Pakistan's Water Challenges: A Human Development Perspective

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Pakistan's Water Challenges: A Human Development Perspective

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Abbreviations

ADB	Asian Development Bank
AWB	Area Water Board
BOD	biochemical oxygen demand
CRBIP	Chashma Right Bank Irrigation Project
DDAC	District Development Advisory Committee
EC	European Community
EIA	environmental impact assessment
EPA	Environmental Protection Agency
ERNP	Environmental Rehabilitation in NWFP and Punjab
FAO	Food and Agriculture Organization of the United Nations
FEMA	Federal Emergency Management Agency
FO	farmers' organisation
GATS	General Agreement on Trade in Services
GDP	gross domestic product
ha	hectare(s)
HCI	head count index
HIA	health impact assessment
IEE	Initial Environmental Examination
INPIM	International Network on Participatory Irrigation Management
JICA	Japan International Cooperation Agency
LBOD	Left Bank Outfall Drain
LGRDD	Local Government and Rural Development Department
LITE	Landhi Industrial Trading Estate
m3	cubic meter(s)
MAF	million acre feet
NCS	National Conservation Strategy
NDP	National Drainage Programme
NEQS	National Environmental Quality Standards
NGO	non-governmental organisation
OFWM	On-Farm Water Management
O&M	operation and maintenance
OPP	Orangi Pilot Project
PHED	Public Health Engineering Departments
PIDA	Provincial Irrigation and Drainage Authority
PIEDAR	Pakistan Institute for Environment Development Action Research
PIHS	Pakistan Integrated Household Survey
RAP	Revised Action Programme
RBOD	Right Bank Outfall Drain
RWSS	rural water supply schemes
SAP	Social Action Programme
SDPI	Sustainable Development Policy Institute
SITE	Sindh Industrial Trading Estate
TDS	Total Dissolved Solids
UN	United Nations
UNDP	United Nations Development Programme
UNCHS	United Nations Center of Human Settlements

USD	United States Dollar
WAPDA	Water and Power Development Authority
WASA	Water and Sanitation Authority
WUA	water user association
WCD	World Commission on Dams
WFP	World Food Programme
WHO	World Health Organisation
WRI	World Resources Institute
WTO	World Trade Organisation
WUF	water user federation
WWAP	World Water Assessment Programme
WWF	World Wildlife Found

Pakistan's Water Challenges: A Human Development Perspective[1]

Karin Astrid Siegmann[2] and Shafqat Shezad[3]

Abstract

This paper gives an overview of the human and social dimensions of Pakistan's water policies to provide the basis for water-related policy interventions that contribute to the country's human development, with special attention being given to the concerns of women and the poor. While Pakistan may not be a water-scarce country, water stress, poor water quality, and inequitable access to water adversely affect large portions of the population. Considerably less water is available in Balochistan and Sindh. This is also the case for people at the tail end of the irrigation distribution system, and for the poor. Though women have a distinct role in water management for domestic and productive purposes, they are hardly represented in user groups. This suggests that water management, rather than water availability, is at the core of Pakistan's water crisis. The unequal distribution, coupled with population pressure, rapid urbanisation, and increasing industrialisation, poses a serious challenge to water management in Pakistan in the 21st century.

Insufficient access to and poor quality of water resources are the major obstacles to human development in Pakistan. This takes several forms. Water-related diseases such as diarrhoea, hepatitis, dysentery, and malaria are among the main causes of death. Industrial water pollution poses direct health hazards and indirectly threatens sources of livelihood, for example for fishing communities. Insufficient water for food production, loss of soil fertility through water-logging and salinity, seepage, unequal distribution in the irrigation system, and droughts lead to reduced agricultural production and thus endangers small farmers' food security.

Domestic water supply as well as irrigation management both saw a shift towards more participatory and privatised approaches during the 1980s and 1990s.

Assessments are mixed about the success of the participatory schemes. Overall, the availability of safe drinking water in all provinces dropped between 1995 and 1999. In irrigation, due to a focus on physical targets rather than on capacity building in water user associations (WUAs), the positive effects of these schemes were largely appropriated by the economic and political elite, increasing the marginalisation of poorer farmers.

The following points are identified as crucial for water interventions that better serve human development:

- A genuinely participatory approach in water management including the voices of all stakeholders, in particular women and the poor;
- A pro-active approach to tackle landed and bureaucratic power structures;

1 The paper greatly benefited from comments by Pervaiz Amir, Mohsin Babar, John Briscoe, Mushtaq Gadi, Mahmood A. Khwaja, Sonia Lioret, and Azam Mohammed. Research assistance by Altaf Ahmed Memon in data collection, compilation, and preparation of the boxes is gratefully acknowledged. All remaining errors are solely our own responsibility.

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- Capacity building in user groups and in government agencies, rather than investment in infrastructure alone;
- Economic incentives, such as secure property rights, to improve access to water for the marginalized and more efficient use of the scarce resource;
- The health implications of water-related interventions should be assessed before embarking on them;
- Water conservation should be given priority over large storage projects. If large reservoirs are constructed, environmental and social impact assessments should be conducted with true stakeholder participation.

1. Introduction: Water and human development in Pakistan

Pakistan, once water-abundant, is now a water-stressed[4] country. Annual per capita water availability in Pakistan dropped to 1,384m^3 in 2002 (WRI, 2003b). Population Action International (2002) estimates that Pakistan will be water-scarce by 2025. In 1991, withdrawal of the available water was mostly for agricultural purposes (97%), and only about 2% for domestic uses and industry, respectively (WRI, 2003b). While Pakistan may not be a water-scarce[5] country by hydrological definitions, nonetheless, water stress, poor water quality, and inequitable access to water adversely affect large portions of the population. This suggests that it is water management rather than water availability that is at the core of Pakistan's water crisis.

The following example illustrates the deficiencies in water management. In Hyderabad, the second largest city in the province of Sindh, contaminated water took the lives of 38 persons between April and May 2004 and caused severe complications for thousands of others leading to their hospitalisation (*The News*, 2004). It is assumed that the water of the Manchar Lake - providing drinking water to the city - caused the human suffering. The Manchar Lake water is fed with saline surface water from the Right Bank Outfall Drainage (RBOD), an intervention to provide drainage to fields located on the right bank of the Indus. At the time of the water contamination, the releases from Manchar Lake were not properly diluted with water from Sukkur barrage. Due to poor laboratory facilities at their water treatment plant, Water and Sanitation Agency (WASA) authorities did not detect the contamination (EPA, 2004). The event points to the crucial importance of access to safe water for human well-being and development – and to its interface with political, management, and environmental factors.

1.1 Relevance of water for human development

Human development is a process of enlarging people's choices. The most critical ones are to lead a long and healthy life, to be educated, and to have access to the resources necessary for a decent standard of living. Human development has two main aspects. On the one hand, it involves the formation of human capabilities, such as improved health, knowledge, and skills. On the other hand, it refers to the use people make of their acquired capabilities for leisure, productive purposes, or for being active in cultural, social, and political affairs (Haq, 1995; UNDP, 1990).

Safe drinking water is essential for people's direct consumption and for sustaining and improving people's health. Conversely, water-related diseases are among the most common causes of illness and death. According

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4 'Water stress' refers to a condition where a country's annual availability of renewable freshwater resources is less than 1,667m3 and more than 1,000m3 per person in the population (Engelman and LeRoy, 1993).

5 'Water scarcity' commonly refers to countries where annual availability of renewable freshwater resources is less than 1,000 cubic meters (m3) per person in the population (Engelman and LeRoy, 1993).

to a former Director-General of the World Health Organisation (WHO), the number of taps per 1,000 persons is a better indicator of health than the number of hospital beds (Daudpota, 2001). Therefore, the objective of halving the proportion of people without sustainable access to safe drinking water figures prominently among the United Nations' Millennium Development Goals (UN, 2000).

In addition to water for people, *i.e.* water for drinking and other domestic purposes, irrigation is the second major application of water. Water for food determines the productivity of agriculture to a large degree and thus indirectly affects food security of the population.

Apart from water for people's direct consumption and water for agricultural production, there are other uses of the precious resource that are relevant for human development. Domestic uses in cooking, sanitation, washing and cleaning are important prerequisites for hygiene and health. Other productive applications, such as hydropower generation and watering of livestock, indirectly generate income.

Taken together, these main uses of water indicate that the availability of water in adequate quality and supply has a major impact on human development.

1.2 Challenges and opportunities in the interface of water and human development in Pakistan

The Pakistan Water Vision 2025 identifies the following challenges for water management at the beginning of the 21st century (Pakistan Water Partnership, 2000):

- Inadequacies in municipal water supply and sanitation leading to the pollution of water resources and deteriorating health standards;
- Severe shortfalls in food production;
- Depletion of forest resources, leading to increased soil erosion, silting of reservoirs and increased variability of flows. Persisting water-logging and salinity problems and salt accumulation in soils;
- Surface storage capacities will be depleted by silting and groundwater resources will be on the brink of exhaustion with a sharply declining water table in Balochistan.

Population growth is one of the triggering factors for this scenario (Table 1.1). Pakistan's population increased from 85 to 141 million between 1980 and 2000. By 2025, the population is estimated to increase by another 63% with an increasing number of migrants to urban centres.

Table 1.1: Population, urbanisation, and industrialisation in Pakistan, 1980-2025

Year	Population (million)	Population growth rate (%)	Urbanisation (% of population)	Industrialisation (share of manufacturing in real GDP in %)	Water demand for domestic use (MAF)
1980	84.9	3.0	24.1	13.8	-
1990	110.8	2.6	34.7	17.4	4.1
2000	140.5	2.1	47.5	23.0	5.2
2025*	228.8	2.4	-	-	9.7

Sources: Population Reference Bureau (2004); Ministry of Finance & Economic Affairs (2004, 2001); Federal Bureau of Statistics (1991); Kahlown and Majeed (2002)
Note: * estimate

It is estimated that urban water demand, including industrial demand, will increase by 95% between 2001 and 2025. Already, major cities in Pakistan face problems of groundwater mining and lowering of the water-table (Ahmad, Bari and Muhammed, 2003). With a 263% increase in demand in the same period, growth in rural domestic water demand will be even higher (Memon, 2004). The growing population not only leads to increasing demand for domestic and industrial water; it also adds to the pressure on the poor infrastructure to treat sewage and industrial wastewater. It is amplified by migration into cities and by industrialisation.

The agricultural sector is also under pressure to accommodate the increasing population's need for food. So far, it produces 23% of Pakistan's gross domestic product (GDP) (Ministry of Finance, 2004) and 68% of the rural population directly or indirectly depends on income from agriculture. 90% of food grains come from irrigated agriculture (Hussain, 2004). Wheat alone constitutes 47% of the calorie intake of the poor in Pakistan, underlining the importance of food grain production for food security (Khan and Ahmad, 1996). It is estimated that Pakistan will have to double its annual food production every 15 years, in order to maintain the status quo in meeting food requirements. This implies an estimated increase in water requirements of about 40% between 2002 and 2025 (Kahlown and Majeed, 2002).

Food production is endangered due to the high degree of water-logging and salinity on agricultural land. In 1998, 9.1 million hectares (ha) of agricultural land were affected by water-logging and 4.9 million ha by severe water-logging, *i.e.* 33.7 and 18.2% of the agricultural land, respectively. Almost 13% of the cultivated land is saline (Ministry of Food, Agriculture & Livestock, 2004; FAO, 2004). These twin menaces have led to crop declines of about 30% in yields of major crops (Pinstrup-Andersen and Pandya-Lorch, 1994) and thus threaten Pakistan's food security.

These challenges, serious as they are, also provide incentives for changes in water management, and thus opportunities. Although increasing competition for water and deteriorating quality suggest an expanding scope for conflict, it also provides an incentive for new forms of co-operation and innovation (WCD, 2000).

1.3 Scope of the paper

In order to give a policy-oriented overview about the human development dimension of Pakistan's water interventions, this paper reviews existing literature on water policies and practices in Pakistan. It has a double focus on water for people, and water for food, or agricultural uses of water. However, in practice, the distinction between water for direct consumption and other domestic uses and water for productive purposes is unclear. For example, where groundwater is saline, irrigation and other surface water becomes a crucial resource for drinking, domestic purposes, and agriculture (Nizamani, Rauf and Khoso, 1998). Surveys conducted on the non-agricultural usage of surface water showed that nearly 90% of the Pakistani population uses surface water for domestic purposes (Waheed-uz Zaman, Jahangir and Iqbal, 1996).

Special attention is given to the concerns of women and the poor because of the special role of the former in water supply and management and the crucial importance of access to the resource in adequate quantity and quality to the latter. The time period considered is the two and a half decades since 1980, depending on data availability. The human development paradigm as developed by Haq (1995) and applied by the United Nations Development Programme (UNDP) serves as a reference point for the assessment of the human and social impact of water management and interventions.

Section two provides a sketch of regional, socio-economic, and gender-related inequalities in access to water. Sections three and four describe water-related policies and environmental factors that directly or indirectly affect human development. Sections five and six analyse the impact of the triggering factors described in sections three and four on human development in Pakistan. In the last section, the paper discusses the results of the analysis developed in the previous sections and formulates recommendations about how interventions can better serve human development in Pakistan, in particular considering the needs of women and the poor.

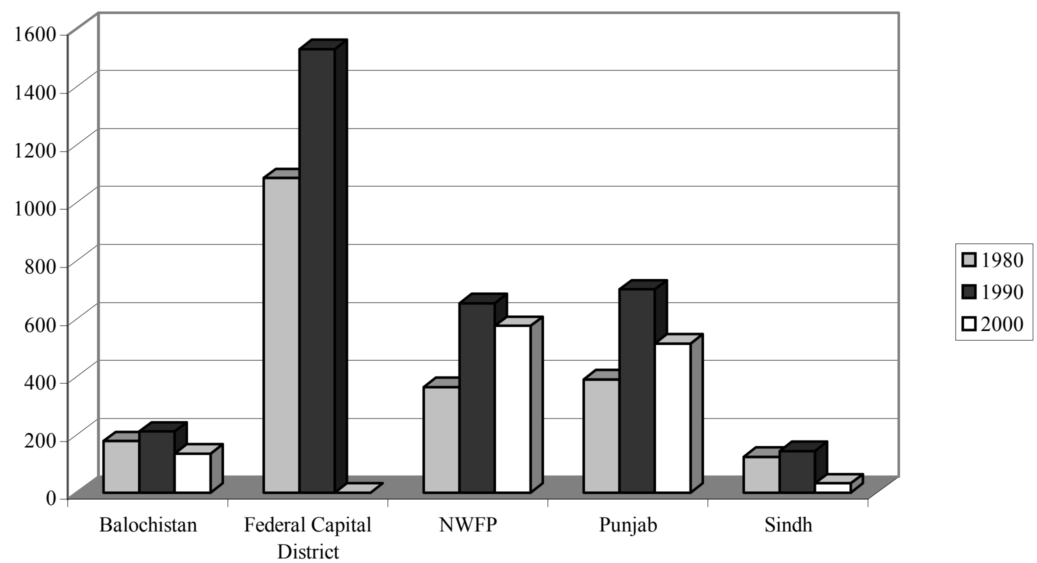
2. Overview: Pakistan's access to water – multiple inequalities

Water-stress is not only related to population pressure, urbanisation, and industrialisation in Pakistan but also results from the multiple inequalities in the country. The problem is not one of shortage only, but of uneven distribution of water across regions, socio-economic groups, and genders. This section provides a brief overview over such differences in access to water in Pakistan, thus highlighting existing and potential conflict and areas of potential intervention in managing the scarce resource.

2.1 Regional differences

Figure 2.1 substantiates the unequal regional availability[6] of water in the four provinces of Pakistan, with Balochistan and Sindh receiving considerably less precipitation than the other provinces.

Figure 2.1: Annual precipitation per province, 1980-2000 (mm)



Sources: Ministry of Food Agriculture & Livestock (Various Issues); Federal Bureau of Statistics (2000)
Note: The data points are averages calculated from main meteorological stations in the respective provinces. No data are available for the Federal Capital District for 2000.

Precipitation is only one part of available water sources. For ground and surface water to be available, it is crucial whether a region is located in or outside the Indus basin. Of Pakistan's groundwater potential of 55 million acre feet (MAF), about 75% is being exploited, with 82% being used in Punjab, 8% in Sindh, 5% in NWFP, and 1% in Balochistan (Kahlown, Majeed and Tahir, 2002). This again clearly disadvantages Balochistan.

The poor water availability in Balochistan is reflected in people's (lack of) access to safe drinking water (Table 2.1). In this province and in Sindh, more than 80% of the rural population did not have access safe drinking water in 1986.

6 'Water availability' is the amount of water that can be appropriated from a given point on a given stream for new out-of-stream consumptive uses (Cooper, 2003).

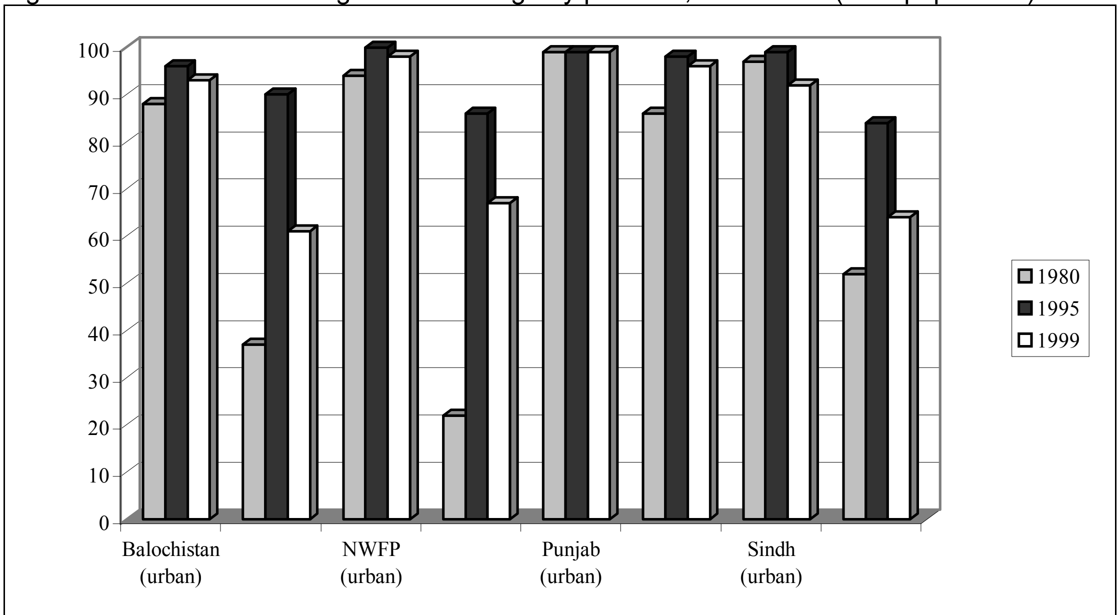
Table 2.1: Source and quality of drinking water, 1986 (% of the population)

Source	Quality	Balochistan	NWFP	Punjab	Sindh	Pakistan
Piped	Potable	18	45	12	3	16
Hand pumps	Potable	0	2	27	13	19
Hand pumps	Contaminated	0	2	27	13	19
Other	Contaminated	82	51	34	71	46

Source: Pasha and McGarry (1989)

Little has changed in the relatively unfavourable situation of Pakistan's largest (but least populated) province. In Sindh and Balochistan, 62% of the area is underlain with groundwater displaying Total Dissolved Solids (TDS) of more than 3,000 which is extremely hazardous (Kahlown, 2004). A TDS value of 80-420mg/l is seen as the acceptable range for human consumption. Access to safe drinking water has been the poorest in Balochistan since 1980. However, if rural and urban areas are examined separately, rural NWFP displays even thinner coverage until the mid-1990s (Figure 2.2)[7]. There is a considerable gap between the coverage of safe drinking water in urban and rural areas. A notable feature of Figure 2.2 is the drop in coverage of safe drinking water in all provinces, and in rural and urban areas, since the mid-1995s.

Figure 2.2: Safe drinking water coverage by province, 1980-1999 (% of population)



Source: IDC (2002)

Notes: The figures to the right of the urban data are rural data for the same province.
Zaidi (1997) points out that the high coverage of the population with safe drinking water in Punjab seems to be an over-representation as a large number of the schemes are not operating.

Pakistan is highly dependent on irrigation for its agricultural production. There is, however, considerable regional inequality in the distribution of water for food production. Almost all of the cultivated area in Punjab, as compared to half of it in NWFP, 37% in Sindh, and 58% in Balochistan, received irrigation in 2002-2003 (Ministry of Food Agriculture & Livestock, 2004). These shares

7 Zaidi (1997) stresses the lack of comparable statistics on access to safe water in Pakistan due to inconsistent definitions and resulting methodologies. Therefore, in the following, the focus is on qualitative statements and changes in access to safe water rather than on exact percentages.

were similar in 1979-80 apart from a major increase in the share of irrigated area of Punjab (Ministry of Food Agriculture & Livestock, 1996). Zaidi (1999) also notes that the tube-well development crucial for irrigation during the Green Revolution was highly concentrated in Punjab.

Within provinces, it is possible to identify considerable regional difference in the distribution between irrigation users at the head and in the tail end of the canal command. Within a watercourse command, water delivered to the head farmers is generally 32% and 11% more than to the farmers at the tail and middle reaches, respectively (Afzal, 1996). Similarly, minor or distributory canals receive different amounts of water. In view of the shortage of canal water in the country, the regions at the tail-end of the canal system are therefore at a disadvantage in adopting new crop varieties and adjusting crop patterns. Farmers in Sindh are particularly adversely affected as they are located at the tail-end of the canal distributory system and they cannot make use of the groundwater due to its salinity (Khan, 1999a). Illegal pumping from canals and excessive losses add to the inequity in the distribution (Afzal, 1996).

2.2 Socio-economic disparities

As Table 2.2 shows, urban areas in Pakistan benefit the most due to better-developed public institutions for, and more investment in, the provision of water supply.

Table 2.2: Safe drinking water coverage in Pakistan, 1980-2000 (% of the population)

	Rural	Urban	Total
1980	70	98	80
1991	80	96	84
2000	84	96	88

Source: IDC (2002)

However, it is mainly the upper income groups that benefit from such public provision (Federal Bureau of Statistics, 2002). For example, in Karachi, the variation of daily water consumption ranges from 336 litres per day *per capita* in high income areas to 63 litres in slum areas (Khan, 2002). The poor communities depend to a large degree on the private sector (Rafiq, 1999). Studies show that the urban poor pay high prices for water supplies and spend a high proportion of their income on water. Flat rates for the affluent areas are as low as Rs. 35-150 per month as opposed to up to Rs. 500 per tanker charged by private vendors (Khan, 2002).

Regarding the provision of sanitation, although 95% of all urban households have toilets (Federal Bureau of Statistics, 2002), it is mainly the poorest urban households, which cannot afford them or are resident in temporary dwelling units, where neither owners nor dwellers find it worthwhile to install latrines (Qutub, 2004). In rural areas, modern sanitation is uncommon and 59% of all rural households have no toilets. Again, access is biased towards richer households (Federal Bureau of Statistics, 2002).

The availability of water for food production also varies by socio-economic group. In the past, it has been argued that due to the unavailability of water for small farmers as the crucial input, the Green Revolution actually caused increases in relative poverty (Zaidi, 1999). It is still the case today that today the distribution of irrigation water discriminates against small farmers because of the unequal power of small and large landowners in the villages (Khan, 1999a). The impacts of water-logging and salinisation also have a socio-economic dimension, affecting farmers with small landholdings most (Rafiq, 1999).

2.3 Gender dimensions

Women can be regarded as the world's "unofficial water managers" (Seaforth, 2004), implying that their crucial contribution to water supply and management is rarely acknowledged. This also holds true in the Pakistani context.

Many of women's domestic work routines include water-related tasks, such as cleaning the house, household sanitation, washing clothes, and last but not least fetching water, often from distant places. This is despite the socio-cultural restriction of women's movement in the context of *purdah* (the practice of female seclusion (ADB, 2000). However, they are almost never represented in management schemes for domestic water supply and sanitation. Khan (1998) reports women to be included in decision-making in only two out of 35 rural water supply schemes (RWSS) studied.
In the context of irrigation, men are seen to best represent the water-related interests and needs of the household, and the congruence of interests between men and women is assumed. In much of the South Asian context, these assumptions are not valid. 66% of all female work in Pakistan is in agriculture (Federal Bureau of Statistics, 2003). Using irrigation water is not confined to men; women also use it both for productive and domestic purposes. Livestock is an important source of food and income for the farmers, and its water-intensive management is largely the responsibility of women (Noreen, 1999, quoted in Iqbal and Alam, 2000). However, evidence from water user associations (WUAs) in South Asia shows that women's participation in these organisations is much lower than men's: in Pakistan's case it is as low as 0% (Meinzen-Dick and Zwarteveen, 1997). One of the reasons is that only a negligible number of women have a legal claim on the land and hence on water, as water is allocated according to landholdings (Noreen, 1999, quoted in Iqbal and Alam, 2000).

3. Policy matters: Water-related policies and interventions

This section outlines selected water-related policy interventions that have had and continue to have a significant (whether positive or negative) impact on human development in Pakistan. This impact will be studied in section 6.

According to Hasan (2003), the following components of water plans in Pakistan can be distinguished. They are rural and urban water supply and sanitation, irrigation and related drainage, and finally the development of water sources and storage.

3.1 Water supply and sanitation schemes

In the areas of domestic water supply in Pakistan, the past two decades were characterised by a move towards more participatory and privatised approaches to rights to water and the provision of water-related services, respectively.

Under the Social Action Programme (SAP), introduced by the government in 1993-94, a uniform policy was developed by each of the provincial and area governments that called for the involvement of user communities in rural water and sanitation services. According to the policy, rural water supply and sanitation schemes were being prepared in consultation with user groups who were required to take over the operation and maintenance (O&M) of these schemes after completion (Ministry of Water and Power, 2002).

In urban areas, there is so far hardly any involvement of communities or the private sector in development and management of water supply and sanitation facilities (Ministry of Water and Power, 2002). This might change in the near future. The Ten Year Perspective Plan (2001-2011) mentions the privatisation of water distribution in selected large cities as an answer to low recoveries of user charges (Qutub, 2004). The commitments Pakistan has made under its World Trade Organisation (WTO) membership add further pressure to privatise. The European Community (EC) demands unrestricted access of foreign private suppliers of water distribution services to Pakistan under the WTO's General Agreement on Trade in Services (GATS) (EC, 2000). Although the Government of Pakistan has not made any commitment on privatising the water sector in the context of the GATS, the Government's Privatisation Commission mentions ground and surface water resources as a potential target sector for future privatisation (Privatisation Commission, 2004; Ministry of Water and Power, 2002).

The Devolution Plan, launched by the Pakistan Government in 2001, established elected local governments. Since then, the district governments headed by the district *Nazims* are responsible for the planning, investment, and control of municipal services including water supply and sanitation (Ministry of Water and Power, 2002).

Currently, Pakistan is developing a National Water Policy. The Draft National Water Policy prioritises access to water to meet domestic water demand. It also envisions the reduction of public spending in urban and rural domestic water through effective and enforced charges for water services. The draft policy sees a greater role for private sector involvement in the provision of urban and rural water supply (Ministry of Water and Power, 2002). On an operational level, the goals for the rural and urban water supply sectors as defined in the Ten Year Perspective Plan (2001-2011) include an increase in the provision of safe drinking water from 53 to 75% of the rural and from 83 to 96% of the urban population by the year 2011 (Ministry of Water and Power, 2002). Despite these ambitious objectives, the funds allocated to achieve these goals are modest. About 3% of the Public Sector Development Programme is allocated to their implementation, compared to about 20% of investment in the area of power generation (Ministry of Water and Power, 2002).

3.2 Irrigation management

Similar to the areas of water supply and sanitation, irrigation management saw a shift towards more participatory and privatised approaches during the 1980s and 1990s. In 1979, the Pakistan government introduced a Revised Action Programme (RAP) for irrigated agriculture. Rather than building more dams, the Action Programme concentrated on saving water and reducing drainage problems. Amongst other sub-projects, the On-Farm Water Management (OFWM) Project was undertaken to support the RAP objectives (Weaving, 1996). With it, private involvement in water resource development and management started. In 1982, the Water User Ordinance enabled the formation of WUAs for participation in water management at the watercourse level. In Punjab, NWFP, and Balochistan, owners, tenants, and renters were eligible to become members of WUAs. In Sindh, membership was open to those who owned or possessed agricultural land (Jan and Saleemi, 1996).

By 1992, it had become clear that the RAP was not resolving the overriding problems of the irrigation system. Two years later, the government and the World Bank agreed to replace the RAP strategy with a far-reaching approach, which was decentralising responsibility for irrigation O&M, and financing to a combination of farmers' groups and public utilities (Weaving, 1996). Such stakeholder participation in the O&M of irrigation systems has been introduced as the institutional reform component of the National Drainage Programme (NDP). Other components included drainage sector planning and implementation. In 1995, the Government of Pakistan decided to decentralise the O&M of the irrigation and drainage system and started institutional reforms aimed at the establishment of autonomous organisations. The institutional reforms launched in 1998 entailed that Provincial Irrigation Departments be transformed into autonomous, self-accounting and self-financing Provincial Irrigation and Drainage Authorities (PIDAs) (INPIM, 2004). Under the new law, PIDAs are required to operate and maintain the irrigation and drainage system through the formation of Area Water Boards (AWBs) responsible for managing the irrigation and drainage system. AWBs are again comprised of farmers' organisations (FOs) (Rafiq, 1999). These irrigation reforms make farmers responsible for the management of O&M and the collection and allocation of water revenues.

Similar to the recommendations regarding domestic water supply, the Draft National Water Policy foresees reduced public spending on the provision of irrigation through cost sharing and irrigation-management transfer. It also aims at improving agricultural efficiency and productivity per unit of water in order to meet Pakistan's growing food requirements (Ministry of Water and Power, 2002).

3.3 Water storage projects

The third area of water interventions comprises projects for water storage. A series of large water storage projects, including the Warsak, Mangla, and Tarbela dams, was developed in the 1960s and 1970s. However, big water-related infrastructure projects have been initiated during the past twenty years, *e.g.* the Left and Right Bank Outfall Drain (LBOD and RBOD) and the Greater Thal Canal. The construction of the Kalabagh Dam has been under consideration since 1953 and remains a highly disputed project.

The Draft National Water Policy mentions the promotion of hydropower schemes, in particular regarding the Northern run-off-river schemes to be one of its objectives. Through the Water and Power Development Authority (WAPDA), the Pakistan Government launched the water resource and hydropower development plan "Vision 2025". According to this plan, 26m^3 billion (21 MAF) of new storage capacity is planned between 2005 and 2025 with a total budget of USD 50 billion over the next 20 years (Ministry of Water and Power, 2002).

4. Environment matters: Water-related natural disasters and water pollution

In addition to policy interventions such as the ones described in the previous section, natural disasters and environmental degradation have a key impact on access to water. This section in particular highlights the role of floods, droughts, and water pollution in Pakistan. Their impact on human development in Pakistan will be analysed in section 5.

The natural environment can broadly be categorised as encompassing natural, physical, chemical, and socio-cultural aspects (Bradley, Stephens, Harpham and Cairncross, 1992). As far as water-related issues are concerned, floods and droughts may be subsumed under natural features. Chemical aspects are, for example, organic and inorganic water pollution. Finally, sanitation, and sewage are socio-cultural aspects of the environment. This section makes use of these categories to highlight environmental factors relevant for the interface between water and human development in Pakistan.

4.1 Natural aspects: The role of droughts and floods

The probability of floods in Pakistan is high (0.66) as compared to drought (less than 0.1) (WFP and SDPI, 2004). Floods are defined as a general and temporary condition of partial or complete inundation of normally dry land area or property from overflow of inland or tidal waters, unusual and rapid accumulation or runoff of surface waters from any source, or mudflow (FEMA, 2004). During the past 50 years, a third of all natural disasters that hit the country were floods (WFP and SDPI, 2004). Their occurrence has increased due to climate change and – more importantly - deforestation of the Himalaya as noted in section 1.2. Between 1990 and 2000 alone, Pakistan's natural forest cover has declined by 33% (WRI, 2003a). Seven of the ten worst floods during the past century took place during the past 25 years (Mirza and Ahmed, 2003). Ahmad, Bari and Muhammed (2003) observe higher peak discharges for the Chenab, the Ravi[8], and the Sutlej rivers in the period between 1961-1990 than during 1931-1960.

The magnitude of the area inundated is especially large in the lower Indus basin. Damage is also significant in urban areas (Ahmad, Bari and Muhammed, 2003). In 1992, for example, Punjab and Sindh experienced devastating floods due to the unwarranted passage of millions of cusecs of water from the Mangla Dam. It affected more than 13,000 villages (Mirza and Ahmed, 2003). Another major flood hit the country in 1996 (Gadi, 2003).

Besides floods, Pakistan also has undergone severe droughts. Despite their less frequent occurrence as compared to floods, they commonly last over a longer period and affect larger geographical areas (Sheikh, 2001). Droughts have several dimensions. Agricultural drought is defined as a reduction in moisture availability below the optimum level required by a crop during different stages of its growth cycle, resulting in impaired growth and reduced yields. Social drought relates to the direct and indirect impact of drought on human activities (Benson and Clay, 1998).

Similar to floods, the incidence of drought has increased in recent years. They occur in four out of ten instead of three out of ten years. One of the reasons given for the more frequent occurrence is climate change (Roy and Ghosh, 2003).

The years 1997 to 2001 were exceptionally dry. During that period, precipitation over most of the country was less than 50% of normal, causing severe losses to agricultural production (Kahlown and Majeed, 2002). Major crops, *i.e.* wheat, cotton, and rice, recorded a negative growth of almost 10%; overall agricultural growth was recorded at a negative 2.6% during 2000-2001 (Ahmad, Bari and Muhammed, 2003). Balochistan, parts of Sindh, and Cholistan in Punjab were particularly affected (Figure 4.1). Stock water ponds in were completely dried in certain areas of the Cholistan and Thar deserts, adversely affecting livestock (Ahmad, Bari and Muhammed, 2003).

8 In the high discharge category.

Figure 4.1: Drought at the end of June 2000

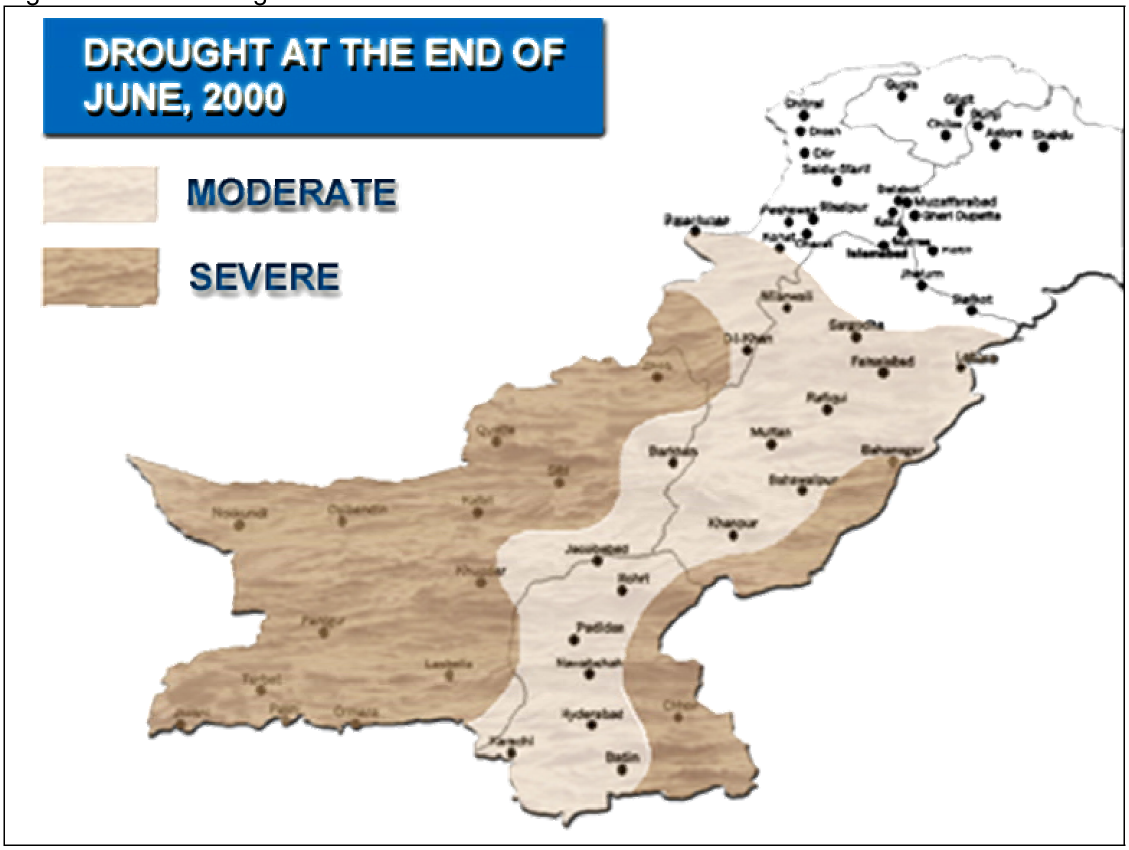


Table 4.1: Drought losses of Pakistan by province (number of districts affected)

Decline in vegetation	Status	Punjab	Sindh	NWFP	Balochistan
>50%	Severely affected	-	1	3	17
30-50%	Highly affected	3	4	4	6
20-30%	Less affected	4	6	3	1
Up to 20%	Affected	27	6	14	2
0	Not affected	-	-	-	-
Total		34	17	24	26

Sources: WFP and SDPI (2004)

4.2 The role of environmental degradation: socio-cultural and chemical aspects

Besides natural disasters, the environment has been deteriorating in Pakistan through human intervention. Water pollution has three main sources: domestic sewage, industrial discharges, and agrichemical pollution.

In Pakistan, municipal sewage is a major source of water pollution. About 13 million wet tonnes of excreta are generated per year, resulting in bacterial contamination. In the urban sector alone, about 2 million wet tonnes of human excreta are produced annually, of which around 50% go into water bodies to pollute them (Rafiq, 1999). Sewage treatment plants exist only in Karachi, Islamabad, Faisalabad, Peshawar, and a few military cantonments. Even these few plants have not been upgraded during the past two decades (Qutub, 2004). Lahore puts much of its untreated municipal sewage into the river Ravi, which is used for potable water supply and for irrigation further downstream. Quetta's municipal wastewater is conveyed to a watercourse from which it is pumped to irrigate vegetables (Kahlown, 2004). According to the 1998-99 Pakistan Integrated Household Survey (PIHS), 44% of Pakistan's urban population is provided with underground drains, *i.e.* in most urban areas, waste-water is disposed through open drains. Some 10-30% of such sewage either remains in the streets or is discharged into water bodies. Drinking water supply lines and open sewage drains often are laid side by side in the streets. This results in frequent water contamination when pipes erode (WWF, no date).

Solid waste is another source of water pollution. In Pakistan, an average of 50,000 metric tonnes of solid waste is generated every day. Municipalities collect only 60% of this waste. Poor areas of the cities are generally the worst served by garbage collection services or not served at all. Adding to that, the solid waste collected in the upper and middle class areas of cities is often dumped in the slums and city peripheries, either in landfills or directly in watercourses. Compounding the problem is the fact that there is a chronic lack of health facilities to deal with the effects of water pollution. The absence of adequate nutrition, lack of education and overcrowded houses increase vulnerability to diseases (Khan, 2002).

The major industrial sources of water pollution in Pakistan are chemical-production, (including fertiliser and pesticides), textiles, pharmaceuticals, tanneries, cement, electrical equipment, glass and ceramics, pulp and paper board, and petroleum refinery. Industries do not control waste-water effluents through process control, waste recycling, or end-of-pipe treatment. Untreated industrial wastewater containing toxic chemicals is thus disposed into nearby open land, drains, canals or rivers, from where the chemicals seep into the ground water. The industrial centres of Lahore, Faisalabad, Karachi, and Sialkot contribute major pollution loads into their water bodies. Saleemi (1993) shows that in Pakistan, around 9,000 million gallons of wastewater - having 20,000 tonnes of biochemical oxygen demand (BOD)[9] loading - are discharged daily into water bodies from the industrial sector. A survey conducted by the Federal Environmental Protection Agency (EPA) shows that tanneries located in Kasur and Sialkot were discharging effluents with chrome concentrations between 188-222mg/l against standards of 1mg/l prescribed in the National Environmental Quality Standards (NEQS).

In addition to the pollution of surface water, groundwater pollution near industrial plants is another area of concern, as industrial wastes are discharged directly into streams and drains or onto the ground. Groundwater pollution is often permanent, in that it may take hundreds or even thousands of years for pollutants such as toxic metals from tanneries or electroplating industries to be flushed out of a contaminated aquifer (Rafiq, 1999).

9 Biochemical oxygen demand (BOD) is a measure of how much oxygen is required to biologically decompose organic matter in the water. It measures the strength of wastewater discharges (Minnesota Technical Assistance Program, no date).

Box 4.1: Industrial water pollution in Pakistan

In Punjab, the Kala Shah Kaku industrial estate consists of chemical industries, tanneries, textile plants, steel re-rolling mills and others. These industries discharge effluents containing hydrochloric acid and high levels of organic matter into drains and streams discharging into the river Ravi. More than 250 industries in Faisalabad discharge high levels of solids, heavy metals, aromatic dyes, inorganic salts, and organic materials directly into the municipal sewers and open surface drains, ultimately also leading into the river Ravi. Discharges from the industries in the Sialkot area generally reach the Chenab river while those from Kasur, site of Pakistan's major tanneries, are disposed of through the Pandoki drain into the Sutlej river.

More than 6,000 units, or about 60% of the country's industries, are located along the coastal belt of the Sindh Industrial Trading Estate (SITE) and the Landhi Industrial Trading Estate (LITE). Most of these industries discharge their effluents untreated into the sewers or directly into the Lyari river, the Malir river, and adjacent creeks leading to the Arabian Sea. It is estimated that about 7m3 of effluents are discharged into the coastal waters of Karachi per day from industrial and municipal sources: these contain heavy metals and their compounds, detergents, lubricating oils, chlorine, and various organic and inorganic toxic compounds.

In the NWFP industrial cluster around Peshawar, out of 40 units, only two have waste-water treatment facilities. Others discharge their effluents into lakes and tributaries of the Indus river, mainly the Kabul river. The adverse effects of receiving such water bodies for domestic purposes have been identified, especially those originating from leather tanning operations.

Source: Rafiq (1999)

Especially in the northern half of the country, agricultural drainage poses a real problem. Currently, most of the effluents are directly discharged into canals, rivers, or evaporation ponds, which are not environmentally safe. The contamination of water sources has increased with the excessive use of chemical fertilisers and pesticides. From 1980 to 1997, pesticide consumption increased 67-fold. During the same period, the consumption of chemical fertilisers rose by 136% (Khan, 2002).

Table 4.2: Water pollution control legislation in Pakistan

Legislation	Enforcing Agency	Offence
Pakistan Penal Code 1860	Provincial government	Fouling a public spring or reservoir
Factories Act 1934	Ministry of Industries	Disposing untreated industrial waste in water bodies
Punjab Local Government Ordinance 1979	Punjab Government	Polluting a water supply source for human consumption
Sindh Fisheries Ordinance 1980	Sindh Government Fisheries Department	Discharging untreated sewage and industrial waste in water.
Balochistan Water and Sanitation Ordinance 1988	Water and Sanitation Authority	Discharging unlicensed industrial waster water into sanitation or water systems
Canal and Drainage Act	Provincial Governments	Fouling of Canal Water
Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) Regulation 2000	Pakistan Environmental Protection Agency (EPA)	Makes EIAs mandatory

Sources: Khan (2002), Rehman (1994)

Table 4.2 makes it clear that environmental legislation to sanction water pollution does exist in Pakistan. Apart from the laws listed, a more recent example of relevant environmental regulation are the abovementioned NEQS. These were enacted in 1993, and delineate allowable limits for 32 pollutants in effluents and industrial discharges along with other limits.

5. The human development impact of natural hazards and water pollution in Pakistan

This section assesses the human development impact of the environmental factors outlined in the previous section. It addresses the question of how human health and productive activities, especially in agriculture, have been affected by floods, droughts, and water pollution.

5.1 The human development impact of natural hazards

As outlined in section 4.1, natural hazards have seriously affected the Pakistani population. Since independence, the cumulative financial loss through floods has been estimated at around Rs. 110 billion, besides the loss of more than 6,500 lives (Ahmad, Bari and Muhammed, 2003). In urban areas, the poor are more vulnerable to flooding. They tend to settle in the low lying urban areas, which are affordable but flood-prone (Khan, 2002). Displacement through floods has significant health implications, with diseases such as cholera and dysentery becoming rampant in temporary shelters and camps (Ahmad, Bari and Muhammed, 2003). In rural areas, flooding has destroyed farmhouses, damaged crops, and buried topsoil under infertile sediment, thus hurting agricultural production. Thus, apart from the directly negative effect on human health and life, floods have also severely affected income-generating activities and thus sources of livelihood. As a result of the floods in 1992 alone, about 5,000 people were either killed or reported missing, and the state suffered a loss of USD 2 billion. Agricultural growth was rendered negative for 1992-1993 (Ahmad, Bari and Muhammed, 2003). In Punjab alone, approximately 880,000 acres of cotton crop (20-50% of the total crop) were destroyed. The floods of 1996 killed 134 people and led to an estimated loss of Rs. 19.8 billion to property and livestock (Gadi, no date).

Table 5.1: Human impact of flood in Pakistan, 1980s and 1990s

Year	Property Damaged (Rs. million)	Lives Lost	Villages Affected
1978	51,489	393	9,199
1988	25,630	508	1,000
1992	69,580	1,008	13,208
1995	8,698	591	6,852
2001	450	219	50

Source: Ministry of Water and Power (2004)

Despite the construction of flood protection embankments, *e.g.* in the context of the Second Flood Protection Sector Project, which started in 2000, (Ministry of Water and Power, 2002), over-bank flooding remains a major problem. Semple (2003) emphasises that the process whereby a given natural hazard, such as flooding, translates into a disaster involving loss of life and the destruction of livelihoods is essentially a political one. A key aspect in the politics of flood vulnerability is the notion that there are winners and losers in flood management, but that frequently there is no process for the winners to compensate the losers. The losers in flood management are typically the weakest, poorest, and under-represented inhabitants of flood-prone areas. They are systematically lacking in the means to articulate their interests in the politics of flood management and too often find that flood management for the rich means increased vulnerability for the poor.

Severe droughts result in nutritional stress, higher morbidity, and possibly, higher mortality (*i.e.* social drought). The economic impact of drought is largely felt via its effect on agricultural sector (*i.e.* agricultural drought). This is also shown by a substantial percentage decline in GDP during the recent drought, which led to losses in agricultural produce and employment opportunities and the widespread sale of assets by the people.

More than 3.3 million people in Pakistan were affected by the 1999-2001 drought described in section 4.1 (Ahmad, Bari and Muhammed, 2003). According to estimates, between November 1999 and July 2000, 143 people and 2.48 million livestock died as a result of damage to agriculture. Thousands became environmental refugees. The loss was most pronounced in the arid areas of Balochistan and Sindh. Women and girls had to travel much longer distances to fetch water for household consumption (WFP and SDPI, 2004). Other effects included increased incidence of malnutrition, diarrhoea, respiratory infections, measles and malaria as well as school drop-outs, and permanent dislocation of families (Kahlown and Majeed, 2002). Overall, the climatic condition resulted in a rise in the poverty head count index (HCI) from 30.6% in 1998-1999 to an estimated 32.1% in 2000 (Ministry of Finance, 2004).

Box 5.1: The human development impact of drought on Balochistan, 1998-2001

Twenty-two of Balochistan's 26 districts were declared drought-affected areas in 2000. Among these, seven were declared worse affected. As compared to the pre-drought year 1997-98, production of field and horticultural crops dropped between 19-55% and 24-37%, respectively, during the years 1998-2001. About half of all sheep and more than a third of all of goats were lost due to the drought. The complete lack of rainfall from 1999-2000 led to increased groundwater mining through the installation of tubewells. As a result, the groundwater table has been falling by up to 3m annually in the drought-affected districts. More than half the population in the worst affected districts of Balochistan was badly affected in terms of food availability. Milk, butter, and sometimes even water were not available during the drought. 5% of the families in Kharan district reported having nothing to eat.

Source: Ahmad, Bari and Muhammed (2003)

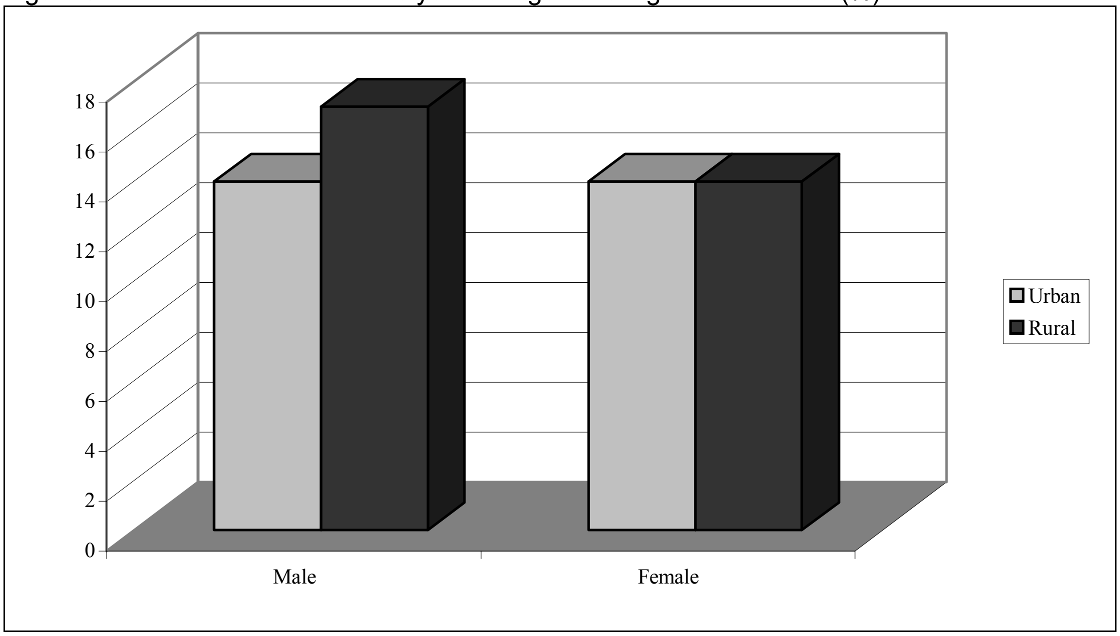
5.2 The human development impact of water pollution

The link between water pollution and human health is crucial. Water-related diseases[10] are among the most common causes of illness and death, affecting mainly the poor in developing countries.

In Pakistan, 25-30% of all hospital admissions are connected to water-borne bacterial and parasitic conditions, with 60% of infant deaths caused by water infections (Memon, 2004). The most common water-related diseases in Pakistan are diarrhoea, cholera, typhoid, hepatitis, and dysentery, kidney stones, malaria, and skin diseases (Khan, 2002). According to some estimates, more than 10,000 people die annually of renal infection due to polluted water. The diarrhoea rate in Pakistan is the second highest amongst 31 Asian countries. One third of under-five deaths are owing to diarrhoea (Qutub, 2004).

10 Water-borne diseases causing gastro-intestinal illness (including diarrhoea) are caused by drinking contaminated water. Vector-borne diseases, such as malaria, are passed on by the insects and snails that breed in aquatic ecosystems; water-washed diseases, *e.g.* scabies and trachoma, originate from bacteria or parasites that take hold when there is insufficient water for basic hygiene (WWAP, 2003).

Figure 5.1: Children under five years of age suffering from diarrhoea (%)



Source: Butt and Toor (2001)

In rural areas, the supply of water through hand pumps rather than through pipes results in a higher incidence of diarrhoea (Figure 5.1). Figure 5.1 also highlights a gender dimension in water-borne diseases, including diarrhoea. A higher prevalence of diarrhoea is found in boys. Van der Hoek, Feenstra and Konradsen (2002) relate similar finding to the less restricted mobility for boys than for girls, increasing risks of infection.

In Pakistan, the source of most water-related diseases is human excrement. As stated in section 4.2, major cities dispose of untreated sewage into the irrigation system, where waste water is reused without any consideration of river's assimilative capacity. The impact of such unsafe water supply and sanitation is mostly felt by the marginalized. Older parts of cities are more prone to in-migration. There, sewage infrastructure is both poorly designed and corroded, which results in mixing raw sewage and drinking water. Thus, even piped drinking water in poor urban localities is highly contaminated. In many cases of poor urban settlements, no piped water is available. Residents have to resort to using groundwater that often contains bacterial and chemical impurities, as does the surface water used for drinking and washing (Khan, 2002).

Many people lack awareness about the link between water supply and sanitation arrangements and human health (Qutub, 2004). One important reason is that behavioural change has not been a focus of the various government and donor interventions (Arshad, 2004). Khan *et al*. (1996) find that even in the most sustainable water supply schemes they investigated, users lack a sense of basic hygiene. Change can, however, be catalysed if, on the one hand the communities feel a need for alternative practices and, on the other, role models are available. For example, in the BUSTI programme for the installation of soak pits in slums in Karachi, the key to the success of the project was that the community wanted some form of sanitation as the past problems with bucket latrines had encouraged people to pay for better forms of sanitation. Twenty percent of the houses already had soak pits. Women played a major role as it soon became clear that the soak pits would only be used properly and maintained if women and children were taught how to use them. Therefore, females from the community were trained to give primary health education to children in their homes. The fact that the programmes' health components were run by women for women led to snowball effects in spreading health education in the community (Pasha and McGarry, 1989).

As mentioned above, in rural areas, large shares of the population depend on surface sources, such as irrigation canals, for domestic water use. Due to periodic canal closures for maintenance, the population is forced to find ways to store water for longer periods. The quantity and quality of water provision through water tanks therefore becomes an issue (Waheed-uz-Zaman, 2000). When families have to store water for an uncertain period of time, they will impose restrictions on its use. Water for personal and household hygiene is the first to be restricted, in order to maintain drinking water supplies. The availability of water for hygienic purposes is a key factor in interrupting the transmission of water-related diseases including diarrhoea.

The large quantities of water that can be made available by irrigation systems can be an important advantage to health (Jensen, van der Hoek, Konradsen and Jehangir, 1998). This has been confirmed by Van der Hoek, Feenstra and Konradsen (2002) in research in an area of Southern Punjab where people depend on irrigation water for all their domestic needs. The study assessed whether the availability of water for domestic use had impacts on the nutritional status of children. The results show that children from households with a large water storage capacity in the house had a much lower prevalence of diarrhoea and stunting than children from families without this facility. An increased quantity of water for domestic use and toilet facilities turned out to be important interventions for reducing the burden of diarrhoea and malnutrition. These findings highlight the importance of non-irrigation and non-agricultural uses of irrigation water and, thus, of an integrated rather than a sectoral approach to water management.

Similar to the impact of municipal sewage, the water pollution induced by industrial clusters, as sketched in section 4.2, has been a threat to human development in the form of human health and productivity in Pakistan. Villagers living on the banks of the Kabul river have been complaining of the prevalence of skin diseases in people, maladies in livestock, reduced crop yields in the areas irrigated by the polluted water, decline in fish catches, and periodic killing of fish due to toxic effluent discharges from nearby industries (Khwaja, 2003).

Along the coast of Sindh, industrial pollution and mangrove destruction and over-fishing have resulted in a sharp decrease in shrimp production, which translates into lower earnings. This damages the fisheries and threatens fishing communities' livelihoods.

This is partly due to the improper implementation and enforcement of environmental regulation, such as NEQS, and to the lack of resources, equipment and skilled staff, as well as training and monitoring programmes (INPIM, 2004).

The gender division of work regarding water management outlined above (section 2.3) bears special health consequences for women and girls, especially in rural areas of Pakistan. The fact that it is mainly women and girls who carry water from sources outside the home has a negative impact on the female skeletal system. Carrying heavy pots of water may lead to spinal injuries, pelvic deformities, and chronic fatigue. It may also induce premature births, spontaneous abortions or a prolapsed uterus and is of great concern during pregnancy. Travelling long distances, especially carrying heavy loads of water, utilises a large number of calories. This, coupled with a poor diet, can lead to anaemia and malnourishment and affects not only women's health but also that of the children she might bear (Seaforth, 2004). The scattered evidence available from Pakistan mirrors these health risks. In the Rahuki canal command area, women, especially those who were middle aged and responsible for fetching water, complained about pains in the neck and shoulders. Common diseases reported were diarrhoea, tuberculosis, hepatitis, still births, miscarriages, and thyroid, skin and eye problems. Women attributed many of these health problems to water (Nizamani, Rauf and Khoso, 1998).

In summary, water-related aspects of the environment have had the following impacts on human development in Pakistan:

- Through dislocation: Natural hazards forced people migrate due to floods and droughts.
- Through health deterioration: Water pollution increases the prevalence of diseases such as diarrhoea, dysentery, and malaria.
- Through economic losses: Natural hazards as well as health deterioration imply economic losses, for example, through loss of human productivity and negative effects on crops and livestock.

Although water-related environmental factors such as natural hazards and water pollution figure prominently across the country, its impact is predominantly on the poor. This is a result of the skewed distribution of amongst other things, sewage, sanitation and piped water facilities. Poor people are more prone to adverse health impacts because of their inadequate nutrition, unhygienic living conditions, lack of access to health facilities, and greater exposure to polluted water. This bias thus contributes to a vicious circle of poverty.

6. Poverty and inequality implications of water policies in Pakistan

Pakistan's official poverty line signifies a person as poor if he or she falls below the bracket of Rs. 750 per capita per month (Ministry of Finance, 2004).

Table 6.1: Poverty in Pakistan, 1979-1999 (%)

Year	Rural HCI	Urban HCI
1979	32.51	25.94
1984-85	25.87	21.17
1990-91	18.32	18.64
1993-94	23.91	13.58
1998-99	25.98	19.13

Source: Ahmad, Bari and Muhammed (2003)

As Table 6.1 shows, poverty as measured by the 'head count index' (HCI) declined both in rural and urban areas of the country until the beginning of the 1990s, and then increased again. Inequality has increased throughout the 1990s, with the Gini index rising from 31.2% in 1996-1997 to 33% in 1999, but data sources are scarce (World Bank, 2004; JICA, 2003) This section analyses the implications of the policies outlined above for poverty and inequality as core aspects of the impact on human development. Because existing studies hardly address this question, the section gathers the scattered evidence available. It uses in particular the success or failure of the participatory approach in water management outlined in section 3.2 as a proxy for its impact on human development.

6.1 Impact of water supply and sanitation schemes

It is unclear whether the transfer of water supply schemes to communities in the context of the SAP has improved access to water supply. Estimates of coverage derived from design parameters of the SAP are assumed to be a poor indicator of actual coverage as many schemes do not service the entire population of the settlements for which they were designed. Numerous surveys have also found that the coverage figures mask the poor quality of the water supplied (Systems Limited, 1996). Khan *et al.* (1996) conducted a survey on the sustainability of water supply schemes in rural Punjab. In all cases, only 50% or less of the female group respondents were satisfied with the current level of services. Male group respondents were more satisfied with the quality of water supply and less with its quantity. However, the majority of both female and male groups were satisfied with the performance of water user groups.

Zaidi (1997) highlights the fact that some of the schemes had been handed over to the communities despite their resistance to the idea, based on the belief that a government agency rather than village water committees would be a better manager of a water supply scheme. Schemes were constructed with little social sensitivity for the needs of the rural communities. The resulting inappropriate design of the schemes was identified as a main reason why the scheme handover to communities has failed. The drop in coverage with safe drinking water in all provinces from 1995 to 1999 (Figure 2.2) does not indicate an improvement during the period of SAP implementation.

In their assessment of factors for (un-)sustainability of the scheme transfer, Khan *et al.* (1996) report that in a number of cases, manipulation of the scheme through local influential people appears to have caused the failure of the scheme. Despite the formal responsibility of the District Development Advisory Committees (DDACs) for the identification of potential water supply schemes, elected, prospective, and defeated members of the provincial parliament often influenced the implementation of water supply schemes based on political expediency rather than on the basis of needs.

In Punjab, political intervention was seen as a major reason for the failure of participatory schemes. Community-based organisations would be formed by friends of the local politicians. In NWFP, as a result of both the low tariff levels and poor collections, resources were diverted to those who could muster political support, thereby leaving some segments of the population, particularly the marginalized, without services. Similar findings were made during evaluations of the SAP in Balochistan (Systems Limited, 1996).

In some cases, awareness of the participatory approach was lacking. Although infrastructure had been set up, community mobilisation efforts had not been undertaken (Systems Limited, 1996). In a majority of the cases investigated by Khan *et al*. (1996), the communities had been informed of the imminent transfer. However, sufficient efforts were not made to make them willing and able partners in the transfer process. This is reflected in these communities' perceptions of scheme ownership. They - particularly the women's groups who are not included in the management of the water supply schemes - perceived ownership to be in the hands of notables.

A social-mobilisation orientation, as often found in the water supply schemes of non-governmental organisations (NGOs), *i.e.* a more a genuine concern for mobilising the community, has been found to be a success factor in RWSSs (Khan, 1998). For government agencies transferring RWSSs, it did not seem to matter that the formation of a community organisation or a water committee was done by working with the local notables in the community and that the general body of the community had little or no say in the decision making. Although it is much easier to approach a community via the local notables, doing so is likely to mean that the local notables will appropriate the major benefits of the scheme (Khan, 1998). Khan *et al*. (1996) conclude that "It is now generally accepted that to generate community involvement and ownership communities need to be involved right from the inception of the scheme. If this were done (…), social rather than engineering criteria may have been more important in site selection and scheme construction."

6.2 Effects of irrigation management schemes

During the period 1985-1999, the correlation between agricultural growth and the poverty headcount ratio was negative with the coefficient of correlation being -0.32 (Ahmad, Bari and Muhammed, 2003). This hints at the positive role for interventions that stimulate agricultural growth for poverty alleviation, especially in rural areas. In this section, the effects of some interventions in irrigation management on poverty and inequality will be assessed.

In irrigation management, Gill and Sampath (1992) find an overall increase in the inequality of irrigation distribution in the irrigated crop area between 1972-1980. They attribute the stronger increase in inequality in cultivated and net sown areas as compared to farm area in the same period to the impact of land reclamation and irrigation development schemes. Large farmers benefited more from these schemes than the others for two reasons. First, the reclaimed lands were mostly the uncultivated areas in the possession of large farmers. Secondly, the proportionality principle underlying the government-owned canal irrigation distribution, along with the inherent economies of scale involved in private tube-well development, contributed to increasing levels of inequality. They conclude that the major source of inequality in the irrigation distribution is essentially in terms of the inequality across farm size groups (Gill and Sampath, 1992).

Similar to the water supply and sanitation schemes, the effective participation in all stages of irrigation of the respective communities also appears to be a decisive factor for the success of the participatory irrigation schemes established under the OFWM and the NDP regarding sufficient and equitable availability of irrigation water. Despite the benefits of reduced system losses, increased food production, a shift towards higher value crops, and health benefits[11] of the OFWM in the project areas, vested interests and the prerequisites of project activities distorted the incentives to WUA participants.

More than 17,000 WUAs were formed in the context of the OFWM project. However, they remained effective only during the improvement of the watercourses. Thereafter, the WUAs ceased to function in any capacity. The reasons for this were, amongst others, the project's emphasis on meeting short-term physical targets rather than a longer-term concern with institutional strengthening of the WUAs and their development impact (Weaving, 1996).

The projects ignored traditional local watercourse committees. As a condition for granting large subsidies for renovation, they called for the creation of new water users' associations, which would assume responsibility for maintaining the rehabilitated watercourses. Some were merely token institutions, and many were traditional committees renamed in order to qualify for the subsidies. In feudal Sindh, with its large farms, the fact that most farm families cannot join water users' associations, because they are landless labourers or sharecroppers, made even the traditional committees superfluous and the formation of new associations often no more than an empty ritual.

However, Addison (1996) finds that on watercourses improved during the OFWM, farmers earned on average a net income of Rs. 21,901, while farmers on unimproved watercourses earned 22.6% less. Net farm income increase was higher on the tail portion of the improved versus unimproved watercourses, rather than in the head portion. This would support the view that the OFWM programme has redressed the claims of unequal distribution of water along the watercourses.

Employment for men has fallen significantly due to labour savings in irrigation management, whereas women's workload in the fields has increased due to the expansion in cropped areas.

Weaving (1996) summarises that while the projects helped to alleviate poverty through their effects on farm production, they also provided large and unnecessary transfers of public resources to some of the rural elite. Watercourse improvement was intended to benefit mainly small farmers. But this intention was unrealistic in

11 In Punjab in particular, lining of watercourses has reduced stagnant swampy areas caused by seepage and overflow, bringing health benefits. Villagers are reported to have less malaria and fewer flies. Women particularly appreciated the increased health benefits of improved watercourses (Weaving, 1996), presumably because of their role as care providers.

much of Sindh. The self-selection of water-courses led by well-connected farmers speeded implementation but resulted in many desperately poor areas being left out.

Findings from Waheed-uz-Zaman (2000) exemplify that farmers' awareness and active participation are prerequisites to appropriate the benefits of technical improvements in irrigation management. In the case of FOs in Southern Punjab, he identifies a more equitable water distribution between head and tail-enders of the canal. It has improved by forming FO committees that correct faulty outlets and perform several joint inspections of channels together with the PIDA. In this specific case, farmers were involved in the assessment of maintenance needs to participate in the review of the legal framework for FOs on the province of Punjab. This government-FO interface helped in developing the negotiation capacity of the FOs. It also increased the commitment of the higher levels of the PIDA to the participatory reforms.

In other cases where the social mobilization component was lacking in the process of forming WUAs and Water User Federations (WUFs), farmers were not aware of the importance of the WUAs and thus did not nominate suitable members for them. Resultantly, meetings were not held regularly at watercourse level. Information about the results of WUFs' meetings was not passed on to farmers. Similarly, in the same study area, the technical know-how passed on to presidents of WUAs in the research area through training was not found to be passed on to ordinary farmers. In some cases, farmers rejected the participatory management schemes as they assumed that local influential people, mostly landlords, dominated the WUAs (Iqbal and Alam, 2000).

The local elite may have a catalytic role in bringing forth the collective action needed for the participatory management of water schemes (Khan *et al*., 1996). However, in general they appear not to take on this role, presumably because of the lack of need. Studies find large landowners to be generally less cooperative in helping to clean and maintain the watercourses and more prone to factionalism. They also tend to more frequently violate sanctions as compared to smaller farmers. Cooperative efforts, *e.g.* for watercourse improvement, are more likely to be supported by farmers at the tail end of watercourses, since their potential gains are greater than those at the head (Gadi, 2003), stressing the role of need as a catalyst for collective action. The local elite's resources may contribute to increased inequality in access to irrigation water and its contribution to farm productivity and thus human development.

Jan and Saleemi (1996) note that the attitude of those responsible for implementing OFWM favoured large farmers. Despite the focus on poverty alleviation as explicitly spelled out in the OFWM programme, there was no focus on small farmers and tenants. Resultantly, the policy adversely affects equity as benefits were hijacked by large and influential farmers. Resources may be used to bribe officials, or influential farmers are found to plant mock orchards to lay claim on an increased share of water (UNDP, 2003; Iqbal and Alam, 2000). In addition, tariff subsidies favour the rich rather than the poor. In Pakistan, the highly subsidised rates for water are assumed to be the main cause for irrigation mismanagement. They result in the exclusion of the tail-end communities (Nizamani, Rauf and Khoso, 1998).

Gender inequality in access to water is affected by the sectoral approach to irrigation, focusing on the use of canal water for food production alone, while ignoring its multiple uses. Canal lining is promoted as a measure against seepage losses in the irrigation system. However, lined canals may hinder other uses of canal water if no countervailing measures are taken. For example, it is not possible for livestock to drink water from or bathe in the canals after lining (Weaving, 1996). Similarly, washing clothes in lined canals is not possible unless appropriate stairs are integrated in the canal (Iqbal and Alam, 2000). Both concerns are related to female tasks in production and reproduction. Given the lack of representation of women in participatory irrigation management, gender inequality is corroborated with negative effects on human development. Again – as emphasised in section 5 – an integrated approach to water management is called for.

Box 6.1: Water stress and poverty dynamics in the Rahuki canal command

It is estimated that out of the 13 million acres comprising the greater canal area in Sindh, at least one million - mostly owned by small and poor land-owning families - do not receive sufficient irrigation supplies. The situation is particularly distressing for communities that are dependent on surface irrigation flows for drinking and other domestic uses. The Rahuki irrigation canal draws its irrigation supplies from the Hyderabad branch canal of the Sukkur barrage irrigation system. Crop yields and returns in the lower tail of the Rahuki canal are much lower than in the head area, reflecting water scarcity. In recent years, water has completely disappeared from the last 40-45% of the canal command, due to excess use in the canal head area.

It is estimated that 17,000-18,000 persons in the Rahuki area faced water stress and that 8,000-10,000 have migrated due to water or irrigation shortage over the last three decades. In the canal area, such water stress induced large flows of environmental migration, with migration occurring in the last 45% of the canal, being most severe in the last 25% of the command area. The decision to migrate was particularly difficult for small landowners and the poor. Large landowners can sell land in one area and buy agricultural property in other canal areas, whereas small landowners do not have that option. The landless sharecroppers are worst affected: as land could not be cultivated for many years, the sharecroppers were denied subsistence credit from the landowners, thus pushing large numbers into unemployment.

Of the villagers facing severe water stress, women were hardest hit because of the long way they had to carry water. The distance they had to carry water from varied from two to ten kilometres. Most landless people had purchased donkeys and were engaged in bush cutting on the abandoned lands and roadsides, which barely brought any profit to them. In a situation where mobility of women is restricted by gender norms, female labour migration is difficult. Those unable to leave the village for employment had to depend on traditional crafts providing them with a meagre and irregular income. Being deprived of employment possibilities, women were also engaged in making coal from burning cut bushes.

Another survival strategy was selling land to brick kiln owners. Often soil was extracted until ground water appeared. Even with the improvement in the water flow poor farmers are likely to suffer as they lack the resources to reclaim their land. As a result, the socio-economic gap is widening due to the water scarcity faced.

Source: Nizamani, Rauf and Khoso (1998)

6.3 Water storage projects and their human development implications

More and more predictable energy supply is assumed to be an important contribution to human development. The second important argument in favour of large dams relates to food security through their beneficial impact on agricultural productivity (Khan, 1999b). The large hydropower projects initiated in Pakistan since the 1960s contributed to a “clean” and more stable energy supply of in the country. Hydropower accounts for 29% of Pakistan’s power generation capacity. The main purpose of large dams in Pakistan is irrigation, with hydropower generation as a by-product.

However, large dams to create large reservoirs also cause many development concerns. Large areas are submerged by the reservoir. Increases in cropping intensity and crop yields, however beneficial, have added to the already severe problems of water-logging and salinity in the past.

Populations are displaced, often with no or inappropriate compensation for the loss of land and livelihoods. Only scant data is available about the number of dislocations involved in the various projects. In case of the Tarbela Dam, about 96,000 people were affected by resettlement (Box 6.2). The Ghazi

Barotha Hydropower Project, completed in 2003, displaced 20,000 people. The total number of displaced persons due to the Chashma Right Bank Irrigation Project will amount to over 13,000 (Sungi, 2002). The dispute about the Kalabagh Dam to be built is - amongst other social and environmental factors – triggered by the estimated 83,000 people that would be affected by resettlement (Malik, 2003).

The reduction of water flows due to large dams has had a negative impact on the riverine ecosystem with repercussions on livelihoods. For example, due to average outflows of water downstream from the Kotri barrage - that are well below the volumes necessary to sustain the Indus delta ecosystem (Khan, 2002) - seawater intrusion has been witnessed inland up to 25 kilometres[12] north of the coast with the districts of Badin and Thatta worst affected (Asianics Agro-Dev. International, 2000). The coastal mangrove forests have been destroyed, threatening the livelihoods of about 100,000 people, mostly marginalized communities. They directly use the mangroves as fuel, fodder and for grazing and generate income from seafood (Khan, 1999b). About one million acres of agricultural land has become saline and thus unfit for agriculture (Khan, 2002). Water supplies are destroyed and people are compelled to drink brackish water, exposing them to numerous diseases.

Large hydropower irrigation projects have also been associated with inter-provincial water conflicts. The dispute over the construction of the Kalabagh Dam is an evident example. Sindh argues that as a consequence of diminished flow due to diversions for other areas than Sindh, large areas in the province would be affected, crippling Sindh's agrarian economy. NWFP's politicians oppose the Kalabagh Dam due to the submergence of thousands of acres of cultivable land, and the large-scale displacement of the indigenous population. It is also assumed that the Kalabagh Dam would cause water-logging and salinity in the districts of Mardan, Charsadda, and Swabi (Gadi, 2003; Malik, 2003).

Flood control is mentioned as another objective for the construction of large storage projects. However, large dams notwithstanding, there has been no reduction in the incidence and intensity of floods nor in the associated losses in lives, crops, livestock and agriculture (Khan, 1999b). As mentioned above, in 1992 and 1996, for example, Punjab and Sindh experienced highly devastating floods due to the unwarranted passage of millions of cusecs of water from the Mangla Dam (Khan, 2002).

Box 6.2: The Tarbela Dam Project – contribution to and challenge for human development in Pakistan

Tarbela Dam was the world's largest earth-filled dam of the day. The main objectives of the project were to provide additional water supplies for further development of irrigated agriculture, thereby increasing food production to achieve self-sufficiency, and to generate cheap hydro power. The construction was started in 1968 and finalised in 1976. The project's overall cost of USD 1.5 billion was an 81% overrun of the estimated costs.

Although it is not possible to separate the effect of building the Tarbela Dam from other interventions in irrigation management, irrigation diversions downstream of Tarbela in the dry season increased by 98% at Taunsa, by 168% at Guddu, and by 80% at Kotri in the post Tarbela era. The cultivated area in the country increased by 12% from 1974-75 to 1997-98, about 8% less than what had been predicted for the year 2000. The irrigated area increased by 35% during the same period, slightly higher than predicted. Cropping patterns in the Indus basin shifted towards irrigated wheat, cotton, rice, and sugarcane. However, the achievement in crop yields for the major crops in Punjab and Sindh was about 30% below the predicted levels. At the same time, water-logging and salinity have increased in the Indus basin as a result of increasing water diversion for irrigation. Increased agricultural mechanisation led to some displacement of farm labour, whereas employment in cotton-

12 Less conservative estimates mention up to 100 km seawater intrusion (Memon, 2004).

and sugarcane-related industries has increased significantly, together with forward and backward linkages in the transport sector.

Another unexpected benefit was the availability of canal water for domestic purposes and livestock production in areas where groundwater is too saline. It is estimated that about 40% of the population may presently be benefiting from Indus water supplemented by Tarbela storage.

The actual average annual hydropower generation at Tarbela was 9,255GWh between 1978-1998, or 82% of the predicted amount. This represents over 22% of Pakistan's installed capacity for power generation. The major beneficiaries have been the enterprising industrialists who received cheap electricity thus reducing their cost of production.

The number of villages submerged as a result of water storage in the Tarbela Dam was 120 as compared to an estimate of 100. About 96,000 people were affected by resettlement. The resettlement process was criticised for, amongst other things, lack of participation of those affected, in the planning and development process; displacement before provision of alternative land and compensation; delays in the payment of compensation, and lack of employment in new townships.

The gender dimension had been totally neglected and women in particular have suffered as a result of the disruption of their social life due to migration from ancestral places.

Negative changes downstream in Punjab included the loss of forestland to agriculture and the loss of livelihood opportunities to the landless people who made products from forests and wetlands along the river. These outcomes represent the marginalisation of poorer segments of the population that depended on the river. In Sindh, fish catches were reduced considerably as a result of reduced dry-season flows. Resultantly, there has been a large-scale out-migration of population from the lower Indus delta to Karachi and other places in search of livelihood.

Source: Asianics Agro-Dev. International (2000)

Khan (2002) concludes that the absence of consultative processes involving key stakeholders of large water storage projects gives rise to poor governance in implementation. In summary, the following effects of the selected water policies and interventions outlined in section 3 on poverty and inequality can be identified.

- A focus on physical targets rather than on capacity building in WUAs has been identified as a core problem in participatory water management schemes.
- Therefore, the positive effects of these schemes were largely appropriated by the economic and political elite, increasing the marginalisation of poorer farmers and landless tenants and sharecroppers, a situation referred to as 'resource capture' (Gizewski and Homer-Dixon, 1996, quoted in Khan, 2002).
- The lack of female stakeholders' participation in WUAs is a core problem, given women's strong role in water supply and management. Ignoring their needs leads to further widening of the gender gap in resource access.

7. Water management for human development

In this last section, the paper formulates recommendations about how water-related interventions can better serve human development in Pakistan. Cross-cutting issues, such as how to ensure the representation of the interests of all stakeholders, in particular of the poor and of both women and men and how to prevent negative health effects of water interventions are discussed before specific suggestions are made regarding rural and urban water supply and sanitation, irrigation, and large water storage projects.

7.1 Stakeholder participation on equal footing

Three of the so-called 'Dublin Principles' set out at the 1992 International Conference on Water and the Environment in Dublin are particularly relevant for water management that takes a human development perspective. Principle 2 states that water development and management should be based on a participatory approach, involving users, planners, and policy-makers at all levels. Principle 3 emphasises that women play a central part in the provision, management, and safe-guarding of water. Finally, Principle 4 stresses the economic value of water in all its competing uses (Solanes and Gonzalez-Villarreal, 1999). The question is how to translate these principles into recommendations applicable to the Pakistani context.

Improved and safe access to water for domestic and irrigation purposes were the objectives of the moves towards the transfer of water management to water user groups throughout the 1990s, as outlined in section 3. As the previous section has shown, participatory approaches to water management both in domestic water supply as well as in irrigation management have not yet shown the desired results. However, the discussion in section 6 suggested a number of prerequisites for successful participatory water management.

The role of awareness in participatory water management has become evident. Funding and skilled personnel for raising awareness and capacity building should therefore be made available as an integral part of any effort to involve user communities in scheme management. This also holds true for flood management. Semple (2003) emphasises the need for riverine people to be organised, represented and consulted on issues of flood management. He sees a need to take district preparedness plans seriously, and to make them inclusive, rather than as a bureaucratic-led paper exercise with no real follow up.

Being staffed with engineers, government departments often do not have the capacity to undertake participatory planning for the design and development of infrastructure. Recruiting personnel skilled in participatory planning thus need to be a priority.

In his assessment of the OFWM, Tariq Banuri (1996) stated: "Two years ago, UNDP published a report on Pakistan's development experience in which the term *capital bias* was used to describe Pakistan's near obsession with building physical capital. This way of thinking is fast disappearing. From bitter experience we have learnt that development is about building capacity." Ten years later, this point still needs to be stressed when it comes to recommendations for water management in Pakistan that serves human development.

The relevance of local power structures for the success of decentralised water management has been shown. These power structures must be explicitly addressed in the design of schemes, for example, to prevent the development of water markets in favour of large farmers, thereby widening existing socio-economic gaps. Rather than using village notables as the entry point for communication with communities, a more effective strategy would be to ascertain who is generally trusted by the community and work with those individuals as activists and leaders (Khan, 1998). Cleaver and Elson (1995) issue a warning note about the ability of user communities to take over water scheme management completely as it is not evident why community members should be competent to undertake most of the tasks in which governments have failed. Management tasks involving risks regarding the influence of the local elite and requiring considerable technical expertise can be left with government agencies (Khan *et al*., 1996).

Committees could then be instructed to train back-ups for these core water scheme operation and management functions.

As section 6 has shown, women's interests are hardly represented at all in water supply and sanitation, or in irrigation management, due to their effective exclusion from user associations. Pakistan's Water Vision 2025 proposes the following concrete steps for gender mainstreaming in water management (Pakistan Water Partnership, 2000; emphasis added):

- *Build capacity* to increase the understanding of gender implications for water management, as part of an effort to empower women so that they can acquire the skills to enter water management at a senior level. This involves an increase in technical and scientific education offered to women.
- Identify existing female institutional forums at the village level that can be used to *enhance women's participation* in the water sector.
- *Include women* in the water-user's associations at the watercourse level as well as in farmers' organisations at the distributory and minor level.
- Encourage in-depth *gender-sensitive consultation processes* that allow both women and men to participate in decisions regarding location of water installations, technology, and price implications.

Capacity building *inter-alia* relates to government departments. Participatory planning implies in particular the inclusion of the interests of women as a major, but so far neglected, user group. Since in most of the relevant government departments there are few women, the outreach directly from the government to women also may not be very effective.

Regarding enhanced women's participation in the water sector, it is critical to identify both the public sites where it is socially acceptable for women to meet with men as well as a suitable time that does not conflict with their domestic or productive activities. The successful example from the Environmental Rehabilitation in NWFP and Punjab (ERNP) project shows that even in the context of Pakistan, where female mobility and social interaction between women and men is restricted, the participation of female water users on an equal footing with men is possible: "Women, who did not previously venture beyond the restrictive confines of their homes and neighbourhoods emerged as an influential interest group in their communities. (…) [I]t is now for the first time, that the women are creating and controlling their own physical and financial assets and are learning new skills in the process" (Cheema, 2004).

Section 2.3 highlighted the crucial role women play in agriculture in Pakistan. The lack of land rights for women and thus water entitlements and legal cover hamper women in their ability to have a say in irrigation management and thus to better utilize the resource. However, even if the gender division of work were such that women were not involved in agricultural work in large numbers, the interdependence of water for domestic purposes and water for food production is a recurring issue and requires integrated water resources management. In particular, the relevance of irrigation water for domestic supply and its health implications as highlighted in section 5, as well as other productive uses such as livestock watering, exemplify the need to include women in decision-making and policy formulation regarding irrigation and drainage (Gender and Water Alliance, 2003).

The previous sections have highlighted that economic incentives discourage efficient use of water and are biased towards those who have sufficient access to the resource. The flat rates in domestic water supply for water conservation mentioned in section 2.2 are one example. In accordance with the Dublin Principle 4 mentioned above, proper pricing, secure property rights, and equitable access to economic resources can be used as incentives for water conservation (Zia and Hasnain, 2000; Banuri, 1996). Cross subsidies can be extended to the poor in order to achieve universal access to the resource (Khan, 2002). For example in industrial uses, Ghous (2004) assumes 30-40% water conservation to be achievable in the paper and pulp, leather, and textile sectors by adopting water conservation techniques at the industrial unit level.

As the previous sections have shown, a major channel for the impact of water interventions on human development is their effect on health. Given the important role female household members play in domestic water management and as role models in hygiene as highlighted in section 5, water supply schemes should be accompanied by instruction on general hygiene, targeted to women (Khan *et al*., 1996). The incorporation of sound, health-based practices for water resource systems should thus include water quality management in source protection, treatment, and distribution of drinking water, using health impact assessments (HIA) on all development projects, including irrigation drainage and storage and power generation projects to reduce the threat of vector-borne diseases, such as malaria and yellow fever.

In addition, higher level practices can also contribute, such as making the different water-use sectors responsible for the adverse health effects of their projects; having regular evaluations of the costs of ill health from water resource development; and evaluating the cost effectiveness of water-supply and water-management interventions versus conventional health interventions (WWAP, 2003). Strengthening the institutional capacity at the provincial Environmental Protection Agencies (EPAs) responsible for monitoring and implementing the NEQS would be an important step in this direction. This implies more technical knowledge, continuing monitoring networks, adequate economic and human resources, and adequate environmental research. In the short run, it is suggested that EPAs may focus on a few industries with comparatively higher effluent levels rather than focusing on all industries (Talpur, 2004).

Ultimately, improvements in access to safe and clean water help to reduce poverty. Productivity is increased through reduced occurrence of diseases and lower expenditures on medical care, and nutrition is improved through prevention of helminthic infestations (Safe Drinking Water Group of Pakistan and The Network for Consumer Protection, 2003)

7.2 Water for people

The preconditions of water-supply scheme management that enable equitable access to the resource (outlined in section 6.1) should be kept in mind. The gender division of work in water management is crucially important. It calls for the participation of women in WUAs and for an integrated approach to domestic water supply. Addressing the potentially detrimental local landed and/or bureaucratic power structures is a decisive factor. Awareness and capacity of the user community are other important features that suggest that the preparatory phase of scheme transfer needs more attention. Khan (1998) states that public schemes need to function like development NGO projects in order to be successful. This requires social mobilisation training for government personnel and an altered incentive structure and service rules so that they have the will and flexibility to deliver.

Last but not least, the communities' need for a water supply scheme is another key success factor. Specifically for water supply and sanitation schemes, larger schemes offer less opportunity for direct participation by users in planning decisions and thus addressing their specific needs. Hasan (2003) emphasises that communities express a desire to have systems in place that relate to their clan or neighbourhood (*mohalla*) identity and which can be run by these groups themselves. Implementation means a move from capital intensive and mechanised projects to decentralisation and miniaturisation of engineering systems. The treadle water pump used in Bangladesh is an example of a low-cost appropriate technology (Daudpota, 2000). Such decentralisation may include localised systems of monitoring water quality, *e.g.* portable and easy to use kits for testing crucial parameters of the potability of drinking water (Development Alternatives, 2004).

Some of the success factors of the Orangi Pilot Project (OPP) (Box 7.1) reflect these features. The needs of the community triggered collective action. Creating or enhancing awareness is seen as an essential prerequisite. Community participation, including that of women, in cooperation with municipal infrastructural support, guaranteed effectiveness and efficiency. The resulting safer sanitation infrastructure is an important tool for reducing the impact of diarrhoeal diseases for poor, vulnerable communities. Institutional arrangements should therefore be established to replicate such successful community-based water supply and sanitation schemes (Khan, 2002).

Box 7.1: The Orangi Pilot Project

Orangi is the largest squatter camp in Karachi with an estimated population of over 1.2 million. Like other slums, Orangi faces severe problems of health, sanitation, education, housing, and unemployment. Government-provided facilities, such as roads, water supply networks, electricity, and some schools and hospitals, proved insufficient to solve the problems of the dwellers. In order to address them, the late Akhtar Hameed Khan, a renowned social scientist, launched the Orangi Pilot Project (OPP) in 1980. It functions as a research NGO which helps people solve their problems by providing social and technical assistance. The basic idea of the OPP is that, if properly motivated and suitably organized, ordinary people possess ample capacity to get things done. It encourages community participation and the practice of cooperative action to solve the major problems of the area. In this vein, OPP identifies activists among the residents at the lane level (each consists of 20 to 40 houses), provides training and technical details, provides further guidance and supervision and helps to simplify designs so that they are affordable and can be implemented locally. Moreover, the project strengthens the position of women in the communities by encouraging their participation in community affairs.

The project enables low-income families to construct and maintain an underground sewerage system with their own funds and under their own management as the project's 'internal development' component. Until 1980, most households used bucket latrines and soak pits for the disposal of human waste and open sewers for the disposal of wastewater, resulting in a high rate of water-borne diseases.

OPP provides social and technical guidance to help people build underground sanitation systems in their homes, lanes, and neighbourhoods. People have invested Rs. 86.28 million on internal development, building over 6,250 lane sewers, 417 secondary sewers and nearly 94,000 latrines in their homes.

OPP's 'external development' component consists of a trunk sewer and/or the development of a culvert in a natural drain, and treatment plants or lagoons and marine outfalls. External development cannot be undertaken by the people and is the government's responsibility. After the municipality's initial hesitation to pick up the work done by the communities, the government has adopted the OPP model.

Due to its stress on community participation and thus the knowledge about appropriate and low cost solutions, OPP operates cost efficiently. It is estimated that, if the government had carried out this plan, it would have probably have cost Rs. 600 million. Moreover, it also empowers small family enterprises with micro-credit, provides guidance for low-cost housing, provides information regarding the causes and prevention of common diseases, conducts family planning programmes, extends training to the nursing and teaching staff so as to provide better services to the people and arranges financial assistance to the schools.

Over a couple of decades, OPP has successfully solved major problems faced by the people of Orangi, such that a substantial improvement can be seen in their human development. The OPP model is being replicated in other slum areas of Karachi, numerous towns in different parts of the country, and in some other developing countries as well.

Sources: Bhagwandas (2003); Rahman (2003); Akhtar Hamid Khan (no date); Urban Resource Centre (no date); Yespakistan.com (no date)

As section 5 has underlined, hauling water is a strenuous task involving a number of serious health risks for the women and girls responsible for it. Due to the restrictions imposed on female mobility, men in the Pakistani context have an incentive to make water available to their women as close to home as possible (Khan *et al*., 1996). Examples from Bangladesh and Rajasthan show that through consultation with female users, appropriate technology for their needs can be chosen. The hand pumps female users requested there, for example, were both close to home and less heavy to operate (Development Alternatives, 2004).

At the same time, the government should aim at replacing dysfunctional infrastructure and developing more water-related infrastructure in order to improve water quality. In particular low-cost water treatment plants for the treatment of sewage and industrial waste-water is needed. This should be considered central to sustainable growth, development, and poverty reduction. National Drinking Water Quality standards should be developed and implemented. The National Water Quality Monitoring Programme started in 2001 with the objective of establishing a permanent water quality-monitoring network across the country (Kahlown, 2004) is a first, albeit insufficient, step in this direction.

Given the inequality in access to safe and sufficient water between the rural and urban and poor and wealthy populations outlined in sections 2 and 6, and the policy move towards privatisation sketched in section 3, exemplified in recent efforts to privatise water supply in Karachi and Lahore, it is important to ensure access of the poor to safe and sufficient water supply. The private suppliers' main objective can realistically be assumed to be profit generation rather than universal access. Special attention should therefore be given to regulation that ensures such universal access (Gender and Water Alliance, 2003).

7.3 Water for food

According to Pinstrup-Andersen and Pandya-Lorch (1994), policies to ensure sustainable irrigation management should include, amongst other things, improved access of the poor to productive resources. In this context, Khan *et al*. (2001) stress the need for land reform in Pakistan in order to counter large farmer's less efficient use of irrigation water. The prevalent corruption in the relevant departments is an obstacle to more equitable irrigation water distribution that supports poor farmers' development. The South African policy of de-linking land ownership from access to water may effectively ensure landless tenants and women's rights to water.

Gill and Sampath (1992) warn that if no regressivity in irrigation distribution is introduced in the development and distribution of irrigation in Pakistan, inequality in agricultural income and wealth will increase even further. They outline different types of equity-improving irrigation policies. One option is 'lexicographic' ordering, for example in the form of the provision of irrigation water to a group of smallest farmers first, then to the second smallest group and so forth. Alternatively, equal shares could be provided to households independent of the size of their landholdings with the option for the poorer households to trade their water rights.

Water-demand management is necessary due to the increased demand for water for agriculture. This includes water-conservation measures in the irrigation systems by considering improvements in crop and water efficiencies, including lining of water courses, sprinkler and drip irrigation, the stimulation of highly profitable and low water-intensive crops, and land levelling (Memon, 2004). Alternatives need to be explored, such as water harvesting methods, *e.g*. the *sailaba* system common in Cholistan whereby people build embankments and bunds to divert streams and floodwater; the *khushkaba* catchment systems in Balochistan, or hill-torrent management through *rud kohi* (Zia and Hasnain, 2000). Such improvements will result in a significant reduction in agricultural water demand with the surplus available for more equitable distribution both in agriculture, for domestic and industrial needs.

During the past 20 years, about 20% of the total number of watercourses have been improved. The Government of Pakistan is implementing a watercourse-improvement plan for the remaining watercourses during the next five years (Hussain, 2004). In the management of water for food production, one of the indicators of equity in water distribution is that farmers at the tail-end must get their proportional share of water. National and international experiences of canal lining to reduce water losses through seepage show that equity conditions at the tail end can be improved as a result of lining. In the words of one farmer: "Whatever share of water we are getting is reliable. Before the lining of the minor, the upstream influentials were making cuts frequently and downstream farmers were not sure about getting their share of water". Improved reliability can lead to improved crop yields, more income, and thus poverty reduction in the farming community (Waheed-uz-Zaman, 2000).

Better drainage and canal lining, both leading to reduced amounts of standing water, may reduce the risks of vector-borne diseases (Pinstrup-Andersen and Pandya-Lorch, 1994). However, sections 5 and 6 have underlined the importance of the availability of irrigation water for domestic uses and thus for improved health. Measures to improve the efficiency of water supply delivery for agricultural production, such as lining canals, may have an impact on the availability of water for domestic purposes in communities that are dependent on surface water household use. An integrated approach to water management is therefore needed in irrigation schemes, so that the supply of domestic water is given priority when allocating water in time and space within the systems (Van der Hoek, Feenstra and Konradsen, 2002). The role of WUAs should therefore be extended to integrate domestic water use and other rural development functions.

Access to water, and resource-control in general, is identified as a critical area of gender disparity in agriculture. Affirmative action in these areas is necessary: this includes budgets for gender mainstreaming and significant advocacy as part of government's, agencies', and donors' policies. Apart from the typical extension services of information (*e.g*. methods of growing various crops and agro-chemical needs) extension services should also be able to give advice on water conservation and management (Gender and Water Alliance, 2003). Providers and beneficiaries of extension services in Pakistan are commonly men, despite the crucial role of women in agricultural activities and in water management. Extension training should therefore include gender issues and be directed towards both women and men. As noted above, women should be employed in extension services.

7.4 Water storage for human development

Regarding large water storage and power generation projects, the recommendations of the World Commission on Dams (2000) should be taken into account. Again, by bringing to the table all those whose rights are involved, and who bear the risks associated with different options for water and energy resources development, the conditions for a positive resolution of competing interests and conflicts are created. EIAs and social impact assessments are legally binding and/or commonly required by the funding agencies involved. However, so far, such assessments have been rare and the commitment to a participatory approach was more 'lip service' rather than practice.

Given the costs in terms of resettlement, loss of fertile land and inequalities in compensation schemes, government support for small storage and power plants might be a more feasible option for the future. Alternatives with a more positive impact on human development are available and should seriously be considered. Studies show that, for example, de-silting the Tarbela Dam would yield the same irrigation benefits as building the Kalabagh Dam, but at one seventh of the costs in net present value (Khan, 1999b)[13].

The previous sub-section emphasised the need for a focus shift from attempts to store and increment water supply to water conservation and use efficiency. This might also be the more economical option. Hussain (2004) underlines the fact that macro-level resource development strategies are expensive and time-consuming, while micro-level conservation measures are relatively inexpensive, feasible and workable. Still, there is a wide-spread imbalance between investment in large projects and capacity building.

7.5 Outlook

Pakistan's water challenge is that of protecting human health and life from water scarcity, inequitable distribution, pollution, and water-related natural disasters, all of which seriously hamper human development. The preceding sections have highlighted the limited success of water management in providing safe and sufficient water to all users, despite the fact that the country is not water poor. The government has committed itself to increased access to safe water supply in the Ten Year Perspective Plan (2001-2011) and with the Millennium Development Goals. Article 38 of the Constitution guarantees that the state shall provide the basic necessities of life to all, irrespective of sex or socio-economic background (Islamic Republic of Pakistan, no date).

It is questionable whether the challenges can be met and the government's own targets can be achieved with reduced government engagement in water management as foreseen in the Ten Year Perspective Plan.

As the previous sections have shown, the following points are crucial in order to achieve the goal of Pakistan's water interventions in order to better serve human development:

- A genuinely participatory approach must include the voices, concerns and knowledge of all stakeholders, in particular women and the poor, in water management;
- Landed and bureaucratic power structures have to be tackled pro-actively;
- Capacity building has to be prioritised over building of infrastructure alone. It needs to take place in user groups, and in government agencies;
- Economic incentives, such as secure property rights, can help to improve access to water for the marginalized and the more efficient use of the scarce resource;
- The health implications of water management should be assessed before embarking on specific water-related interventions;
- Due to the potential for consequences harmful to human development, water conservation should be given priority over large storage projects. If they are constructed, EIAs and social assessments should be conducted with true stakeholder participation.

13 WAPDA however, considers this an unprecedented option with adverse affect the downstream hydropower projects of Ghazi-Barotha and Chashma (Asianics Agro-Dev. International, 2000).

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