduction of IWMI and a review of the specific research themes within IWMI. Dr. Hussain then introduced the project. He mentioned that motivations for the project are based upon the history of agricultural and rural development in the Asian region. While great progress has been made, benefits from irrigation remain highly skewed in their distribution and performance remains generally poor. These conditions have led to persistent poverty within irrigated areas. Therefore, the project will initially conduct research in order to identify the linkages between irrigation performance and poverty. Then from these findings potential intervention strategies in irrigation will be identified that have a positive impact on poverty alleviation.

The goal of the project was given as, "Overall goal of this project is to promote and catalyze equitable economic growth in rural areas through pro-poor irrigation interventions in participating developing countries." The objective of the project was stated as, "To determine what can realistically be done to improve the returns to poor farmers in low productivity irrigated areas in the context of improving the overall performance and sustainability of established irrigation systems."

The project will involve the participation of six countries. The basic approach of the project will involve field research, literature review, and data analysis to examine the linkages, opportunities and constraints. Research will be conducted at the macro, meso, system, and farm levels. System and farms will be studied belonging to low productivity agricultural areas with persistent poverty. Finally, the study will confine itself to medium and large and medium scale irrigation systems.

The next presentation was given by Dr. Nguyen Hai Huu from the National Program for Poverty Alleviation Office in the Ministry of Labor, Invalids, and Social Affairs (MoLISA). Dr. Huu's presentation focused on lessons that can be learned from experiences in Vietnam to create effective intervention strategies. Dr. Huu pointed out that poverty in Vietnam could be attributed to three broad reasons: harsh natural conditions, limited education and skills, and the slow pace of policy reforms. Dr. Huu recommended that, based on Vietnam's experience, intervention strategies for poverty alleviation would need to focus on several issues at all levels of society. The specific issues included the identification of development needs from a participatory approach, identification of proper investment mechanisms, identification of appropriate management reforms for irrigation systems, guiding irrigation system management to benefit agricultural production, encouraging private participation in irrigation development, and protection of natural resources. A major point was that disagreements between authorities and local people can present a major constraint to the implementation of reforms.

The next presentation was made by Mr. Tran Huu Toan from the Ministry of Planning and Investment (MPI). Mr. Toan reiterated the difficult natural conditions of Vietnam as a barrier to poverty alleviation. He also raised the issue of limited financial resources with which to invest in irrigation. Achievements made by Vietnam in regard to irrigation include a large increase in the area receiving irrigation and drainage services, agricultural productivity gains (and associated income gains), and the experience gained. Drawbacks from the current state of irrigation development in Vietnam include low capacity utilization, degraded reservoirs, inconsistent services, and irrigation provided primarily to rice fields. Reasons for poor irrigation performance were listed as primarily investment based, where investments had been incomplete, poorly focused, and insufficient in quantity. Mr. Toan's recommendations for the study included an examination of investments focused on management services, a focus on small and medium hydraulic works, analysis on multiple uses of irrigation water, and creation of an incentive system tied to labor/fee contributions.

Mr. Nguyen The Ba gave the next presentation entitled "Some Problems on Sustainable Irrigation Development in Contribution to Hunger Eradication and Poverty Reduction During 2001–2005. Mr. Ba detailed the current state of agriculture and irrigation in Vietnam. Problems identified by Mr. Ba in regard to poverty alleviation concerned a failure to make use of the full capacity of existing irrigation systems, failure to complete construction of lower level channels. Vietnam's difficult natural conditions (and the associated need for adequate drainage services) were sited again as a source of problems for the population. Recommended areas of concentration for solutions related to market access issues, cropping intensity, and crop diversification. He also encouraged the utilization of a participatory approach regarding management of the irrigation schemes.

Following a short tea break, Mr. Nguyen Xuan Tiep, Deputy Director for the Department of Irrigation in MARD presented his paper. Mr. Tiep's presentation addressed irrigation's contribution to poverty alleviation. He detailed the vulnerabilities of farmers in Vietnam to water-related problems. These included flooding, droughts, and pests. Mr. Tiep identified the development of irrigation and development as an effective method for combating these problems. In turn, irrigation would boost not only farmer incomes, but other sectors of the economy as well. While irrigation in Vietnam is used for multiple purposes, agricultural uses are dominant accounting for 80–90 percent of water use. Mr. Tiep pointed out the importance of sufficient investments in management activities. He provided a poignant graph

showing irrigation infrastructure being supported by a management leg. He feels too much emphasis has been put on the infrastructure in Vietnam overwhelming the management "leg." The result is poor performance of irrigation limiting their impact on poverty alleviation. Therefore, it is of utmost importance to make sure that financial investments are made in management. Currently, the collection of fees is below the required level creating a vicious circle where poor irrigation performance results in poor productivity and poverty.

Mr. Tiep's suggestions for addressing the problem centered on policies for management, adequate investment levels, and coordination of policies to address management-related issues. In this light, he also stressed the importance of forest management in relation to irrigation. Upland irrigation can protect forest by stabilizing farming practice, which protects the forests. The forests, in turn, protect and help regulate the water supply. He also stressed the value of using models and pilot projects so that lessons could be learnt and widely dispersed. A final crucial point was to gain the cooperation of both the farmers and the authorities at the local level. If one refuses to cooperate then new reforms will meet with failure.

Longer than expected presentations resulted in a shortened presentation for the remaining speakers to insure ample time to discuss the work plan and carry out the brainstorming sessions.

The next presentation was given by Mrs. Nguyen Thi Hien and entitled "Sustainable Irrigation Development for Fostering Agricultural Development and Rural Community Life Quality Improvement." Mrs. Hien is from the Central Institute for Economic Management. Mrs. Hien briefly highlighted problems for Vietnam with regard to economic growth and development and poverty alleviation. These included high population growth rates and their impact on employment. Reasons given as causes of poverty in Vietnam included the difficult natural conditions, a lack of technical knowledge and skills, land scarcity, and low savings. Mrs. Hien recommended that poverty alleviation efforts should focus on specific causes for specific groups. Technical and credit assistance were given as two examples that could help poverty alleviation. Overall, poverty alleviation in Vietnam depended on economic development in general and agriculture specifically. Therefore, irrigation must be ensured in order to alleviate poverty.

The next presentation was given by Dr. Le Ngoc Hung from the National Political Institute. Dr. Hung's presentation dealt with methodological issues for studying rural poverty in Vietnam. One aspect pointed out is the wide range of definitions for poverty used in Vietnam. Regardless of the definition of poverty used, Vietnam has experienced tremendous success in alleviating poverty. However, each definition embodies the use of different indicators, which can be used to guide data collection efforts. Finally, poverty alleviation efforts in Vietnam form a triangle of social equality, poverty alleviation, and environmental protection with economic growth in the middle.

Mr. Dao Van Khiem presented a technical paper on the implementation of various modeling techniques to solve economic and managerial problems. The case study for Mr. Khiem's paper is Dinh Hoa district. A reservoir was built in Dinh Hoa, but people still held claims to land within the reservoir area. Since, inheritance is a strongly held concept in Dinh Hoa, people began to reclaim their old land. This led to farmers moving into the reservoir area, which has seriously diminished the effective operations of the reservoir. Mr. Khiem utilized both a supply and demand model and a game theoretic approach to examine the issue.

His conclusions showed that the capacity and understanding of both the farmers and officials had to be improved so they could cooperate and thus realize a more beneficial situation.

The draft work plan for Vietnam was presented by Dr. Doan Doan Tuan of the VIWRR. He presented a brief background of issues specifically related to Vietnam. He then presented the broad framework for the study. Research would entail field level research and analysis, identification and evaluation of potential interventions, and then formulation of an appropriate set of interventions for Vietnam. The evaluation of possible interventions was suggested through the use of indicators. Specific indicators, however, were not identified. Candidate sites for the field research included the Gia Thuan Irrigation Scheme in the Red River Delta and the Nam Thach Han Irrigation System in Quang Tri in central Vietnam.

BRAINSTORMING SESSIONS

The brainstorming sessions were initiated after a review of guidelines formulated by IWMI. The purpose of the session was to identify research issues important to the study in Vietnam. Identified issues were to be incorporated in the work plan. The key issues could be generally placed in one of four categories: Management and Financial, System Performance, Institutional Setting, and Farming. The following section summarizes the key issues from the two brainstorming sessions.

The fundamental issue to be addressed is an examination of the potential for irrigation to alleviate poverty in Vietnam. It is important to establish this potential at the outset of the project. This can be accomplished through the establishment of a thorough poverty and irrigation profile. This profile should be made at the outset of the study.

Under the management/financial category, one issue mentioned repeatedly is the issue of local authority cooperation. It was stated that if the local authorities do not understand or cooperate with proposed reforms there is very little chance of them meeting with success. There are cases where the local management board has some fears regarding Irrigation Management Transfer, as they have not been told what will happen to their jobs. The topic of educating and getting the local authorities cooperation was repeatedly mentioned as important to the success of any irrigation- related reforms. Special emphasis was given during the workshop to the issue of capacity building activities for the managers of the irrigation scheme.

Irrigation management transfer was also highlighted as an important issue. A focus of analysis that was brought up concerned the capacity and willingness of farmers to manage themselves. It was mentioned that farmers are generally willing and able to carry out management duties; however, the local authorities often present constraints to carrying out this reform.

Many of the issues related to the financial topics involved with the management of water resources. Another important management issue focuses on the importance of adequate funding and supporting whatever irrigation management is put into place. A persistent problem in Vietnam is that management is not adequately supported and this leads to problems that are manifested as poor and inequitable system performance.

It was generally felt that fees collected from agriculture were too low to cover the costs of operations, management, and construction. Further, appropriate cost-sharing plans will need to be determined. This is especially true if it is determined that the government subsidies are necessary and/or help for poverty alleviation. A review of previous investments could illuminate this topic as it applies in Vietnam.

Another issue involved subsidies necessary for irrigation. The question was raised whether subsidies will help the poor. If so, then the issue was raised concerning the design of the cost-sharing burden. It was stated that irrigation investment costs between 30 and 50 million VND/ha in the low delta and 80 to 100 million VND/ha in the mountainous areas. A regional issue was raised pointing out that collecting water use fees is more successful in the north than in the central region.

The closely related topic was raised about examining the potential of the irrigation scheme's current management to initiate and implement changes independently. It was pointed out that one problem is that the irrigation management jobs are usually inherited from parents. Therefore, problems tend to get engrained and making changes becomes more difficult.

Under the System Performance category, aspects of irrigation performance should be studied including performance, equitable distribution patterns, and condition of physical infrastructure. Other related topics discussed during the workshop include water allocation and distribution issues (e.g., head-tail inequities), water use efficiency, operations and maintenance issues, and crop diversification. Other performance indicators concern quality, timeliness, information and data adequacy.

Technical aspects concerned the lack of water measurement methods in Vietnam. This has implications on how use can be monitored and charges applied (if deemed appropriate). It is important that the water charges present a variable cost in order for the proper incentives to be given. The proper structure of water fees must be determined if implemented. It was suggested to study the potential degree of water savings possible under a water fee plan.

With regard to the institutional category, it was seen as important to establish the current state of the legal and institutional framework. In this manner, it can be established whether appropriate policies are in place or if the problem is one of implementation. It was pointed out that policy formulation is easy compared to successful implementation. Mr. Tiep mentioned the Vietnam's Law on Water Resources that calls for sectoral and financial approaches to the management of water resources. Another policy related issue dealt with the coordination of policies and institutions to ensure maximum effectiveness. Finally, the rights and duties of all relevant stakeholders should be firmly established. Establishing a connection of rights with responsibilities was mentioned as an important issue in practice.

Topics raised under the farm category dealt with how farmers would respond to changes in irrigation services. A prominent topic concerned credit availability. Specifically, efforts should be made to examine the degree of access the poor have to credit.

The issue of how irrigation will affect agricultural practices, such as crop diversification was discussed. For any changes in output, quality, or choice, it will be important to examine impacts on the market. Specific mention was made to examine the possible impact of market saturation and any price effects. Other changes that will be important include cropping intensity, technology utilization, and farm size.

APPENDIX

List of Participants

No.	Name	Designation	Organization	City	Phone/fax/ email
BANGLADESH					
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03	Dr. Jahangir Alam	Chief Scientific Officer	Bangladesh Livestock Research Institute (BLRI) Savar, Dhaka-1342	Dhaka	Phone: 7708320, 7708323
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06.	Dr. M Asaduzzaman	Director General	Bangladesh Institute of Development Studies (BIDS) Agargaon, Sher-e-Bangla Nagar, Dhaka-1207	Dhaka	Phone: 8118920, 8113843 (Off), 9119883 (Res)
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09.	Ms. Dil Afroza Begum	Scientific Officer	WARPO Simon Centre (4th Floor), House No. 4/A, Road No. 22 Gulshan No. 1, Dhaka-1212	Dhaka	Phone: 8814554, 8814556, 8814431 8814217
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11.	Mr. Nittananda Chakroborti	Economist	CAD Project, Kranti Associates, Dhaka	Dhaka	

12	Mr. Gyasuddin Ahmed Chowdhury	Director General	Haor Wetland Development Board, 72 Green Road, Dhaka-1215	Dhaka	Phone: 9551088, 9552194, . (Res) 600669
13.	Dr. Md. Abdul Gani	Senior Irrigation Engineer	Arsenic Research Project, FAO, 76 Sat Masjid Road, Dhanmondi RA. Dhaka -1209	Dhaka	Phone: 9131618 (Off)
14.	Dr. M. Mozammel Haque		Institute for Flood Control Drainage Research (IFCDR), BUET, Dhaka-1000	Dhaka	Phone: 9665650-4 (PABX)
15.	Dr. A.F.M. Afzal Hossain	Head, Water Resources Division	Surface Water Modelling Centre, Road No. 32, House No. 476; New DOHS, Dhaka 1206	Dhaka	Phone: 8822105-6, 8824590, 8827902
16.	Mr. Saad Siddiqui	Associate Specialist	Surface Water Modelling Centre, Road No. 32, House No. 476; New DOHS, Dhaka 1206	Dhaka	Phone: 8822105-6, 8824590, 8827902
17.	Mr. M. A. Khaleque	Chief Planning	Bangladesh Water Development Board , WAPDA Building Motijheel C.A, Dhaka-1000	Dhaka	Phone: 5960957
18.	Mr. Arzel Hussain Khan	Principal Scientific Officer	WARPO, Simon Center (4th Floor), House No. 4/A, Road No. 22, Gulshan No. 1, Dhaka-1212	Dhaka	Phone: 8814554, 8814556, 8814217, 8814431
19.	Dr. K. Mustafa Mujeri	Senior Research Fellow	Bangladesh Institute for Development Studies, Agargaon, Sher-e-Bangla Nagar, Dhaka-1207	Dhaka	Phone: 8124350
20.	Mr. Golam Mostafa		Joint Rivers Commission (JRC), House No.13, Road No. 4 Dhanmondi R A. Dhaka –1205	Dhaka	Phone: 8618985
21.	Mr. Md. Fazlur Rahman	Executive Engineer	Joint Rivers Commission, House No.13, Road No. 4, Dhanmondi R A. Dhaka –1205	Dhaka	Phone: 8618985
22.	Mr. Md. Mukhlesuzzaman	Additional Director General (Planning)	Bangladesh Water Development Board WAPDA Building, Motijheel C.A., Dhaka-1000	Dhaka	Phone: 9550253, 9562293
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IWMI—A Future Harvest Center supported by the CGIAR

ISBN 92-9090-450-X