Irrigation and Poverty in Pakistan: A Review of Policy Issues and Options

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Introduction

It is gospel truth that no life, human or otherwise, is possible without water. It is because of scarcity of water that the world's major deserts with inadequate rainfall have little or no vegetation. The annual precipitation in major areas of Pakistan does not exceed 10 inches and is heavily concentrated in the monsoonal months of July–August (Pakistan 2000). Thus the possibility of any crop production would critically depend on the availability of irrigation water, which can truly be regarded as the lifeblood of Pakistan's agriculture. Realizing the significance of irrigation water, Pakistan has built a huge irrigation system comprising 3 earth-fill dams for storage of water, 19 barrages, 12 link canals, 43 irrigation canals extending over a length of 58,500 km and nearly 100,000 watercourses with a total length of 1,621,000 km (Gill 1996). In addition, more than 530,000 tube wells are also currently pumping underground water for irrigation. In spite of all this, the available water supplies fall much short of Pakistan's crop-water requirements. According to the required delta of water only about 75 percent is available from various sources of irrigation and the situation is likely to worsen by 2010 when Pakistan will be able to meet only 55 percent of its requirements (WAPDA 1997). This state of affairs has tended to constrain Pakistan in terms of scarcity of water, inability to expand the irrigation frontier, low agricultural production and high unemployment rates and endemic rural poverty. If allowed to persist indefinitely, Pakistan will soon be caught up in a helpless economic crisis.

To overcome these problems, Pakistan must resort to either increase the available supply of irrigation water or raise its use efficiency. While there is large scope for the latter, little can be accomplished through the former option. This is because sustainable use of water is governed by the fact that withdrawal of water from reservoirs, barrages or other sources cannot increase faster than it is replenished through the natural hydrological cycle (Bhatti et. al 1997).

In light of these constraints, it is the purpose of this paper to highlight the salient features of Pakistan's irrigation system with special emphasis on a) history of irrigation water development and current status of irrigated agriculture, b) evolution of different irrigation policies along with their implications for the poor, and c) macro-economic policies and their impact on poverty. Given this outline, we proceed to exhaust its subcomponents in detail.

History of Irrigation and Current Status of Irrigated Agriculture

The history of Pakistan's irrigation system spans over many centuries. The use of floodwater for crop production involves the entire history of the human race. Archaeological remains testify to the great antiquity of controlled irrigation by wells as far back as the Indus civilization. Tanks and inundation canals were important sources of irrigation during the ninth and tenth centuries (Habib 1963). While wells, tanks and uncontrolled flow canals were increasingly used during the entire Mughal period, the Persian wheel became another novelty of the period (ibid.). However, with the decline of the Mughal Empire, most of these canals closed down due to silting and poor maintenance.

Development of Surface Irrigation

Although inundation canals continued to flourish, a new era of irrigation development began under the British rule with the construction of the Bari Doab canal (now in India) as the first canal having permanent masonry head-works. This was followed by the construction of a number of weir-controlled canals in the Punjab and the North-West Frontier Province (NWFP). These included the Sidhnai canal, the Lower Chenab canal, the Lower Jhelum canal in the Punjab and Kabul and Swat canals in NWFP.

The program of irrigation development was sharply expanded beginning with the twentieth century. The major canals built in the Punjab included triple canals, Sutlej Valley canals, Thal canal, Taunsa barrage and a number of link canals. The triple canals involved the construction of the upper Jhelum, the upper Chenab and the lower Bari Doab canals. The Sutlej Valley canals now falling in Pakistan territories involved such canals as Fordwah, Pakpattan, Bahawal, Quimpur, Mailsi, Panjnad and Abbasia. The Thal canal from Kalabagh on the Indus river and the Haveli canal from the Trimmu head-works at the confluence of the Chenab and Jhelum rivers also went through the completion process. In addition, three link canals, namely Bambanwala-Ravi-Bedian-Dipalpur (BRBD), Balloki-Suleimanki (BS) and Marala-Ravi (MR), were also undertaken for improvement of supplies to various areas (West Pakistan 1963).

In NWFP, a multipurpose (irrigation and power generation) canal was taken out from the Swat river to irrigate the plains of Dergai and Mardan districts between 1990 and 1930. The Paharpur canal was constructed to irrigate parts of the D. I. Khan division.

Until 1920, the province of Sindh still depended on inundation canals for irrigation. To bring it at par with other provinces, the need was to start a more vigorous program. As a consequence, the construction of the Sukkur barrage and seven canals followed. The canals that originate from the Right Bank are Northwest, Rice and Dadu canals and those originating from the Left Bank are Rohri, Easter Nara, Khairpur West feeder and Khairpur East feeder canals (West Pakistan 1963).

In the period following independence in Pakistan irrigation development was pursued with even more renewed vigor than under the British rule. Right at the time of independence in 1947, Pakistan decided to take up the construction of the Kotri barrage for irrigation of lower Sindh. This barrage involved the construction of the Katri Beghar feeder, Panyari, Fuleli

and Akram Wah (lined channel) canals. As work on this barrage reached its final stage in 1955, all formalities on the initiation of the Guddu barrage were in order. The project involved digging of three canals, namely, Begari Sindh feeder, Desert feeder and Ghotki feeder to be completed by 1963. Beginning in 1954, a weir across the Kurram river was constructed for irrigation canals of the Kurrum upper main canal, the Kurram lower main canal and the Marwat canal (Ahmad and Chaudhry 1988).

Under Indus Water Treaty signed in 1960 with India, huge replacement works were carried out in major irrigated areas of Pakistan. They mainly centered on link canals, barrages, siphons and earth-fill dams, the Rasul-Qadirabad link, the Qadirabad-Bulloki link, the Bulloki-Suleimanki link, the Taunsa-Panjnad link, and the Chashma-Jhelum link came into existence. Chashma, Rasul Qadirabad and Sidhnai along with the Mailsi siphon were the new barrages. Mangla and Turbella (world's largest earth-fill dam) were part of replacement works under the Indus Water Treaty. More recently, the Chashma and Hab dams have also been converted into earth-fill multipurpose dams. Apart from regulating irrigation water supplies, these dams also provide secondary benefits of power generation and flood protection.

Although it is difficult to extend irrigation water to major areas of Baluchistan, part of the Hab dam water has been used for irrigation in the Bela district. Canals have been dug to supply irrigation to the Nasirabad district from the Indus river.

Tapping the Underground Aquifer

As indicated earlier, wells and Persian wheels have been historically used for mining underground water resources for irrigation purposes. However, the full potential of these resources could not be exploited due to manually or animal-operated systems. With the availability of motorized power in the 1960s, tube wells revolutionized the entire system, which began to increase at a rapid pace. Within a decade and by 1970–71, the number of tube wells had reached 98,000. The number rose to 200,000 by 1980–81, to 340,000 by 1990–91 and exceeded half a million in 1999–2000. As the number of public tube wells has been on the decline since 1989–90, the increase in the total number of tube wells in the 1990s must be largely attributed to private tube well development (Pakistan 1975, 2000).

Current Status of Irrigated Agriculture

With the passage of time, the development of irrigation has significantly changed the status of agriculture. Although historical data beyond Pakistan's history are not available, farm-gate supply of irrigation water has increased from 58.74 million acre-feet in 1960–61 to 133.28 million acre-feet in 1999–2000. This, in other words, implies that the total increase over the 39-year period was nearly 127 percent, which would correspond to an annual growth rate of 2.04 percent in irrigation water resources. As a result of expanding irrigation supplies, Pakistan's agriculture has become increasingly irrigated both in terms of total and proportionate irrigated area. Looking at the expansion of irrigated areas shows that only about 22.6 million acres were irrigated during 1950–51, which rose to 26.0 million acres in 1960–61, and further to 32.0 million acres in 1970–71 and 38.8 million acres in 1980–81. The values for 1990–91 and 1999–2000 corresponded with 41.4 and 44.7 million acres,

respectively. In terms of irrigated area as a proportion of the total cropped area, there was a stagnation of the ratio at 71.0 percent between 1950–51 and 1960–61. It rose to 77.9 percent in 1970–71 and to 81.2 percent in 1980–81. However, the percentage fell to 76.8 and 79.5 percent for 1990–91 and 1999–2000, respectively (Pakistan 1975, 2000).

In spite of these positive developments, Pakistan's agriculture continues to suffer from low productivity relative to world levels (Pakistan 2000). Agricultural growth rates have dwindled down to 2–3 percent per annum from 1994–95 to 1999–2000, which fell further to minus 2.5 percent during 2000–2001 (Pakistan 2001). Poverty in agricultural/rural areas has been on the increase as a consequence of adverse trends in rural employment and income distribution. Although these adverse trends may be attributed to a large number of factors including low fertilizer-application rates, high incidence of pest attacks and inclement weather conditions, many of them may be associated with uncertain supply of irrigation water or management of the irrigation system as follows.

First, it has been pointed out that groundwater has been a major factor in agricultural production over the last 40 years. Because of flexibility of tube-well water to match crop-water requirements, the resource perhaps stands overexploited and poses the threat of excessive lowering of the water table and intrusion of saline water into the freshwater aquifer (Bhatti et al 1997).

Second, due to age, overuse and poor maintenance, the Indus Basin Irrigation System has developed into a low-delivery and use-efficiency system. For example, the delivery efficiency of the canal system ranges between 35 and40 percent from the canal head to the crop-root zone. Thus, in practical terms, this means that most of the surface water is currently lost en route.

Third, the canal water supplies are highly inequitably distributed between canals, watercourses and head- and tail-end users. The situation is worsened by frequent thefts of water by influential farmers in collusion with irrigation officials. This inequitable distribution results not only in inefficient use but also in reduced agricultural production.

Last, the prices of surface irrigation water in Pakistan are kept low and have no relationship with the amount of water supplied. The low water prices have contributed to poor maintenance of the irrigation system and deteriorating canal water supplies. The water supplies to a farmer are determined by his canal command area but the charges are levied on the basis of cropland. The farmers, especially the large ones, have a tendency to minimize their water bills by cropping the minimum possible area with available supplies. It is such practices that, in quick succession, have often led to the twin menace of waterlogging and salinity.

Interventions in Irrigated Agriculture

The above discussion has already referred to irrigation policies that were aimed at the expansion of the irrigation system. Being a necessary evil, artificial irrigation, although necessary for improvements in agricultural production, can also lead to many attendant undesirable side effects especially on the poor. To the extent that these effects may prove to be counterproductive and defeat the very purpose of irrigation development, their minimization remains a central issue of a comprehensive irrigation policy. The following

discussion lists some of the emerging problems, and evolving policies needed to rectify these problems.

Major Irrigation Interventions

Among the first of these problems, which Pakistan encountered, has been the recurring twin menace of waterlogging and salinity. As the menace has been associated with excessive seepage from the irrigation system and rise of water table close to the soil surface, its effective solution involves no less than lowering of the water table and reduction in seepage. Pakistan has been alive to the problem and has attacked it at both fronts.

To lower the water table, a program of vertical and horizontal drainage was chalked out as early as 1960 and has been under implementation since then. While vertical drainage involved the installation of public tube wells in the severely waterlogged and saline water areas designated as SCARP (Salinity Control and Reclamation Project), at last, 18 such projects have been completed or are in various stages of completion (Bhatti et al 1997). In the fresh groundwater areas, rapid development of private tube wells has been instrumental in keeping a check and lowering the water table. The horizontal drainage is being practiced in the form of tile drains on a limited scale and open drains on a large scale. While the National Drainage Programme (NDP) is a replication of open drains on a countrywide scale, the creation of PIDAS is likely to take the program a step further. The massive projects of Left (LBOD) and Right (RBOD) Bank Outfall Drains are an attempt at the disposal of effluent water into the sea.

As a measure of controlling excessive seepage from the irrigation system, a beginning was made with lining of certain canals but the program being extremely costly could not be extended to the entire system. As a result, the emphasis shifted to reduce watercourse conveyance and field losses under such programs as Command Water Management and On-Farm Water Management Programme (OFWM), respectively, through watercourse improvement/lining and precision land leveling (Gill 1996). Although still in the experimental stage, some of the components of Command Water Management (CWM) also include lining of canals (minor) and watercourses, and land leveling for water conservation (WAPDA 1997).

A second policy area concerns not only flood protection to curtail losses of life, property, infrastructure and crop production but also to use available supplies of water more productively. The provincial irrigation departments run a normal program of flood protection. Works of an emergent nature are undertaken on a priority basis. A comprehensive program for construction of spurs along vulnerable reaches of Indus River and its tributaries has been in operation for a number of years under Prime Minister's River Management Programme. Likewise the construction of earth-fill dams has enabled Pakistan to store flood water and reduce the down-stream intensity of floods.

Thirdly, in response to deteriorating shape of irrigation system, a number of policy actions followed. Beginning with 1967, a policy of periodic increases in water rates was initiated which followed a number of rate increases subsequently. A program of Irrigation System Rehabilitation (ISPR) was started in 1982 to take up rehabilitation of badly deteriorated selective irrigation and surface drainage works. The privatization of public tube well in most of old SCARP areas was increasingly pursued in the 1990s to rid the public

exchequer of immense costs of O&M. Finally desilting (Bhal Safai) of the entire canal system was completed in 2000–2001, for rehabilitation of the system and somewhat equitable water distribution among the head and tail enders.

Finally, in the light of worldwide experience and experiments in Pakistan, a revolutionary approach to resolve major institutional problems is being groomed for implementation. It involves restructuring of Provincial Irrigation Departments (PIDs) to form Provincial Irrigation and Drainage Authorities (PIDAs), creation of Area Water Boards (AWBs) at the canal command level and formation of WUAs at watercourse level and their federation at minor and distributary levels. The WUAs and federations will be fully responsible for operational maintenance of the canals in their jurisdiction, allocation of available water supplies and assessment and collection of water rates. The experience to date has shown that WUAs have been instrumental in promoting equitable distribution of water, checking water thefts and in reducing burden on the government exchequer (Gill 1996). The fact that WUAs have resorted to supplying and charging water on the basis of canal commanded area would rid the small farmers of onerous cropping-intensity-based water rates (Chaudhry et al. 1993).

Implications for the Poor

It should be clear from the foregoing that the major objective of the evolving irrigation policies has been to add to farm-gate water supplies, raise agricultural productivity and enable small farmers to have better access to canal water supplies at fair prices. All these novel objectives are intimately and positively related to raising the standard of living of the poor or to poverty reduction in agriculture and elsewhere in the economy.

For example, the additional supply of irrigation water at the farm gate often involves excavation of new canals or expansion, desilting, remodeling and lining of existing canals and watercourses. Being highly labor-intensive, these activities can be expected to generate tremendous employment opportunities for the poor farm and nonfarm households. The routine work of strengthening the canal banks to prevent breaches and of river embankments and spurs for flood protection can be similarly classed. The availability of additional water at the farm level is a source of intensive land cultivation and adds to labor intensity of agricultural operations. For example, it has been shown in Pakistan that average labor input per acre in the Barani areas varied between one-fourth and one-third of that in the irrigated areas (Khan 1978). Similarly, additional supplies of water from tube wells have been noted to raise cropping intensities and labor input by as much as 57 percent (Kaneda and Ghaffar 1970).

The latter, however, depicts only the direct employment effects of tube wells and ignores their indirect effects. It may be noted that the development of farm-level tube wells has been associated with the emergence of tube-well-related small-scale manufacturing industry, sale and repair-shop business, tube-well-installing teams, electric-transmission lines, diesel-distribution centers and transportation services. More specifically, tube wells have strengthened forward and backward linkages between the farm and the nonfarm sectors. Although the total indirect employment effects of tube wells may not be quantifiable, some anecdotal evidence may be cited to pinpoint their significance. Ignoring all other indirect effects, the tube well manufacturing industry alone, it has been noted, provided more than 106,000 year-round jobs at the end of the 1960s (Johnston and Kilby 1975). While there

were only 87,000 tube wells in 1969–70 in contrast to 531,000 at present, the current employment potential of the industry on proportionate grounds may not be difficult to estimate at around 600–700,000 (Pakistan 1975, 2000).

The irrigated agriculture and appropriate policy formations have a definite role in raising agricultural productivity and promotion of agricultural growth. Relative to irrigated areas, crop production in Barani areas is uncertain and yields are only half (Pakistan 2000). Similarly, assured supply of water, as from private tube wells, can result in the doubling of crop yields and farm incomes (Chaudhry 1982) and contribute significantly to the growth of agricultural output.

There is a general consensus in the literature that rapid economic growth and poverty reduction may be mutually nonexclusive for obvious reasons. For example, most of the developing countries like Pakistan may be too poor to fund the massive outlays needed for direct reduction in poverty. Similarly, the mere redistribution of incomes without enlarging the available "pie" would not at all be effective (Chaudhry 1996). This follows from such succinct arguments as "poverty abatement policies are unlikely to show an actual decline in poverty if agriculture is doing badly, or that when the level of per capita food production is rising, the level of poverty is declining" (Mellor 1988). Mellor has further argued that an employment-oriented labor-intensive growth strategy pursued in Pakistan's agriculture has resulted in sharper declines in rural poverty than in India. Much the same follows from a recent study, which remarked that because the poor live mostly in rural areas and generally depend on the farm sector for their incomes, growth that stems from agricultural productivity and that raises the incomes of the small-scale farmers and landless laborers is particularly important in reducing poverty (Rosegrant and Hazell 2001).

Apart from general effects of irrigation policies on the poor through employment and productivity growth, the participatory irrigation management may also be characterized by specific pro-poor effects. For example, participatory approach, as also the *warabandi* practice, is likely to stop water thefts by the well-to-do farmers and ensure more water for small farmers than was possible previously. To the extent that WUAs will have full control of water supplies, rent seeking by the irrigation officials from the small farmers will be eliminated (Gill 1996). To the extent that WUAs supply water and levy charges on the basis of the canal commanded area, small farmers with 150–200 percent cropping intensities, no longer have to pay onerous cropping intensity-based water rates (Chaudhry et al.1993).

While it is clear that irrigation development and participatory management have the potential to contribute to poverty alleviation, the key question is how to exploit this potential to enhance the role of irrigation for poverty alleviation. It is well documented that input subsidies and price supports worked more to the advantage of large and well-off farmers, and the overall institutional support in the past had benefited the minority of the these well-off farmers. This has contributed to worsening of the highly skewed resource distribution pattern in the country. The current situation in irrigated agriculture in Pakistan may be characterized as:

- highly skewed land distribution
- high population growth, and increasing number of smallholdings
- high illiteracy rate

- stagnant crop yields
- lack of information sharing
- centralized bureaucracies, political interference
- lack of transparency and accountability of officials
- inequity in distribution of water
- inadequate maintenance of irrigation infrastructure, lack of effective implementation of operational rules.

All these factors are contributing to worsening the poverty situation in rural Pakistan, and substantially reducing antipoverty impacts of irrigation.

Poverty Situation in Pakistan

In spite of the pro-poor nature of the evolving irrigation policies, poverty in Pakistan, after falling to the lowest levels in the 1980s, has been on the increase throughout the 1990s in the urban and the rural areas. Poverty is a multidimensional complex phenomenon with many underlying causes including the macro-economic policies. The following sections review the trends in poverty and some of its underlying causes as envisaged in the government's macro-economic policies.

The study of poverty trends involved inter-temporal comparisons of quantitative estimates, which must be based on consistent and clear definitions of poverty. As is usual, we would stick to the most commonly used and understood measure of head count ratio defined as the proportion of households or population below a given poverty line for the purposes of this study. The poverty line, in turn, refers to the minimum real income needed to purchase a basic food involving daily intake of 2,450 calories per adult equivalent in the rural areas and 2,150 calories in the urban (World Bank 1990). Although other alternative measures are also available, it matters little in practice as to which poverty measure is used for measurement of trends (Tabatabai 1995). To ensure somewhat more valid inter-temporal comparisons, dependence on poverty estimates reported in the economic survey (Pakistan 2001) seems to be inevitable and are reproduced here in the form of table 1 as follows.

It should be clear from table 1 that there was consistent improvement in poverty between 1969–70 and 1987–88 on a Pakistan-wide scale as also in the rural and urban areas. The trend, however, was reversed since 1987–88 as the proportion of the poor population below the poverty line continued to rise throughout the 1990s. To be more specific, 46.5 percent of Pakistan's total population was poor in 1969–70, which in a decade's time fell to 30.7 percent. The proportion was reduced to 24.6 percent by 1984–85 and only 17.5 percent of the people were poor in 1987–88. These drastic improvements in poverty levels, however, could not be upheld in the 1990s as the percent of the poor rose to 22.1 percent as early as 1990–91. The incidence of poverty registered a sharp increase between 1990–91 and 1996–97 to lie at 31.0 percent during the latter period. It continued its upward trend, in a gradual

Table 1. Poverty incidence (head count ratios) in rural/urban Pakistan for selected years since 1969–70.

Year	Total	Rural	Urban
1969–1970	-46.53	49.11	38.76
1979–1980	30.68	32.51	25.94
1984–1985	24.57	25.87	21.17
1987–1988	17.32	18.32	14.99
1990–1991	22.11	23.59	18.64
1992–1993	22.40	23.35	15.50
1996–1997	31.00	32.00	27.00
1998–1999*	32.60	34.80	25.90
1999–2000*	33.50	NA	NA

Sources: Amjad and Kemal 1997; Qureshi and Arif 1999.
*Social Policy and Development Center (SPDC) 2000.

manner, during the rest of the 1990s as poverty rose to 32.6 percent in 1998–99 and to 33.5 percent in 1999–2000. Although the trend in rural and urban poverty was the same as in total poverty, the levels of poverty were somewhat higher in the rural areas relative to those in urban and total poverty.

The changes in growth, employment, income distribution, and inflation as reported in table 2, are the trendsetters in poverty. The improvement in poverty was associated with high growth rates exceeding a threshold level of 6.0 percent per year. By contract the degree of poverty accentuation varied with the level of downward deviation from this growth rate. For example, the slower the growth rate of a year the higher its poverty level. The slowdown in growth was caused by generally falling or stagnating investment rates of nearly 20 percent in the late 1980s to 16 percent in 1999–2000 (Pakistan (2001). Similarly, the unemployment rates, which did not exceed 2–3 percent during the 1960s, 1970s and 1980s, gradually rose to 5–6 percent levels, respectively, during the early and late part of the 1990s. The recessionary situation of the 1990s created by near stagnation in per capita incomes and growing unemployment rates was bound to result in deteriorating income distribution. Although the Gini coefficients improved consistently through the 1980s and were never in excess of 0.37, they began to assume values greater than 0.40 beginning in 1990–91. To the extent that these values are historically the highest in Pakistan, they point to the fact that income inequalities in the 1990s have peaked at the worst possible level. Finally, inflationary tendencies affect the poor more adversely and determine the prevailing poverty levels. As the 1990s, in general, were characterized by double-digit inflation, high and rising poverty levels would be a normal expectation.

Table 2. Growth, unemployment, Gini ratios and inflation rates 1969–70 to 1999–2000.

Period	Annual Growth Rate	Unemployment Rate	Gini Ratio	Inflation Rate
1969–1970	9.5	1.9	0.386	4.1
1978–1979	5.5	3.55	0.376	6.6
1984–1985	8.7	3.72	0.369	5.7
1987–1988	6.4	3.13	0.348	6.3
1990–1991	5.6	6.22	0.407	12.7
1992–1993	2.3	4.73	0.410	9.8
1996–1997	1.9	6.12	0.400	11.8
1998–1999	4.2	6.12	-	5.7
1999–2000	3.9	6.00	-	3.6

Impact of Macro-Level Policies on Poverty

A government can monitor changes in growth, employment, income distribution and inflation by direct interventions or indirectly through the use of policy. Pakistan has exercised both of these options.

Some of the more important direct interventions are: price controls, procurement and food subsidies, public investment and extension of credit to raise investment for accelerated growth, public works programs for employment generation, the Zakat system for improvements in income distribution and restriction on trade, foreign exchange and exchange rate for control on balance of payments and trade. More recently, the Khushal Pakistan Program, cash support for a nutritionally vulnerable, micro-credit scheme and social-sector spending have emerged as leading direct interventions by the government. It may be noted that the impact of these approaches may be highly limited in view of the growing worldwide emphasis on deregulation, privatization and liberalization. In fact, the government has been forced to curtail public-sector employment and, since 1988, a ban has been in force on fresh employment. In addition, it is also questionable if the resource-constrained government made worse by the prevailing credit crunch, would allow expanded government expenditure for direct intervention. Already, the government-development expenditure has fallen to less than 3.0 percent in 1999–2000 against 9.3 percent in 1980.

Like direct interventions, even monetary and fiscal policies had perverse effects on poverty. For example, the monetary policy during the 1990s was increasingly used for financing budgetary deficits and, as noted above, it has contributed heavily to inflation with regressive impact for the poor. In view of high tax-evasion rates, poor tax compliance and weak tax administration, heavy reliance on indirect taxes has been a cornerstone of Pakistan's tax policy. Being regressive in its incidence, high tax burdens of the poor were a natural phenomenon. The free-float exchange rate policy has resulted in continuous depreciation of the Pak. Rupee, which promotes inflationary tendencies in an import-dependent and trade-liberalizing economy.

In addition to the above, policies pursued in agriculture have even more adverse effects on poverty. First, for one thing, there has been, and continues to have, considerable underpricing of domestic (support prices) agricultural commodities relative to world levels (farm-gate parity price), causing immense resource transfers from the relatively poorer agriculture sector to the urban consumers, middlemen and industrialists with incomes four to five times those in agriculture (Chaudhry 2000). What is more. it is a fact that agricultural commodity markets often fail and prices that farmers receive are generally lower than government-fixed support/procurement prices. Second, a policy of subsidy withdrawal has been in vogue. The implementation of the policy is likely to discourage modern input use, intensive land cultivation, technological breakthroughs and, above all, employment, productivity and output growth in agriculture. It will also hurt the finance-constrained small farmers more than the large rich farmers. Third, in view of steeper increases in input prices than those in agricultural commodities, farmers have to face low profit rates than elsewhere in the economy. This induces receding investment incentives in agriculture and outflow of investable resources to other more profitable sectors. Fourth, the imperfections in input and output markets place agriculture in a highly vulnerable position. It often faces rent-seeking in the disposal of commodities and blackmarketing, adulteration and use of underweights for purchase of agricultural inputs. Fifth, despite attempts at reforms, Pakistan's agricultural tax system remains oppressive and highly regressive in its incidence. Last, Pakistan has made three serious attempts at land reforms but without any success. To the extent that poverty levels may be associated with land distribution, failure of land reforms in Pakistan may have been a reason for the high incidence of rural poverty.

Conclusions and Policy Recommendations

The main objective of this investigation was to review and analyze Pakistan's historical experience in Pakistan's irrigation system and relate it to poverty reduction. The analysis springs from historical irrigation developments and leads to the present state of irrigated agriculture in Pakistan, how the irrigation policies currently in vogue evolved and how they have affected the poverty levels. Although the policies in the 1960s, 1970s and 1980s were favorable to poverty reduction, the 1990s have seen a reversal of most of these policies. As a consequence, poverty levels were adversely affected. The deteriorating parity trends were caused by slower growth, high unemployment rates, skewed income distribution and double-digit inflation. The misuse of monetary, fiscal and trade, and exchange rate policies and direct state interventions were the major causes. To a large extent, the state of affairs at the national level was caused by stagnating conditions in agriculture.

The major causes of the poor growth performance of agriculture in the 1990s were associated with a) under-pricing of agricultural commodities vis-à-vis sharply rising input prices, b) heavy tax and transfer burdens of the agriculture sector, c) increasing physical intervention of public and private monopolies in commodity and input markets and trade, d) deteriorating quality of modern inputs like water, seeds, fertilizers and pesticides and their inadequate supplies during peak demand periods, e) poor performance of research, education and extension services, and f) continuing problems within the land tenure system.

It was also found that income distribution and poverty are positively associated with growth, and growth can be accelerated by concentrating on the following factors.

First, technological change is at the heart of a high-growth strategy. To this end, there is a need to evolve and disseminate new HYVs of crops, new breeds of livestock and to develop new cultural practices suited to Pakistan's resource endowment and climate. To accomplish these tasks effectively, the importance of sharply stepped-up efforts at education, research and extension cannot be underestimated. Also the introduction of a basic course on agriculture, including crop agronomy and livestock husbandry at primary school level, should be an integral part of the efforts. The Field Assistants should be given additional responsibility for teaching such courses in their duty areas. Apart from imparting knowledge to school children as prospective farmers, the added responsibility should ensure the presence of Field Assistants in the duty areas and improve accessibility to farmers for advice on day-to-day agricultural activities. Further, the arrangement of joint refresher courses for teachers, researchers, extension agents and farmers would be highly instrumental in creating viable links and ensuring rapid breakthroughs in agriculture.

Second, from the growth maximization viewpoint, the efficiency of the input delivery system should be enhanced. Although the government's strenuous efforts are already underway, the menaces of blackmarketing, using underweights and selling substandard and fake fertilizers, pesticides and seeds should be declared nonpardonable social crimes, punishable by rigorous imprisonment and heavy penalties. In addition, efforts should be made to reduce the intensity of the problem by open market sales, by breaking up government and registered dealer monopolies, and by ensuring the supply of inputs at the right price, time and place and in adequate quantities. The same should apply to livestock feed, forages, medicines and insemination stock and materials. Improvement in range management in the dry regions of Pakistan, especially in Balochistan and NWFP, should be given highest priority. In view of the high incidence of fatal animal diseases, there is immense need for establishing a widespread network of veterinary hospitals, dispensaries and medical stores in the public as well as in the private sector. The veterinary doctors, like medical doctors, should be encouraged to operate clinics for advice and treatment of seriously infected animals and for day-to-day animal health problems.

Third, for efficient use of irrigation water, there is a need to a) restore a direct relationship between amounts of irrigation water supplied to individual farmers and the prices charged, b) ensure transfer of irrigation management to WUAs, c) promote equitable water distribution among canal commands, and d) extend all possible help for land leveling and improvement/lining of watercourses and minors.

While most of the above are straightforward recommendations, the implementation of the first one may be problematic. To resolve this problem a direct relationship between the volume of water delivered and chargeable water rates could be established even without the installation of meters if the water charges, like canal-water supplies, are also assessed on the basis of the canal-commanded area. Since, on average, farmers receive a specific amount of water per canal commanded acre, charges thus levied should boil down to a charge per unit of water supplied.

This concurrence of the two bases would be highly desirable in many respects. It would, unlike the current cropland-based charges but like strict volumetric pricing, encourage an efficient use of land and water since it would leave the planting decision to farmers, given

the available supplies and opportunity costs of irrigation water (Chaudhry 2000). It would also relieve many small farmers of onerous water rates imposed under the present cropland-based system of water rates because of their relatively higher cultivation intensities and would induce positive changes in the distribution of income. Also, investment in private tube wells would be encouraged because of the elimination of double charge for running tube well water in watercourses that were originally constructed for delivering the canal water. It may also lead to improvement in the cost effectiveness of the system by eliminating the staff needed for crop records. This is especially important as IDs in Pakistan are overstaffed by nearly 50 percent compared to those in other countries in Southeast Asia.

Furthermore, while a change in the water-rate base is a primary requirement, water use efficiency can also be enhanced further by achieving a more equitable distribution of water across the watercourses. Irrigation officers may be made more accountable to WUAs and empowered to ensure the delivery of the due share of water and the collection and spending of water receipts. Budgets should be so prepared as to present a more realistic picture of receipts from, and expenditures on, irrigation. There is a growing consensus in Pakistan on recovery of full O&M costs of the irrigation system and removing subsidies as currently reflected in low rates charged for canal water. While full cost recovery is highly desirable, it must be accompanied by right-sizing of PIDs and eliminating of overstaffing. In addition, as the benefits of irrigation extend beyond the irrigators, farmers alone may not be held responsible for cost recovery of O&M.

Fourth, it should be noted that the interventionist government policy pursued in Pakistan has adverse consequences for investment, production, employment, income distribution and poverty in agriculture. In view of the heavy dependence of the national economy on agriculture and the importance of some of the above variables, an indefinite pursuit of such a policy is neither desirable nor sustainable and must be discontinued.

By way of recommendations of this paper, the current price policy needs to be modified in at least three important respects, as follows.

First, in order to end underpricing of agricultural commodities effectively, the fixation of agricultural commodity prices must be undertaken on the basis of corresponding import and export parity prices of various commodities. It may be noted that this type of fixation of commodity prices does not involve government intervention but their delivery might, which is the task of a regulated marketing system to be defined shortly. Since parity prices tend to be higher than procurement prices favorable incentive effects of the recommended policy on investment, production, trade, employment, income distribution and poverty should be noted. Although higher domestic prices of food may be hard on some consumers, they should not unnecessarily tax most urban consumers, while providing "safety nets" for the poorest of the poor, as they are the minimum prices that would prevail in the country in the absence of domestic production. As, however, parity prices are likely to vary directly with highly fluctuating world prices, the stability of agricultural commodity prices at home can be ensured if they are based on 5-year moving averages or trend lines of the past parity prices. In so doing, domestic prices would be higher than parity prices in the years of low world prices and lower than them in years of high world prices. As cyclical fluctuations around the trend would be cancelled out over time, the desired result would be marked by the absence of any implicit taxation on agriculture. Therefore, it would be unnecessary for government involvement by setting up and maintaining a price stabilization fund, as was proposed in the

recent strategy document of the Ministry of Food, Agriculture and Livestock. Farm-gate prices of milk can be sharply improved by disallowing dried milk imports by milk plants and by promoting competition among them for procurement and processing of fresh milk supplies. There seems to be little justification for milk plants to charge Rs 32 for one kilogram of milk when fresh milk prices in the rural areas do not exceed Rs 10–12 per kilogram. The recommendation, if implemented, should result in drastic reduction in poverty of may rural landless families

Second, there is no doubt that most of Pakistan's parastatal organizations suffer from gross inefficiencies with immense costs to producers, consumers and the government exchequer. To save on these costs and to promote the cause of privatization, the government would be well-advised to desist from active and direct engagement in procurement, storage, distribution and external trade on a massive scale and leave these tasks for the regulated private marketing system operated by market committees with membership from farmers, market functionaries and associated government officials. While the restrictive trade policies such as licensing and bans on interregional movement of commodities should be discontinued, severe penalties backed by law, should be imposed on illicit trade practices. The government, in its new role, must be watchful of private sector activities, ensure competition in agricultural commodity markets, and discourage private sector monopolistic tendencies, excessive profiteering and price hikes. The experience in Pakistan suggests that the recommended private markets should operate quite competitively.

Third, apart from the implicit taxes, the agriculture sector is also subject to immense resource transfers to the government exchequer through indirect taxes. Due to the government's already large and growing dependence on indirect taxes, taxation on agriculture seems to have become highly oppressive. Therefore, the system should be replaced by direct taxes in agriculture. The often-made recommendation is to move to the extension of a general income tax to agriculture and the efforts to implement such a tax at present, as pointed out earlier, have their own difficulties. This is what should be expected in view of the many inherent limitations of the suggested income tax policy on agriculture. For one thing, agricultural incomes are difficult to quantify and the concept remains meaningless. For another, the implementation of agricultural income tax requires honest and efficient administration. Lacking such administration, enforcement of the policy is most likely to fail. For still another, being income and price inelastic, the agriculture income tax is no better than land tax in terms of revenue generation. In fact, it would be worse than land tax in terms of its narrower tax base because of exemptions and falling government revenues over time due to subdivision of agricultural holdings on account of inheritance laws and fictitious transfers in collusion with revenue officers. For yet another, taxes based on cultivated and cropped area coupled with higher tax rates for orchards and cotton tend to distort efficient land use and optimal cropping decision of the farm sector. Finally, despite a progressive rate structure, the income tax policy based on cropland and self-assessed incomes may turn out to be regressive in its impact as intensity of cultivation exceeds 130 percent for under 12.5-acre farms but is only 60 percent for farms exceeding 150 acres. This likelihood is greatly increased as most of the large farmers have the ability to evade taxes especially under rising tax rates of agricultural income tax. To ensure fair prices in the livestock markets, animal sales on the basis of live-weight should be introduced.

If equitable taxation of agriculture is desired, progress in agricultural taxation has to be achieved in an indirect way. This being so, a combination of a proportional land tax and a tax on marketed output seem to be more appropriate under Pakistan's conditions. Furthermore, this two-tier system of agricultural system has all the desirable characteristics of a rational tax policy and would largely be consistent with the theory of optimal taxation. For example, a proportional land tax based on owner's farm area (cultivated or uncultivated) is preferable to the graduated land tax because, as was argued before, it will keep the tax base stable and relatively broader, reduce the temptation for undue subdivisions of landholdings, avoid the possibility of declining absolute tax revenues over time, ensure efficient use of resources and, above all, will be easy to administer.

A proportional land tax, although in line with optimal tax rules, is inherently handicapped by its inequitableness, income and price inelasticities and is risk-prone. A tax on the marketed produce is best suited to overcome these deficiencies of agricultural taxation. For example, the incidence of such a tax, as distinguished from that of land revenue, will be appropriately heavy on the large landholders. While the small landholder, to the extent that his crop is consumed and not sold by him, will not have to bear the tax at all. Similarly, the tenants will not be subjected to heavier tax rates along with the large landholders, the largest producers of marketed surplus. The tax base will be widening and the revenue from the tax on marketed produce.will be expected to grow at the rate of growth of the marketed surplus plus the rate of increase in prices of agricultural commodities. In the case of crop failures and market gluts, tax payments by farmers will be automatically reduced for relief against unforeseeable events. This tax-sharing arrangement thus reduces the farmer's vulnerability to risk and makes the tax more desirable in terms of optimal tax theory. The tax may be implemented through the administration of local bodies to avoid any additional cost as the local bodies in the recent past were collecting a similar tax on agricultural commodities and have now been given additional powers under the current government's devolution plan. In addition, it will avoid tax evasion, as the farmers will be easily approachable at the market place. Moreover, there will be less corruption because the tax collectors will be closely supervised.

To a certain extent, a tax on marketed produce may be accompanied by deleterious effects on farm and marketed outputs. This can be expected because no system of taxation can be perfectly neutral with respect to allocation (World Bank 1988). However, it may be noted that the disincentive effect of the policy on output and marketed surplus can be considerably reduced by the presence of a heavy land tax, especially on unused lands.

In view of the above, it is but natural to conclude that the combination of the two taxes would be Pareto-efficient, administratively feasible and income and price elastic, ensuring risk coverage, greater and rising revenues and price stabilization.

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