Part 1

Chapter I Introduction

1.1 Backdrop

A large majority of population in Asia-Pacific continues to face food insecurity, malnutrition, vulnerability, and injustice despite decades of efforts to alleviate these ills. Growing populations, increasing demand for food, scarcity and degradation of natural resources, and ensuing social unrest are causing concern among development planners. Of particular concern is limited access to and quality of land and water resources which militates against food security for the poor and perpetuates poverty.

International development assistance agencies and donors have recently reinvigorated their efforts to alleviate poverty in the developing countries. *A world free of poverty* has become the key foci of their development lending. The Millennium Development Goals (MDGs) have been internationally recognized as common set of objectives to be achieved by 2015. These include: G1- eradicate extreme poverty and hunger (halve those below $1 a day); G2 - achieve universal primary education for all; G3- Promote gender equality and empower women; G4 - reduce child mortality; G5- improve maternal health; G6- combat HIV/AIDS and malaria etc; G7 - ensure environmental sustainability; and G8 - develop a global partnership for development. Alleviation of extreme poverty, hunger and food insecurity, empowerment of the poor through improved access to resources, and environmental protection was also emphasized as important goals in Johannesburg Summit on Sustainable Development in August 2003. An interesting aspect of these problems is that most of them are directly or indirectly related to water in its both production as well as consumption uses.

In poverty reduction efforts, two issues remain central: (1) proper identification and targeting of the poor to enhance the effectiveness of anti-poverty initiatives and programs; and (2) identification of interventions/ investments that have the highest impact on poverty (i.e. pro-poor investments). Once the poor and the pro-poor interventions are rightly identified, part of the poverty problem may be solved. There has been significant debate in the past on the first issue, leading to developments in concepts of poverty. It is now widely recognized that poverty is multi-dimensional, extending from low levels of incomes and consumption to lack of education, and poor health, and includes social dimensions such as powerlessness, insecurity, vulnerability, isolation, social exclusion and gender disparities. Similarly, the concepts of livelihoods, basic capabilities and entitlements, and well-being have broadened the understanding of the poverty problem. In recent years, the perception of poverty has changed from static to a dynamic one. Two useful concepts of dynamic poverty are: Chronic or permanent poverty. The chronic poverty is caused by persistently low levels of income and, therefore remains the same over time, while transient poverty is caused by inter-temporal fluctuations in income and, therefore changes over time. Recent studies suggest that the two poverty types are not the same, and a significant component of existing poverty is only transitory. Further, the processes that cause these also differ. The implication is that

any efforts to quantify and alleviate poverty using estimate from single point in time would poorly define and target the poor: Static measurements of poverty may poorly estimate the poor by capturing those who fall into the poverty trap because of temporary misfortunes, or by skipping those who escape poverty due to temporary good-fortunes. Targetting errors or errors of inclusion and exclusion are well documented concerns in conventional poverty studies. Poverty alleviation policies, based on static poverty definitions can, therefore, lead to poor targeting and large leakages to the non-poor. Hence, for applied policy making and fine-tuning the targeting efforts, the concept of dynamic poverty has become popular among development planners. The construction of reliable dynamic poverty profiles, however, generally requires panel data sets that spans several seasons/ years. Not only such data are hard to come-by from the developing world, efforts to collect such information have only recently begun.

It is commonly accepted that irrigation infrastructure developments promote growth and help to improve the welfare of rural communities, and therefore has the potential to alleviate poverty. Further, irrigation infrastructure development, *inter alia*, in general helps small, and presumably poor farmers, to manage risk and reduce income variability caused by untimely and unevenly distributed rainfall. However, little is known about (a) the potential of irrigation infrastructure development and rehabilitation to alleviate dynamic poverty and (b) the enabling conditions under which such interventions are pro-poor. This study aims to fill this important gap in irrigation-poverty literature in terms of clarifying the linkages between irrigation infrastructure development and dynamic poverty.

IWMI has identified following basic premise to intensify dynamic poverty-irrigation discourse:

a. Irrigation can help reduce transient poverty by reducing sudden fluctuations in income. Opportunities offered by irrigation can enable poor farmers to mitigate or skirt the adversities associated with water scarcity, floods or drought, or personal shocks.

b. Past investments in the irrigation infrastructure have tended to be more growth/production rather than equity-oriented. This imbalance can be corrected by complimentary interventions in the mainstream programs and by reaching out to the poor through better analysis and quantification of opportunities and constraints.

c. All inclusive and poverty-focused interventions are needed to enable the poor to share equitably in the benefits of irrigation; special poverty-focus is needed in *all* interventions designed to mitigate the impacts of water scarcity and associated problems on the poor.

d. There is complimentary between irrigation infrastructure and other forms of infrastructure such as physical, human, social, and environmental. A mix of

irrigation and other infrastructure interventions would together achieve more than a single intervention alone.

1.2 Goal and Objectives

This study aims to evaluate the effectiveness of irrigation infrastructure development and rehabilitation as a policy instrument for dynamic poverty alleviation in developing countries. The objective of this study is to make an impact assessment of infrastructure development by using the concept of transient and chronic poverty, taking case studies of irrigation projects in Sri Lanka and Pakistan.

The study aims to fill a major gap in the literature on the role of irrigation in dynamic poverty reduction. This study formally investigates the dynamic poverty reduction effect of irrigation infrastructure development by integrating field observations, economic theory, and econometric analysis, and voices of the poor. In addition, this study also takes into account the impact of other infrastructure developments, such as credit use, access to medical facilities, availability of electricity, access to paved road and communication facilities etc. By using the quantitative and qualitative evaluation results, the study also derives policy implications for future infrastructure development.

Specific objectives of the study:

1. To assess the impacts of irrigation infrastructure development on poverty alleviation taking JBIC financed irrigation projects as case studies, using a multi-season panel data sets.

2. To develop and refine an analytical method to quantify the impact of irrigation infrastructure development on dynamic poverty alleviation.

3. To identify a set of performance indicators to measure the impact of irrigation infrastructure development on dynamic poverty alleviation, and to test their inter-temporal stability in contrasting environments.

4. To establish a panel database for impact assessment and to understand the dynamics of poverty in the selected study areas.

1.3 Scope and Coverage

The scope and coverage of the study includes the following:

1. Undertake assessments of impacts of irrigation infrastructure development on poverty taking selected JBIC funded projects – areas in districts Mandi Bahauddin and Gujrat in Pakistan (Upper Jehlum Canal Irrigation System).

2. Establish a detailed methodology including inputs, outputs, and data requirements for the study. Develop an analytical framework including indicators of poverty to analyze inter-temporal changes in income, consumption, and welfare.

3. Utilize sampling framework developed in Phase-I of the study for implementing second round of surveys, by incorporating lessons learnt in Phase-I . The framework is based on several criteria including access to irrigation water, cropping patterns and stage of development of irrigation infrastructure. Specific locations identified within the selected areas were where irrigation infrastructure is well established/developed/improved, partially developed/improved, unimproved and with no infrastructure.

4. Carryout household level surveys over the course of the agricultural year of a representative sample of 720 rural households in order to establish panel database.

5. Evaluate the impact of irrigation infrastructure on dynamic poverty reduction using "with and without" approach by comparing sample areas with improved, unimproved and with no infrastructure and without irrigation to construct the optimal mix of irrigation accessibility in each of the selected settings.

6. Compare the inter-temporal movements of income and consumption, e.g., variance and means, of household income and consumption in the surveyed areas. Through this quantitative evaluation, assess the impact of the irrigation infrastructure on dynamic poverty in selected locations, *ceteris peribus* (assuming that other conditions such as climate, soil, and access to the market is more or less similar across the selected areas and locations in order to control those external factors in the analysis).

7. Carry out econometric analysis of household level panel data to investigate the dynamic poverty reduction impacts of irrigation infrastructure development and rehabilitation. The empirical framework will be based on rigorous analysis of dynamic investment and consumption decisions of rural households.

In summary: Main activities during Phase-II include: (1) generate panel data base by undertaking household level surveys during the year (2001-02) to cover 'before', 'during', and 'after' situations both for the Rabi and Kharif seasons of the year, and (2) implement previously established protocol for irrigation-poverty impact evaluation and undertake econometric analyses of impacts of irrigation infrastructure on dynamics of incomes/expenditures and poverty.

1.4 Organization of the Report

This report is organized into three parts consisting of 12 chapters. Part 1 (chapters 1, 2, and 3) provides background material for the study. Chapter 2 provides a brief review of literature on the impact of irrigation infrastructure development on poverty. Chapter 3 gives an overview of key developments and poverty trends in Pakistan Part 2 (chapters 4, 5 and 6) provides details on study methodology. Overall study design, approach and sampling framework are discussed in chapter 4, while details on household level survey

instrument, administration and data collection procedures in chapter 5. Chapter 6 elaborates on approach and analytical framework of the study. Part 3 (chapters 7, 8, 9, 10, 11, and 12) reports results of the study. Profile of sample households covering asset base and livelihood patterns is given in chapter 7, followed by economics of crop production in chapter 8, and dynamics of household incomes and expenditures in chapter 9, whereas, chapter 10 provides detailed estimates of chronic and transient poverty. Econometric analysis of income-consumption seasonality and quantitative estimates of impact of infrastructure development on poverty are provided in chapter 11. Last chapter provides summary of study findings, conclusions and policy implications. Other information, including detailed descriptive statistics, graphs and supplementary tables are given in the appendices of the report.

Chapter II Role of Irrigation Infrastructure Development on Poverty Alleviation: Review of Recent Research

This chapter presents common perceptions, beliefs, and empirical evidence on the role of irrigation infrastructure interventions in alleviating poverty, food insecurity, and vulnerability. In so doing, we synthesize the impacts of irrigation infrastructure on poverty reducing intermediate variables and direct poverty outcomes from empirical studies using (a) with and without (b) before and after (c) more or less scenarios, and (d) those analyzing interactions between irrigation and other forms of rural infrastructure interventions to glean on-ground anti-poverty impacts of such interventions. Our synthesis shows that irrigation interventions, *inter alia*, improve agricultural productivity, rural employments, household income/consumption, and reduce vulnerability to risk, and therefore empower rural poor by integrating them into land, labor, capital, and information markets. Anecdotal evidence on infrastructure-related negative externalities also exits, which points to the need for complimentary interventions.

Historically, irrigation, and other rural infrastructure interventions have been operated in the public domain with the belief that not only such interventions benefit rural communities, and help fight hunger and poverty therefore, they also self-select the poor, because these projects tend to be targeted to the rural areas, where majority of the rural poor live. While arguable it is, there is no denying to the fact that globally most of the poor are concentrated in rural areas and depend heavily on agriculture and related activities for their livelihoods support, therefore, rural infrastructure development in general, and irrigation in particular, should help increase returns from agriculture, and thereby combat rural poverty. Nevertheless, empirical evidence of direct and on-ground anti-poverty impacts of irrigation is at best nascent.

It also bears pointing that conventional impact assessments have focused on *ex ante* and *ex post* evaluations of project outcomes based on a set of financial and monetary indicators, and have therefore not been able to take into account the welfare and distributional outcomes of these interventions. The modern orthodoxy, however, leans to the view that the success of a project should not be determined solely on economic and financial efficiency grounds rather ethics and sustainability demands that these analyses should take account of the winners and loser of the game, as humans in general and poor in particular are the sole intended beneficiary of these projects. This orthodoxy has, therefore, witnessed an integration of poverty/welfare analysis into impact assessments. Proponents also argue that static poverty estimates using with without or before after frameworks disguise inter- and intra-seasonal/year effects of infrastructure interventions on poverty, therefore, foci of irrigation impact assessments should be the realized reductions in overall, chronic, and transient poverty, and for various categories of the poor, the latter being defined by the relative position of the poor to the setting-specific and international poverty lines. Unfortunately, such like impact assessments are few and attempts have begun only recently.

How can irrigation infrastructure development and rehabilitation alleviate dynamic poverty? The argument goes like this: better infrastructure such as irrigation dams, canals, and water courses, piped water supplies, storage godowns, roads, railways, seaports, piers, schools, health clinics, electricity, telephone, and internet are the forms of economic instruments, whether operated in public or private domain, that could increase the rates of return to human, physical and capital endowments and new investments. These could also affect growth rates in employment opportunities, including the ability to export skilled labor and earn remittances and smooth consumption with attendant effects on chronic and transitory poverty. Infrastructure development increases the mobility of goods, services, employment, and information and reduces poverty therefore. The case of irrigation infrastructure is a special one as irrigation plays a disproportionately powerful role in agricultural production and adoption of modern production technology hinges on irrigation water. Irrigation investments can directly increase agricultural output and incomes by shifting the production frontier up, and yield indirect benefits through economy-wide multiplier impacts, although incidence of these benefits may differ for various socio-economic groups, depending on their entitlements, and endowments of physical and human capital and access to credit and information markets. Irrigation nevertheless enables small and poor farmers in shifting from production of self-consumption to market-oriented production; accumulate wealth by earning a higher implicit wage rate for their surplus family labor; garner opportunities by participating in local labor and goods markets -the transition to the market economy places poor at a level playing field with the others (presumably non-poor), and also enables poor to participate effectively into non-farm labor markets and earn higher non-farm incomes. These mechanisms may result in higher permanent incomes, and therefore, help to reduce chronic poverty. In addition, by increasing the viability and profitability of investments, irrigation infrastructure can facilitate the emergence and growth of financial institutions that increase poor's access to production and consumption credit and reduce the opportunity cost of borrowing. Better credit facilities enable consumption smoothing and may also increase willingness of the farmers to venture into high-risk high-profit enterprises with attendant effects on income diversification and chronic poverty reduction. In brief, rural infrastructure interventions, including irrigation, help promote productivity and trigger economic growth and provide livelihood opportunities for the rural poor.

Studies on irrigation-poverty nexus fall into three categories, namely macro or economy-wide studies, meso or village/irrigation scheme level studies, and micro or household level studies. A number of macro level studies have established that rural infrastructure investments, including irrigation, helps to promote growth, enhance technological change, green revolution technology, for example, and benefits poor though economy-wide multiplier effects. Lipton and Ravallion (1995) argue that raising the productivity of the poor requires a sustained investment in infrastructure development, particularly rural infrastructure, which raises agricultural production and thus permanent incomes of the poor, which reduces chronic poverty in the long-run. Jimenez (1995) demonstrated that improvement to irrigation, paved roads, or an increase in the density of regional roads, had a direct impact on poverty reduction by generating an increase in agricultural productivity, the highest impact coming from irrigation

development. Studies by Fan and others (2000) analyze the linkages between government spending, growth and poverty in rural India, using state level data from 1970 to 1993. The results of the study show that government spending on productivity enhancing investments, such as irrigation, research and development in agriculture, rural infrastructure (including roads and electricity), and rural development and welfare programs which target the rural poor directly have all contributed to reductions in rural poverty. Most of these investments have also contributed to growth in agricultural productivity, but their impacts on poverty and productivity show large variations. For example, expenditure on roads has the largest impact on both poverty reduction and productivity growth. On the other hand, expenditure on health reduced rural poverty significantly, but had little impact on productivity. Government spending on agricultural research and extension has had the largest impact on agricultural productivity growth, and it has also led to large benefits for the rural poor. Additional investments in irrigation had the third largest impact on growth in agricultural productivity, but a smaller impact on rural poverty. These studies, however, acknowledge that irrigation development have played a large role in productivity growth in India (Fan, Hazell and Haque, 2000; Fan, Hazell, 2000; Fan, Hazell, and Throat, 2000). Taking the case of public irrigation investments in China, Fan, Zhang and Zhang (2002) provide further support to the aforesaid finding that infrastructure investments enhance agricultural productivity and promote growth, although the size of these impacts differs for various regions of China.

A more robust account of the growth promoting impacts of rural infrastructure interventions and irrigation comes from Mundlak, Larson and Butzer (2002). They analyzed the effect of infrastructure variables, inputs, and price incentives on agricultural growth in Indonesia (1971-98), the Philippines (1961-98) and Thailand (1971-95). The infrastructure variables together accounted for a large proportion of total factor productivity growth in all three countries, which should have negative effect on poverty. Further, the second generation or multiplier effects should generate higher employments and incomes for poor and non-poor. This study show that irrigated land contributed between 10-16 percent of output growth. The irrigated land has an elasticity of 0.46 in Indonesia (very high). The contribution of rainfed land is substantial in the Philippines and Thailand in the first period of analysis, but less important in the second period. The marginal productivity of irrigated land increased slightly in Thailand but less so in the Philippines. And, the marginal productivity of irrigated land rose drastically in Indonesia (due to scarcity of irrigated and resource shifting). The marginal productivity of irrigated land adjusted for labor is 1.6 labor years for Thailand and the Philippines and 4.9 for Indonesia. However, the marginal productivity of irrigated land is higher than rainfed land for all three countries, and so is its contribution to total factor productivity and growth rates. Scholars, however, argue that alleviation of rural poverty is not progressing well because modern agricultural technologies are labor savings, wage rates are intentionally kept low, and labor income is low. Therefore, the welfare of landless is not improving. On the other hand, land owners are able to work more days on their farms and earn a higher implicit wage rate, which in turn increases returns to their physical and human capital endowments. Therefore, the alleviation of rural poverty, in authors view, depends largely on the creation of non-farm employment opportunities in these countries.

Taking the case of India and by combining data from 24 household sample surveys spanning 35 years (1958-94) with other sources, Datt and Ravallion (1998), however, show that higher farm productivity brought both absolute and relative gains to poor rural households. A large share of the gains was via wages and prices. Higher real wages and higher farm yields reduced absolute poverty, and with about the same elasticity. Scholars find that poor gained in absolute terms from lower relative prices of food, and benefits to the poor were not confined to those near the poverty line, but reached deeper.

Among the meso level studies, there is a strand of donor evaluations that have assessed the impacts of On Farm Water Management Project (OFWM) in Pakistan- an irrigation system rehabilitation initiative lead by international donors, including JBIC, focusing on lining of watercourses and tertiary level management transfer to the farmers. These studies include World Bank (1996a), World Bank (1996b), World Bank (1997), World Bank (1999), and those covering OFWM projects currently underway in Pakistan including World Bank (1999)-Balochistan province, World Bank (2001)-North Western Province, World Bank (2001)-Punjab, World Bank (2002)-Sindh province, and World Bank (2002)-Azad Jamu and Kashmir community infrastructure and services project, and JBIC (2002). A common theme emerging from all these studies is that OFWM has delivered considerable gains to the user communities in terms of area cropped and yields, farm incomes, employment creation, improvements in living conditions, and farmer training. These studies have, however, hinted that in order to realize better on-farm water management, water user associations should consider pursuing other activities such as joint input supply, marketing and obtaining access to credit and training services.

Apart from these donor evaluations, several other studies have evaluated the impact of watercourse lining program implemented under the OFWM project in Pakistan. These include Renfro et al. (1983); WAPDA (1984); Sarwar et al. (1985); and Saleem, Amin and Ul-Haq (1993); and other related paper as compiled by Inayatullah (1994) in proceedings of a conference held in Islamabad on " An Assessment of the on-Farm WaterManagement Program". In all these studies, emphasis has been on evaluation of conveyance efficiency and agricultural productivity through 'before and after' or 'with or without' comparisons. The key impact indicators used included conveyance efficacy, cropping patterns, cropping intensity, productivity of major crops and gross value of production/farm income. The study by Saleem, Amin and Ul-Haq (1993), compared improved watercourses with un-improved watercourses. The key findings of the study included: (a) land use (cropping) intensity is 2 percent (4 percent) higher on improved watercourses compared to that on un-improved watercourses, (b) there were no significant difference in labor use per cultivated acre and per cropped acre on improved and un-improved watercourses, (c) the delivery efficiency is estimated at 68 percent and 61 percent on improved and un-improved watercourses respectively (an increase of 7 percent with improvement in watercourses, therefore), (d) average yields of wheat, cotton, rice, sugarcane and maize on improved watercourses improved by 11.2 percent, 7.4 percent, 16.8 percent, 31.8 percent, 23.1 percent and 18.9 percent respectively, (e) the average net farm income per cultivated acre is Rs. 2162 on improved watercourse and Rs.

1700 on un-improved watercourses, and (f) overall annual manual labor saved for irrigation is 29.2 person days i.e. 45 percent reduction after watercourse improvement. None of the above studies evaluated the impact of watercourse improvements on poverty alleviation, however. The conference in Islamabad concluded that it is difficult to determine the impact of on-farm water management program on poverty alleviation from the information presented and that more research is needed to answer poverty related questions.

A recent review of over 120 topical, peer reviewed, published empirical studies on irrigation-poverty nexus concludes that cropping intensity, land productivity, labor employment, household incomes are all higher in the irrigated than rainfed settings. Further, incidence of poverty is lower in settings with irrigation infrastructure than in the rainfed areas (Hussain and Hanjra, 2003). The quantitative evidence presented in this review, and reviews by other scholars (for example, Kishore, 2002; Lipton et al. 2002; Silliman and Lenton, 1985; and DFID, 2001) lead us to conclude that irrigation infrastructure interventions help to alleviate rural poverty, and enhance livelihood strategies of the rural communities. We acknowledge that there are certain conditions or enabling environments under which anti-poverty impacts of irrigation infrastructure interventions are stronger and more pro-poor, and these impacts could be even negative if those conditions are missing, as our discussion below shows.

There is little argument to the fact that irrigation infrastructure developments are strong pro-poor intervention strategies as they (a) improve poor's access to irrigation (b) enable poor to manage income and employment risk associated with water shortages and (c) empower poor by improving their decision making and by integrating them into domestic, and regional goods, labor, and information markets. And, there is little surprise to the fact that despite massive investments in irrigation infrastructure developments, poverty and affluence continue to co-exist in irrigated agriculture, and this is particularly true about South Asian countries including Pakistan. This raises an important policy question; Why irrigation has not been able to eradicate poverty in old established irrigation systems like those of Indo-Gangetic? This observation often plays in the hands of the critics who are enticed to jump to the conclusion that benefits of irrigation investments have often been cornered by the rich, and the hardcore of the chronic poor has proved too resistible for the irrigation trickle down to affect poverty. While true it might be, the fact is that firstly, there are complementarities between physical capital, and its forms, and human capital, and then both the quantity and quality of physical infrastructure and human endowments matters for poverty alleviation, and thirdly land, labor, and credit market failures interact often to disadvantage the poor such that poverty in irrigated agriculture persists. And lastly, it is important to distinguish between poverty types: a major part of remaining poverty may be only transitory which arises due to temporary income fluctuations, and majority of the households in irrigated systems may not be not long term or chronic poor.

The case of complementarities among various forms of human capital is well known: there are strong linkages between; education, human productivity, wages and earnings, and take-up rates of new technologies; and between health, nutrition, fertility, life expectancy, and mortality. The thesis is that nutrition and health interact with schooling to generate better education and employment outcomes (Strauss and Thomas, 1995).

Past allocations and investment priorities are important too. Using state level time series data for the period 1957-91, for India, Datt and Ravallion (1998) demonstrate that how states with higher initial investments in physical and human infrastructure have performed better in promoting growth and alleviating poverty than poorly endowed states. Scholars note that differences in trend rates of poverty reduction (measured as squared poverty gap) are attributed to differing growth rates of yield per acre, an indicator for technological progress in agriculture, and differing initial conditions. Starting endowments of physical infrastructure and human capital appear to have played a major role in explaining the inter temporal trends in poverty: higher initial irrigation intensity, higher initial literacy, and lower initial infant mortality rates all contributed to higher long term rates of poverty reduction in rural India. For example, states with lower irrigation rates such as Maharashtra achieved lower reduction in poverty than states with high irrigation rates such as Punjab and Haryana. Evidently, the differences in poverty outcomes are due to differences in initial stock of physical and human capital resources, or past spending priorities, rather than inequitable growth and distributional outcomes. Authors find 'no sign' of trade offs between growth and pro-poor distribution outcomes. However, they note that rural poor are adversely affected in the short run by inflation and fluctuations in crop yields, and therefore general policy environment and macroeconomic framework matters. In another study Binswanger et al. (1993) show that there are complementarities among investment decisions of government, financial institutions, and farmers and these in turn affect growth rates and aggregate agricultural output. Investments in canal irrigation, primary education, rural electrification and commercial banks have all contributed to increased crop output over the 1971-81 decade in India. This study helps us to move further on the learning curve by showing that agricultural output, and therefore income level, is determined by a complex interactive process where the agents (state-private sector institutions-farmers) respond to the same set of incentives; while farmers respond to infrastructure investments, the governments in turn allocate infrastructure investments in accordance with the agro-climatic potential of the districts (but not in accordance with the equity outcomes), and banks locate their branches where agro-climatic conditions and infrastructure are favorable for their operations. Then there is the question of strong complementarities between public and private investments in irrigation infrastructure and agriculture sector which do have strong equity implications for the poor.

The complementarities between public and private investments stand out prominently. Looney (1994) evaluates the causality between Indus Basin infrastructure investments and agricultural growth in Pakistan and contends that investments in rural public works program, and particularly private investments are warranted to help enhance returns to the Indus Basin investments.

The strong complementarities between returns to irrigation and household education, particularly adult primary education, have been uncovered by van de Walle (2000) in case of rural Vietnam. The study hints at pro-poor character of irrigation investments, given the right level of education and economic environment. It shows that increased investments in adult education would generate gains accruing primarily to the poor and would have a strong equalizing effect on returns to irrigation investments, that is, returns to irrigation would be higher for the poor than non-poor, given the right level of adult education. Therefore, properly targeted adult education program in Vietnam would have a 'substantial equalizing effect' through its impact on returns to irrigation investments. Conversely, in the presence of inequalities in educational endowments, returns to irrigation for the poor are likely to remain lower: knowledge-poor will remain income-poor.

Both the quantity and the quality of physical infrastructure and human endowments and entitlements matters simultaneously for poverty reduction. Canning (1999) emphasizes this distinction by presenting measures of both quantity and quality in his database of world infrastructure stocks for 152 countries. The database contains six measures of quantity: kilometers of road, paved road, and railway line, and number of telephone main lines and electricity generating capacity. Measures of infrastructure quality are the percentage of roads in poor conditions, percentage of local telephone calls unsuccessful, percentage availability of diesel locomotives (environmental quality variable), and percentage of electricity lost from the distribution system. Normally, these quantity and quality distinctions are lacking in the analyses, and therefore people continue to act in information vacuum. Canning's regression results for infrastructure stocks show 'a stable long run relationship' between infrastructure and economic growth worldwide. This finding implies that development of physical infrastructure will raise permanent incomes, in the long run, and therefore make large reductions in chronic poverty globally.

Canning's analyses however point that wide disparities exist in the distribution and access to infrastructure among rich, middle income, and poor countries. Based on World Bank's Living Standards Measurement Study surveys from fifteen countries, including Pakistan, Komives et al. (2001) strengthen this observation further. They explore the relationship between access to infrastructure and income level of households. Study reports the extent to which poor households do not have access to electricity, in-house water taps, sewer connections, and private telephones. The study shows that as monthly household incomes increase from US$ 100 to US$ 250 [notice this lower (upper) bound is about 1.2 (2.9) times the poverty line used in our study], coverage rates of all these infrastructure rises but at different rates. With exceptions, the findings confirm that very poor rarely have these infrastructure facilities, and where communities are connected, many poor decide to connect too. The study negates self-exclusion but hints that infrastructure gaps exist for poor households. For example, in Pakistan although very few households obtained water from rivers or streams directly, most lacked in-house water taps, and about 2.4 percent reported using private vendors as their primary source of drinking water.

At micro level, quantity and quality distinctions are even more important for effective targeting. Form an irrigation-poverty standpoint, quantity refers to say, household size, farm size, size of irrigable land, etc. and quality refers to household age composition, type of farmland, tenure status, number of missed irrigation turns, incidence of soil salinity, land quality etc. Micro details matter for effective targeting: even it is more important to know who the poors are, where they live, what they do, why they are poor, how they perceive poverty, and how they react to chronic poverty situations?

The case of inequity in land distribution is well known. Often poor are located in marginal environments with poor quality land that may lack access to any kind of managed irrigation system (such as canal works or pumps, that prevents flooding and drought). Where land entitlements are lacking, land tenures are insecure, working environments are instable, resource quality is marginal, and vulnerability to climatic risks is high, credit constrains are common, realized benefits to poor from pro-poor expansion of new irrigation infrastructure as well as by the rehabilitation of the long term non- or ill-functioning irrigation networks will fall short of potential benefits.

In essence, in assessing the impacts of irrigation investments, one need to acknowledge strong complementarities that exist between irrigation and other physical infrastructure and human capital, the quantity and quality aspects of infrastructure stocks, the nature of market perfections, and more importantly to distinguish what proportion of poverty is chronic or and what fraction is transient transitory only. The foregoing arguments lead us to believe that the benefits of irrigation investments to the poor will continue to be discounted, and existing inequality would continue to be compounded and long term pro-poor growth compromised unless complementary and targeted investments in both physical and human capital infrastructure are affected forthwith.

Chapter III Poverty Trends in Pakistan: An Overview

This chapter presents an overview of inter-temporal and geographic poverty trends in Pakistan, and summarizes key institutional responses to poverty. Further, the determinants of poverty are analyzed with a view to understand effective interventions and targeting mechanisms. In particular, an attempt is made to contribute to the understanding as to how the rural infrastructure development programs in general, and irrigation infrastructure development and rehabilitation programs, in particular, can be geared for direct poverty alleviation, given the resource, technological, and socio-cultural constraints faced by the rural poor in Pakistan. The key a thesis of this chapter is that poverty in Pakistan seems be to rising, and the impacts of government level institutional responses to poverty remains to be seen.

3.1 Poverty in Pakistan

Pakistan has a population of 141.5 millions in 2001, which had grown at the rate of 2.5 percent per annum during 1990-2001. The population density is 183 persons per square kilometer. With a gross national income of only 59.6 billion dollars and large population size, per capita gross national income works out to be around US$ 420 during 2001. Gross domestic production per capita registered a growth rate of 0.9 percent during 2000-1. Among other measures of human welfare, it has a life expectancy of 63 years, under five child mortality rate of 11, and adult literacy rate of 57 percent only. Estimates show that during 1996, 31 percent of population was below $1 a day poverty line, and 85 percent of the population was below $2 a day poverty line. Incidence of poverty is higher in rural than in urban areas. Further, the income inequality among the poor and non-poor is very high. The Gin index during 1996-97 is 31.2; the lowest 10 percent of population get only 4.1 percent of income/consumption, while their rich counterparts pocket a hefty 27.6 percent (World Bank, 2003).

A number of studies have attempted to estimate poverty in Pakistan. Some of these studies include Naseem (1973, 1979), Mujahid (1978), Kruik and Leeuwen (1985), Malik (1988), Ahmad and Ludlow (1989), Ercelawn (1990), Malik (1991 and 1994), Gazdar *et al.* (1994), Anwar (1996 and1998), Amjad and Kemal (1997), Jafri (1999), Arif (2000), and FBS (2001). As these studies use different methods and poverty lines, and use different sets of survey data, their poverty trends and conclusions differ.

Table 3.1 gives official estimates of temporal trends in poverty situation in Pakistan. It is clear that there was considerable decline in poverty during 1980s, followed by a somewhat rising trend in early 1990s and worsening situation in late 1990s. Further, overtime rural poverty has been higher than urban poverty but that does not mean that poverty in Pakistan is purely a rural phenomenon or rural areas have been withholding progress in poverty alleviation. Rather, agricultural growth in rural areas have delivered considerable gains to both rural and urban poverty alleviation. During the period from 1985-1999, the correlation between agricultural growth and poverty head count is negative; and the coefficient of correlation is estimated to be -0.32. During 1986-87 agriculture sector grew by 3.25 percent, consequently the incidence of poverty came

down to 17.3 percent in 1987-88,. But all was not well down the road. Poor harvests of 1992-93 resulted in negative agricultural growth of 5.3 percent, and thus registering a higher poverty incidence in 1993-94, particularly in rural areas. Similarly, severe drought and water shortages in 1997-98 affected agricultural productivity thereby increasing rural poverty to 31.95 percent (Government of Pakistan, 2002). The relationship between availability of water supplies and its impact on national economy and incidence of poverty is self evident.

Table 3.1: Poverty Head Count (%) in Pakistan, 1963-64 to 1998-99

Year	Total	Rural	Urban
1963-64	40.24	38.94	44.53
1966-67	44.50	45.62	40.96
1969-70	46.53	49.11	38.76
1979	30.68	32.51	25.94
1984-85	24.57	25.87	21.17
1987-88	17.32	18.32	14.99
1990-91	22.11	23.59	18.64
1992-93	22.20	23.91	17.71
1993-94	25.00	29.72	13.58
1996-97	21.80	25.98	12.44
1998-99	28.20	31.95	19.13

Source: Government of Pakistan (2002), "*Economic Survey, 2001-2002*". Finance Division, Islamabad, Pakistan. http://www.finance.gov.pk

In order to get a complete picture of poverty at households level, it is important to look at all three indices of poverty, namely, head count index, poverty gap index, and squared poverty index (**Table 3.2**). According to the World Bank estimates presented below, the national poverty head-count index in 1998-99 is estimated to be 32.6 percent. This is both higher than official estimates above, and in sharp contrast to the previous decade, when poverty is found to have declined considerably, particularly between 1984-85 and 1987-88. Analysis for the intervening years of the 1990s – between 1990-91 and 1998-99 – show a high year-to-year fluctuations in poverty rates; an overall headcount rate of 29 percent is reported for 1993-94. The poverty gap and the severity of poverty also exhibit similar patterns. While the estimates indicate some reduction in poverty between 1990-91 and 1993-94, by approximately 5 percentage points, followed by an upward spike of 4 percentage points to 1998-99. These movements should be qualified by some concerns about the comparability of the surveys used, and they diverge slightly from estimates reported by Government of Pakistan above.

Table 3.2: Incidence, Depth, and Severity of Poverty in Pakistan

		1984-85	1987-88	1990-91	1993-94	1998-99
Incidence of Poverty	Urban	38.2	30.7	28.0	17.2	24.2
	Rural	49.3	40.2	36.9	33.4	35.9
	Overall	46.0	37.4	34.0	28.6	32.6
Depth of Poverty	Urban	9.2	6.1	5.7	3.0	5.0
	Rural	11.9	8.3	7.8	6.4	7.9
	Overall	11.1	7.7	7.1	5.4	7.0
Severity of Poverty	Urban	3.10	1.8	1.7	0.78	1.51
	Rural	4.10	2.5	2.4	1.87	2.51
	Overall	3.8	2.3	2.2	1.55	2.2

Source:World Bank (2002), "Pakistan Poverty Assessment-Poverty in Pakistan: Vulnerabilities, Social Gaps, and Rural Dynamics". Assessed October, 2002, http:/www.worldbank.org.pk

There is considerable variation in poverty across regions and provinces in Pakistan (**Table 3.3**). Province-wise breakdown of poverty reveals that poverty is lowest in southern Sindh province and highest in the northern North West Frontier Province (NWFP). Further, Punjab is poorer than Sindh, and Balochistan has the lowest poverty rate. The later is due mainly to lower population density in Balochistan, although it has one of the driest and water scarce and fragile environment, which shows that climatic vulnerability, is keeping both the population and poverty at bay. Again, poverty patterns in Punjab and Sindh over the years is more or less in keeping with that of the country as a whole.

Table 3.3: Incidence of Poverty by Province in Pakistan During the 1990s

	Urban			**Rural**			**Overall**		
	90-91	**93-94**	**98-99**	**90-91**	**93-94**	**98-99**	**90-91**	**93-94**	**98-99**
Punjab	29.4	18.4	26.5	38.5	31.9	34.7	35.9	28.2	32.4
Sindh	24.1	13.9	19.0	30.8	31.5	37.1	27.6	23.4	29.2
NWFP	37.0	26.5	31.2	40.6	39.8	46.5	40.0	37.9	44.3
Balochistan	26.7	16.5	28.4	20.9	37.5	24.0	22.0	35.2	24.6
National	**28.0**	**17.2**	**14.5**	**36.9**	**33.4**	**35.9**	**34.0**	**28.6**	**32.6**

Source:World Bank (2002), "Pakistan Poverty Assessment-Poverty in Pakistan: Vulnerabilities, Social Gaps, and Rural Dynamics". Accessed October, 2002, http:/www.worldbank.org.pk

Note: National figures may not be additive, because figures for some other administrative regions (e.g., northern areas, FATA, and Azad J& K) are not shown here.

However, empirical studies indicate that in rural Pakistan, the probability of entering poverty increased over the course of years, while the probability of escaping fluctuated (**Table 3.4**). Altogether, the ratio of entry to exit probabilities increased, leading to an increase in the poverty headcount, which reflects that vulnerability of rural households has been increasing.

Table 3.4: Poverty Entry and Exit Probabilities, Rural Pakistan, 1986-91

From year to year	Probability of **entering** poverty for **non-poor** households (%)	Probability of **escaping** poverty for **poor** households (%)
1986-87 to 1987-88	15	51
1987-88 to 1988-89	17	43
1988-89 to 1989-90	20	51
1989-90 to 1990-91	20	46
Over entire period 1986-87 to 1991-91	24	49

Source: McCulloch and Baulch (1999).

Recent estimates from the Asian Development Bank (2002) indicate that more than 12 million people were added to the poor in Pakistan between 1993 and 1999. The rising poverty was the result of poor governance and slow economic growth, ADB argues. Further, the analysis of poverty by socio-economic groups reveals following stylized facts about poverty situation in Pakistan:

- Poverty increases with household size
- Incidence of poverty among female-headed households is higher than male-headed households;
- Household head with no formal education have highest poverty rate
- Households with their head working in unskilled agriculture and other unskilled occupations are the poorest, and
- The incidence of poverty for those households with head engaged in agriculture is lower than those engaged in all other occupations except professional, management, and clerical positions (Government of Pakistan, 2002).

As about two-thirds of the poor reside in rural areas and their poverty is deeper and more sever than urban poor, a poverty reduction strategy in Pakistan must focus on the rural economy and help to address its specific problems. A central facet of rural poverty in Pakistan is low agricultural productivity. There is a strong link between agricultural productivity, agricultural growth and rural poverty. The growth in rural areas reduces both rural and urban poverty, while urban growth would reduce mostly urban poverty. However, agricultural productivity, and in particular water productivity, is very low in an absolute sense in Pakistan, and offers considerable scope for improvement. Other major constraints to agricultural productivity are limited access to land, irrigation water, fertilizer, and land and water resource degradation.

Distribution of land resources is highly skewed in Pakistan, with Gini coefficient as high as 0.769 (Adams, Jr., 1995), as compared to other regional countries (**Table 3.5**) . Further, land is distributed far more unevenly than income in Pakistan (recall income Gini is 0.312). According to the Agricultural census 1990, there are 5.1 million farms in the country and 93 percent of these are small farms (up to 10 hectares), accounting for 60 percent of total cultivated area. Large farms are only 7 percent of the total farms but account for 40 percent of the cultivated area (Government of Pakistan, 2002).

Table 3.5: Overview of Land Inequality in Some Asian Settings

Author(s) and year	Country and setting	Land inequality Gini coefficient	
		Irrigated	Rainfed
Hussain *et al.* (2003)	Udawalawe area in **Sri Lanka**	0.34	0.25
Ut et al. (2000)	Villages in **Vietnam**	0.55	0.44
Garcia *et al.* (2000)	Villages in **Myanmar**	0.68	0.63
Adams, Jr. (1995)	Country sample, rural **Pakistan**	0.77	
McCulloch and Baulch (2000)	Country sample, rural **Pakistan**	0.78	
Hossain *et al.* (2000)	Rural **Bangladesh** (country sample)	0.69	

Inequitable land ownership has a substantial negative impact on productivity, and also has indirect effects on natural resource base and the environment. For example, inequality in land distribution cuts against smooth working of land-lease markets, promotes friction among owners and tenants, withholds investments in irrigation technologies and on-farm infrastructure, and encourages unsustainable use of irrigation water and production practices, and impedes technological change, all contributing to an increase in poverty through negative impact on productivity. Malik (1996) investigated the reasons of rural poverty in Pakistan and found that the contribution to total poverty by landless households is 65.8 percent. He notes that the intensity and contribution to total poverty declined with the increase in the size of land holdings. A more serious aspects of land inequality is land degradation. As most farms tend to be small and tenant cultivated, due to lack of land title and tenure insecurity, available medium-term and long-term measures to combat land degradation are rarely undertaken, resulting in loss of cultivated area, low yields, and income, and consequent vulnerability for the community as a whole. Similarly, corruption in Pakistan's public canal irrigation system is widely viewed as a constraint on agricultural productivity. Further, corruption does not only involve economically and politically powerless farmers, it also concerns the lower social segments of the society in Pakistan (Rinaudo, 2002).

3.2: Key Responses to Poverty

The Government of Pakistan has been attempting to improve the conditions of the poor in the country through various welfare programs. These programs include Khushaal Pakistan Program, Food Support Program, Zakat Rehabilitation Grant, and Micro-credit program. Another major program is the Social Action Program with four target areas – elementary education, basic healthcare, family planning, and rural water supply and sanitation. Recently, government has reinvigorated its efforts to provide irrigation facilities to marginal areas, not yet served by the canal network. Priority areas in water resources development over the next decade include: (a) raising of Mangla dam,

construction of Mirani dam, Gomal zam dam, Thal canal and other small and medium reservoirs; and (b) efficient use of stored water through construction of new irrigation schemes like Rainee/Thar canals, Kachi canal, greater Thal canal, and modernization of barrages in Punjab. According to the estimates in government's 10 year perspective plan (2001-2011), these developments would augment irrigation water by 6 million acre feet by 2011. These initiatives are expected to contribute to at least partially addressing the problem of growing water scarcity in the country. Further, it is our synthesis that infrastructure development and other anti-poverty strategies in rural Pakistan should focus on:

1. Increasing agricultural production through pro-poor management of irrigation and land resources.
2. Generating land-based employment and income opportunities for the poor.
3. Generating non-land based livelihood opportunities for the poor and landless through small-business and non-farm enterprise development and skill improvement and vocational training.

Improvements in access to water resources, coupled with improved access to other production inputs, particularly production credit, newer seed varieties and fertilizer, specifically for the smallholders and those located at far reaches and tail-ends of canal commands, and strengthening and expanding the coverage of irrigation infrastructure to areas not yet served by the public canal system, would provide a *platform* to achieve 1 and 2 above.