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BLEMISHES OF GOVERNMENTAL INSTITUTIONAL MANAGEMENT TO TRAMPLE WATER POLLUTION IN PAKISTAN

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Abstract

The paper gives an overview of water pollution, which is a major issue of treating public health in Pakistan, as well as weak institutional mechanism for the management of water resources. Pressure of population, rapid urbanization, increasing industrialization and economic development are serious growing problems which Pakistan is facing in present era. Water pollution from raw sewage, industrial wastes, and agricultural runoff limited natural fresh water and deteriorating water quality and pressing quantity. This review article discuss in detailed the quality and quantity and availability of water with special emphasis on pollution, health problems and institutional frame work for monitoring of water pollution and management of water resources in Pakistan. The article briefly discusses the flaws and weakness of water related institutions managing water pollution in Pakistan.

Key Words: Water Pollution, water quality, quantity, availability, population, Urbanization, Public Health, Institutional mechanism

1. Introduction

Water is a basic necessity of life. However, its value is determined differently in different parts of the world (Harvard 2007). Over one billion people globally do not have access to basic water supplies and half of the developing world's population suffers from diseases due to the contaminated supply of water (Erik 2004). The international governance regimes are therefore faced with a difficult task; they have to categorize water in a manner that promotes the standard of living of the global citizenry most effectively (Erik 2004). Everyday two million tons of sewage and industrial and agricultural waste are discharged into the world's water. The UN estimates that the amount of waste water produced annually is about 1,500 km3, six times more water than exists in all the rivers of the world (United Nation 2003). The world's 1.1 billion people lack access to basic water supplies and half of the developing world's population suffers from diseases due to water contamination (Erik 2004). Approximately 2.5 million people of the world live without improved sanitation which is most significant form of water pollution (UNICEF & WHO 2008). Unsafe or inadequate water cause approximately 3.1 percent of all deaths worldwide, and 3.7 percent of DALYS (disability adjusted life years) worldwide. More than 5 million people die each year from water related diseases (World Water Day 2002). Pollution and shortage of water become serious problems in Pakistan. It is now established that most of the reported health problems are directly or indirectly related to polluted water (Ismat Sabir 2012) The increasing competition for multiple uses of water has adversely affected the quality and quantity of water, consequently, a vast majority of Pakistan's population does not have access to clean, portable and safe drinking water (PCRWR 2015). Water sources like surface and ground water are contaminated with bacteriological, arsenic, nitrates and fluoride contamination; municipal, agricultural and industrial waste throughout the country. Drinking water quality is deteriorating continually due to biological contamination from human waste, chemical pollutants from industries and agricultural inputs.

2. Pakistan (Country Overview)

Pakistan is situated in the northwestern part of the south Asian subcontinent. Comprising a total land area of 796,096 square kilometers, it features a diversified terrain and topography, is between India on the east, Iran and Afghanistan on the west, and China in the north. It has a common frontier with China on the border of its Gilgit region in the north. The old "silk route"

connecting China to the Arabian Sea in south Pakistan is now a motor able asphalt road. Pakistan is a federation of four provinces, (Punjab, Sindh, Balochistan, and NWFP) a capital territory and federally administered areas. It is a developing country with the world's sixth-largest population, estimated at over 180.8 million in 2009(World Population Data 2009). It is currently the most urbanized country in South Asia, with over a third of the total population (Population Census 1998) living in urban areas. Administratively, Pakistan is an agricultural country, and about 64 percent of its population lives in rural areas. Agriculture is central to the country's economic growth and development. As the dominant sector, it represents 21 percent of Pakistan's GDP. (Government of Pakistan, 2013). Weak governance in Pakistan is linked to the government's dependence on civil bureaucracy and neglect of popular participation in national decision making, development planning and implementation and provision of basic services.

2.1 Current Situation of Water issues in Pakistan

In Pakistan, as in many parts of Asia, population growth, elite capture of public benefits, rapid urbanization, and shifts in production and consumption patterns have placed unprecedented stress on water resources (Brahma 2011). Coupled with institutional, operational, and governance failures, increasing pressure over water use and misuse is fostering domestic discord. According to World Bank and FAO, Pakistan is headed towards a serious water crisis in 2030-35 (PCRWR 2005). Experts expect this semiarid nation to decline from being water stressed to water scarce because of overuse and misuse, the country is facing declining water availability and quality, growing water pollution, and overall environmental insecurity. The stress on water resources of the country is from multiple sources. Rapid urbanization, increased industrial activity and dependence of the agricultural sector on chemicals and fertilizers have led to water pollution. Deterioration in water quality and contamination of lakes, rivers and groundwater aquifers has, therefore, resulted in increased water borne diseases and negative impacts on human health.

2.2 Water Quantity, Quality and Availability

Water remains a critical resource for sustained well being of its citizens of Pakistan. Over the last decade, Pakistan became a water-stressed country and stands 80th among the list of 122 countries for quality of potable water (Azizullah 2011). The UN currently estimates an annual per capita

availability of water is 1,090 cubic meters (UNDP 2011-2015) which is continuously declining, both in total amount of water and the per capita water availability. In 1951, when population was 34 million, per capita availability of water was 5,000 cubic meters, which has now decreased, reached water scarcity level of 1,090 cubic meters (The Economist 2012) and alarming prediction is less than 500 cubic meters per capita per year by 2020 (see Table 1).

Pakistan has a semi-arid climate with an average rainfall of less than 240 millimeters per year countrywide and internal renewable water resources of 55 cubic kilometers per year, which equals the amount of groundwater resources. (Government of Pakistan 2009).

Pakistan is dependent on a single river, the Indus, for its surface water, and is close to using all the available surface and groundwater to meet increased demands of its agricultural, domestic, and industrial sectors (Khan 1994).

Most major cities depend on tube wells for tapping local aquifers. Rapid urbanization is expected to create demand that exceeds supply. According to Pakistan Social Living Measurement Survey (PSLM 2010-11), the main source of drinking water was: 32% tap water, 28% hand pump, 27% motor pump, 4% dug well and 9% others, assuming that other sources are identical to unimproved water sources.

Like other developing countries Pakistan is also facing critical water shortage and water pollution (Hashmi 2009).

2.3 Population Growth and Water Issues

There are alternative views on population-environment linkages (Marcous 1999). Population and environment is closely intertwined in a complex and dynamic relationship. The relationship between population and environment is mediated by a number of socioeconomic, cultural, political, and developmental variables whose relative significance varies considerably from one context to another. Over the past three to four decades, some economists, biologists, and environmentalists have been debating the role of population in environmental degradation.

At the time of independence in 1947, 32.5 million people lived in Pakistan. By 2006-07, the population is estimated to have reached 156.77 million. Thus, in roughly three generations, Pakistan's population has increased by 124.27 million or has grown at an average rate of 2.6 percent per annum.The present population of the country is 188 million with 1.95 percent growth rate which is higher than average growth rate of South Asian countries will increase to nearly 190 million by 2016, to over 220 million by 2020 and to almost 275 million by 2050, as Pakistan retains its position as the sixth most populous country in the world (Daily Times 2013). Table 2 shows the population growth rate, urbanization, and industrialization in Pakistan from 1980 to 2025. Fig.2 shows that from the year 2001 to 2011 if we compare Pakistan to 10 most populous countries, it ranks first in increasing growth rate annually. Growing population, poor management services, water pollution, lack of public awareness and weak enforcement of environmental laws and policies causes great environmental degradation and health problems.

2.4 Municipal, Industrial and Agriculture Water Pollution

The pressure on water resources caused by industrial growth also merits discussion due to their significant contribution to water pollution problems. It has been estimated that around 2000 million gallon of sewage is being discharge to surface water bodies everyday in Pakistan (Pak-SCEA 2006). In Pakistan out of 6634 registered industries 1228 are considered to be highly polluting (Sial 2006). The industrial including textile, chemical, food processing, pulp and paper, poultry, dairy, plastic, paint, pesticides, leather, tanneries and pharmaceuticals directly discharged waste into the canal system by contaminating the ground water level and leach into the aquifers (World Bank 2008).

Some industries discharge their wastewater on land or in soakage pits which results in groundwater pollution (Ali 2014). In Pakistan, only 1% of wastewater is treated by industries before being discharged directly into rivers and drains, untreated waste causing death of livestock and increasing health risk to humans (Khurram 2005).

Water pollution also influences the agriculture of Pakistan with excessive use of fertilizers and pesticides which are key pollutants as they dissolve in water and seep to the underground water bodies. Becoming the source of salinity and water logging at irrigated land decreases the fertility

of soil, costing Pakistan 0.9 per cent of the GDP. The contribution of agricultural drainage to the overall contamination of the water resources exists but is marginal compared to the industrial and domestic pollution. For example, in Sindh, the pollution of water due to irrigation is only 3.21% of the total Pollution (State of Environment 2005). The discharge of wastewater from domestic, municipal and industrial sectors directly into water bodies without proper treatment is major cause of surface and groundwater pollution in Pakistan (WWF 2007).

In the provinces of Pakistan, Sindh 24%, NWFP 46% and Balochishtan 72% of population rely on unsafe water sources (The Dawn 2011). Pakistan is among 17 countries facing water shortage (The Nation 2009) and 79% water is unsafe for drinking (PCRWR 2005). Pakistan's 96% of urban and 89% of rural population have access in water pollution in broad definition and 57% of urban and 15% of rural population access houses connection water pollution.

2.5 Bacteriological Contaminations and Drinking Water Quality

Arsenic Toxicity Investigations revealed the presence of excessive arsenic in many cities of Pakistan provinces. The concentration of arsenic was found to be 50ppb five times higher that the prescribed limit of 10 ppb by WHO (PCRWR 2007). In Sindh and the Punjab, approximately 36% of the population is exposed to a level of contamination higher than 10ppb and 16% is exposed to contamination of 50ppb (Ali 2014).

Detailed data analysis has identified 4 major water quality tribulations in drinking water sources of Pakistan i.e. bacteriological (68%), arsenic (24%), nitrate (13%) and fluoride (5%). The five years trend analysis has revealed that out of a total 357, only 45 water sources (13%) were found "Safe" and the remaining 312 (87%) were "Unsafe" for drinking purpose. The water quality monitoring (2001-2010) conducted in rural and urban areas of the country revealed that access to save drinking water is only 15 percent in urban and 18 percent in rural areas. Table 3 shows bacterial contamination level in 23 cities of Pakistan from 2002 to 2006 which increased every year.

According to a survey on behalf of PCRWR published in 2012, 88% of the functional water supply schemes in Pakistan provide water that is unsafe for drinking because of microbiological

contamination (PCRWR 2012). According to an official government document (MDP 2004) increased arsenic, nitrate and fluoride contamination was detected in drinking water in various localities in Pakistan. A survey of drinking water samples in Karachi in 2007/08 found that, of 216 grounds and surface water samples collected, 86% had lead levels higher than the WHO maximum acceptable standard (Ul-Haq 2011). The Nation-wide Assessment Survey of more than 10,000 water supply schemes (1808 urban and 8320 rural water supply schemes) carried out by the PCRWR revealed that 72 percent schemes are operational and only 23 percent in urban and 14 percent in rural areas water supply schemes are supplying safe drinking water (Technology Times 2013).

2.6 Water Pollution and Health Problems

In Pakistan contamination of drinking water with industrial wastes and municipal sewage coupled with lack of water disinfection practices and quality monitoring at treatment plants is the main cause of the prevalence of waterborne diseases (Hashmi 2009).

Untreated water, resulting in 100 million cases of diarrheal diseases registered in hospitals, with 40 percent of deaths attributed to drinking polluted water in the country. The diarrhea which is a water-linked disease, accounts for 14% of illnesses in children below Five years old and for 7% of all diseases in people of all ages in Pakistan (Rosemann 2005). Diarrheal rate in Pakistan is the second highest amongst 31 Asian countries. One third of under-five deaths are owing to diarrhea (Qutub 2004). Although in the developed countries typhoid fever has been almost eliminated, in developing countries like Pakistan it is still a common disease and a major cause of morbidity and mortality due to lack of sewage and water treatment facilities (Ahmed 2006).
Lack of effective prevention and control measures contribute in worsening the situation (Qasim 2008).According to an estimation 250,000 child deaths occur each year in Pakistan due to water-borne diseases (Technology Times 2013).Inadequate quantity and quality of potable water is associated with a host of illnesses. 20-40 percent of the hospital beds in Pakistan are occupied by patients suffering from water-related diseases (Khan 2002).

3. Water Institutions

3.1 Institutional Mechanism in Pakistan

In the previous section, we examined the water situation (quality, quantity and availability) in Pakistan, pollution sources (Population, Agricultural, Industrial and Municipal) and health issues related to water pollution. In this section, we focus on analyzing the institutional mechanisms, and make conclusions on the status of their performance in the context of water resources management Institutions related to water are important for the management of resources. Unfortunately, it is commonly noted that Pakistan has weak institutional mechanism for trampling water pollution problems. Environment is a common property according to the institutional point of view and the community institutions are managing these property reservoirs (water) (Ranjit 1992). The important national institutions in Pakistan, which play or can play significant role in safeguarding the water, can be broadly classified into two categories, (a) the governmental institutions, and (b) the non-governmental institutions. Presently, both government and non-governmental sectors are addressing water issues. Water is a provincial issue, and efforts are focused upon maximizing provincial water shares for agriculture to optimize social equity, food security and development (WWF 2007).

Federal level Institutions:

- Ministry of Water and Power (MoWP);
- Federal Flood Commission (FFC);
- Indus River System Authority (IRSA);
- Water and Power Development Authority (WAPDA);
- Pakistan Meteorological Department (PMD).
- Commissioner of Indus Waters (CIW)
- Ministry of Environment (MOE)
- Capital Development Authority Islamabad (CDA)
- The Pakistan Council of Research in Water Resources (PCRWR)
- The International Water logging and Salinity Research Institute (IWASRI)
- The Surface Water Hydrology (SWH)

- **Provincial level Institutions:**
- Provincial Irrigation Departments (PIDs);
- Provincial Irrigation and Drainage Authorities (PIDAs);
- Provincial Agriculture Departments (PADs);
- Provincial Environmental Agencies (EPA).
- Planning and Development Departments (PDD)
- Public Health Engineering Departments (PHED/PP&HD)
- Water and Sanitation Agencies (WASAs)
- Area Water Boards (AWBs)
- Farmer Organizations (FOs) and Water User Associations (WUAs)

Institutional formulation (illustrated in Fig.4) system was introduced in 1997 to make the country's largest and contiguous (approximately 64,000 km) canal irrigation system more efficient, self sustainable and user participatory (RDC 2004).

3.1.1 Governmental Water Institutions at Federal Level

Ministry of Water and Power (MoWP)

MoWP is responsible for all policy matters relating to the development of water and power resources. All public sector water and power projects proposed by WAPDA are first sent to the MoWP for approval. The Ministry examines and analyzes these proposals for their technical and financial viability. Similarly, all private sector power projects are assessed by the Private Power and Infrastructure Board (PPIB) that works under the supervision of the Ministry of Water and Power.

The Water and Power wings are the main functionaries of the Ministry. It coordinates interprovincial water sharing issues including irrigation and drainage and is also responsible for the smooth functioning of the Indus Waters Treaty 1960 with neighboring India (Ministry of Water & Power Website).The ministry has maintained weak coordination with various bodies attached to it. There has been a political distance between the provincial irrigation departments and WAPDA. Since WAPDA has become very huge compared to its Ministry, it has become difficult for the Ministry to control WAPDA with its limited capacity.

Indus River System Authority (IRSA)

To implement the Indus Water Accord 1991, the Indus River System Authority (IRSA) was established in 1992. IRSA is responsible for managing shared water issues among the provinces (Kamal 2010). IRSA is comprised of one representative from each province and a member from the federal government, and is designed to provide continuing interaction among the provinces and to act as a forum for resolution of any disputes among the four provinces on matters relating to sharing the Indus water (Kamal 2010). Each year IRSA projects and determines the available water for Pakistan in the Indus system and makes public the amounts to be released to each province as per the agreed formula (Kamal 2010). It also operates a Telemetry System at 23 locations of dams, barrages and head works to monitor water flow and water distribution among provinces (Kamal 2010). However, various studies which were supposed to be conducted immediately after the Accord are still pending.

Water and Power Development Authority (WAPDA)

WAPDA was created as the result of the WAPDA Act in 1958 as a semi autonomous body responsible for planning and execution of schemes pertaining to the (WAPDA 1958) Generation, transmission and distribution of power; Irrigation, water supply and drainage infrastructure; Prevention of water logging and reclamation of waterlogged and saline lands, Flood control; Inland navigation, Data collection.

WAPDA was created for the purpose of unifying and giving direction to the development of schemes in the water and power sectors. It carries out several key functions in the water and power sectors. It is also completely responsible for operation and maintenance of Pakistan's large multipurpose dams, which are the main hubs of freshwater (Osmani 2003). Since October 2007, WAPDA has been bifurcated into two distinct entities: WAPDA and Pakistan Electric Power Company (PEPCO).

Its main strength lies in its track record and capacity to undertake huge infrastructure projects and attract investments, but among its weaknesses is the perceived hard core engineering approach that bypasses consultation, equity and participatory considerations. It also appears that sustainable development of hydropower has not been given any attention. Nonetheless, WAPDA

has given Pakistan some of its best minds in the water sector, including those who have promoted Integrated Water Resources Management (IWRM) and propelled the Pakistan Water Partnership.

Pakistan Meteorological Department (PMD)

The Pakistan Meteorological Department (PMD) is both a scientific and service organization that functions under the tutelage of the Ministry of Defense. Pakistan Meteorological Department shoulders the responsibility to investigate the factors responsible for global warming, climate change its impact assessment and adaptation strategies in various sectors of human activities (PDM website). For the intents and purposes of this report, the PMD essentially provides data on precipitation, glacier melt, river flows and related areas (Kamal 2010).

The department's mandate is extensive and its ambit appears adequate to handle the requirements of integrated basin management approaches and climate change.

Commissioner of Indus Waters (CIW)

CIW monitored the implementation of Indus Waters Treaty (1960). Pakistan and India are signatories to the Indus Water Treaty, which governs use of Indus River water. The process of reaching agreement was arduous, but the two countries have abided by its terms the institution is weak in performing the various research studies needed to prepare a scientific response to water resource development on both sides of the border.

Ministry of Environment (MOE)

MOE aims Planning & coordination of Environmental policies and projects at federal level. Ministry has been frequently changing its areas of attachment i.e. rural development, local government, etc. it has not been effective in developing and implementing policies and environmental regulations with little technical staff exists. It has weak coordination with other institutions of the country to provide environment related inputs except its own attached bodies i.e. Federal EPA and ENERCON.

Capital Development Authority Islamabad (CDA)

CDA is responsible for Provision of urban water supply and sanitation facilities to Islamabad and rural water supply and sanitary facilities to rural areas within the capital territory.CDA ignores the requirements and inter-connection effects on a major city like Rawalpindi only because it lies outside the federal territory. It coordinates with all federal agencies for planning and provision of water supply network.

Federal Flood Commission (FFC)

FFC main function is to coordinate the planning, development and management of flood protection infrastructure. Prior to 1976, provincial governments were responsible for the planning and execution of flood protection works across the country. However, the devastating floods of 1973 and 1976 proved the inadequacy of the existing flood protection facilities in providing effective protective measures for the country. As a result, the Federal Flood Commission was established in 1973 to oversee planning and execution of flood protection on a countrywide basis (Federal Flood Commission Website). In recent years this Commission became the custodian of the Pakistan's Draft Water Policy.

The Pakistan Council of Research in Water Resources (PCRWR)

PCRWR is Principal research organization at the federal level studying water availability, usage, pollution, quality and environmental effects etc. It operates Drainage and Reclamation Research Institute of Pakistan (DRIP).it has maintained partial coordination with the Ministry of Water & Power and WAPDA. It has been observing scarcity of both human and capital resources.

The International Water logging and Salinity Research Institute (IWASRI)

ISWARI of WAPDA Conducts research on drainage related pollution problems. Produced excellent research in the field and promoted several initiatives which have become the backbone projects in the country. Serious shortages of funds have pushed the institution towards dormancy.

The Surface Water Hydrology (SWH)

SWH wing of WAPDA Monitors discharges in the rivers and collects selected data related to sediment load and water quality on a daily basis at 50 locations on the River Indus, which is

published annually. WAPDA also monitors groundwater depth and quality through the SCARP Monitoring Organizations (SMO).

3.1.2 Governmental Water Institutions at Provincial Level

The major natural resource management and protection responsibilities for water against pollution lie at the provincial level, even though these authorities are often overwhelmed by federal projects Departments, Geological Survey of Pakistan (GSP), Pakistan Forest Institute (PFI), Soil Conservation Department (SCD), Irrigation Department (ID), Wildlife Department (WD), Industry and Mineral Departments (IMD), Pakistan Agricultural Research Council (PARC) and Provincial Forestry and Livestock Departments (PFLD) etc. Many of these institutions carry out surveys, monitoring and research work of great relevance to water protection.

Provincial Environmental Protection Agencies (PEPAs)

PEPA has also been established in all four provinces, which focus on industrial and urban pollution problems. PEPA Punjab established in 1987 is very effective and has a large administrative and professional staff. PEPA Sindh established in 1989, NWFP in 1992, and Baluchistan in 1995, AJK in 2005, and NA in 2007 can also mobilize the local resources, improve the local economy and promote sustained development.

PEPA has the responsibility to control industrial water pollution while municipal governments responsible for solid waste disposal and for sewage handling and treatment.

Under Local Government Ordinance (LGO), 2001 environment offices have been established and most of the implementations of PEPA, 1997 have been devolved to local governments. The provincial governments, in exercising its responsibility for legislation and financing, must provide the requisite support to the local governments to deliver improved sanitation services.

Provincial Irrigation Departments (PIDs)

The PIDS have historically been responsible for all water sector activities at the provincial level, including planning, development, and the operation and maintenance of irrigation, drainage, flood control and reclamation works (Kamal 2010). Within the province, PIDs receive daily data

on water levels and flows in rivers, canals, and minors etc, to check water availability at each successive level. Under the provision of the Provincial Irrigation and Drainage Act, the PID is responsible for all aspects of the distribution and use of irrigation supplies including on-farm use. However, in practice, this responsibility ends at the end of the water course (Kamal 2010). The PIDs are responsible for the delivery and management of provincial waters, once water share is allocated to each province. In this position the department is also subject to great political pressure to facilitate irrigation water out of turn to the powerful, and there are many opportunities for corruption that disturbs the system of entitlements in the Indus Basin. In recent years the PIDs have also come under pressure from institutional reforms in the water sector that have set up PIDAs and AWBs which they see as undermining their authority. The tug of war is not yet resolved and in Sindh and Punjab there continues to be a dual system in operation: i.e. some areas under PIDAs and other directly under PIDs.

Provincial Irrigation and Drainage Authorities (PIDAs)

PIDAs were established in 1997 parallel to the PIDs to ease their workload in each province. The PIDAs are supposed to operate and maintain all the canals, branch canals, drainage systems, and manage the flood protection infrastructure within the command areas. Under the PIDA are Area Water Boards, which divide up the irrigation system into manageable size. Each AWB has a number of Farmers Organizations and Water User Associations an effort to make management of the water system more transparent (Kamal 2009).

PIDA have not been able to acquire the powers from I & P Departments despite the approval of PIDA Acts. Most of the PIDAs are still waiting hiring of staff according to the plans for their establishment.

Provincial Agriculture Departments (PADs)

PADs are mainly responsible for the implementation on farm water management programmes (Kamal 2010). Theoretically the PADs have the mandate and extension services to be key actors in a system of integrated river basin management. Huge extension networks exist but serious lack of coordination and management has restricted the benefits which were envisaged out of this

institution. Most of the on-farm water management projects are not exhibiting the claimed efficiency.

Planning and Development Departments (PDD)

PDD Board in Punjab planning at provincial level, approve and monitor the development projects. The institutions have been weakened by the fact that valuable projects have to get approved from the federal agencies due to ceiling of their budgets. Limited areas fall in the provincial jurisdiction by the constitution. Lack of development funds in the provinces does not allow many needed projects to take-off in the provinces. A vacuum of competent human resource also exists.

Public Health Engineering Departments (PHED)

PHED is responsible for the domestic water supply and sanitary facilities to cities and housing development schemes (other than major cities) and rural areas. Most of the schemes under these institutions were incomplete / unoperational. These have been aborted or taken over by the District Governments.

Karachi Water and Sewerage Board (KWSB)

KWSB responsible for urban water supply and sanitation facilities to Karachi have been able to balance its revenues and expenditures. Sizeable skilled staff is responsible for operation and maintenance of water supply network and water pollution treatment plants. The Board has little coordination with related institutions in the city and almost no coordination with sister institutions in other cities.

Water and Sanitation Agencies (WASAs)

WASA has been established in all major cities like Lahore, Rawalpindi, Faisalabad, Multan, Quetta and Gujranwala. WASA Provision of urban water supply and sanitation facilities to the respective cities. It has been observing huge deficits mainly due to their major revenues being spent on energy. Weak coordination exists among all agencies. These institutions use the offices of other institutions as there is no technical staff to address issues of water supply and sanitation. The coordination mechanism and capacities have changed according to the devolution plan

Area Water Boards (AWBs)

Area Water Boards are active at the canal level. They are responsible for operation and maintenance of the canal and branch canal and related infrastructure under their jurisdiction. The AWB is also responsible for operation and maintenance of drainage infrastructure as well as collection of their share of abiana from the FOs in their area.

The AWBs were designed to be the apex body in a system of stakeholder-based bodies to oversee the irrigation and drainage systems and maximize their use, also ensuring equity and conservation. An assessment carried out in 2004 showed that their performance was variable, but the concept was both strong and feasible (RDC 2004).

Farmer Organizations (FOs) and Water User Associations (WUAs)

FOs operate and maintain the irrigation system associated with their canal and are responsible for ensuring equitable and judicious distribution of water, including water for small and tail-end farmers, and non-agricultural and domestic water users WUAs are responsible for the operation and maintenance of the watercourse as well as equitable distribution of water within the command area of that particular watercourse. An assessment carried out in 2004 showed that these institutions were very much in tune with the devolution system of that time and with the idea and system of local government (RDC 2004).

4. Blemishes of Institutions Management System

Increasing appointments on criteria other than merit, lack of budgets, absence of a clear definition of roles, responsibilities and targets, lack of coordination and communication between federal, provincial and local administrative departments, mistrust of government and lack of commitment from the people hamper the effectiveness of the water institutional management system and Actual water allocation is affected by new modules (opening in canals) as any new outlet means less water to the downstream users and tail end users.

In addition, while the cropping intensity as per water allocation is to be followed by tradition, there is no penalty if farmers exceed this, and they frequently do. Under the ordinance governing these water management organizations, there are no provisions for these water management

organizations to articulate water requirements at the field level (Jan 2010). The result is that, while an appropriate and necessary administrative framework exists in theory, its effectiveness is seriously curtailed in practice due to these shortcomings.

5. Conclusions and Recommendations

Although WAPDA was stipulated to be the custodian of the Indus Basin, in reality, this has not happened due to the ambiguous and overlapping roles and responsibilities of the several water related institutions.

IRSA operates at the federal level, as do the MoWP and WAPDA. Additionally, the provinces have irrigation and public health departments. Since devolution: districts, towns, and union councils have taken over water supply and sanitation (now in disarray). Integrated water resources management approaches, with their three Es of economic efficiency, environmental sustainability, and equity, may provide a useful framework to reorient water demand and improve water pollution management. There are options for increasing water supply from within the system without investing huge amounts in new infrastructure. One such option would be to repair and upgrade the canal system where feasible, while allowing water to seep from canals in areas where ground water needs to be critically recharged.

There is an urgent need for a paradigm shift in thinking about water resources management. Currently, there is no single organization that is responsible for the integrity of water resources or for the Indus River Basin.

In terms of integrated basin management, these participatory institutions could play a constructive role and would be amenable to conservation measures as well as working with agro ecological zoning.

The water governance mechanisms in Pakistan are still at early stage and enforcement is weak due to lack of capacity. Water institutions, as a group, should continue to survive and prosper because society is very much concerned about the water, and justifiably so. Groups who knowingly and deliberately distort facts and provide false information should be treated the same

as those who illegally pollute the water. Hopefully, government will start taking action on this in future. Coordination mechanism between the various water-related institutions is very weak. Decisions are taken within the respective departments without consent and approval of other related institution. Delay in decisions and implementation occurs, in cases where consensus building is done through coordination. However, there is some degree of coordination between the Federal Ministry of Water & Power (FMWP) and the provincial Irrigation and Power Departments (PIDAs). Similarly, the Federal Environmental Protection Agency (FEPA) has a coordination mechanism with the Provincial Environmental Protection Agencies (PEPA). At IRSA and the Federal Flood Commission the federal government and the provinces are represented. To cope with the water pollution and scarcity crisis, it is recommended that Pakistan must move from a business-as-usual scenario to benefit sharing mechanisms between provinces, so that the needs and priorities of all provinces are met by the new water management legislative and institutional frameworks. It is recommended that instead of setting up any further institutions, the existing ones be rationalized and their roles delineated carefully, such that they can collectively cope with all the challenges ahead: investments, repairs, and rehabilitation of water infrastructure.

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4: Water-Related Institutions in Pakistan

ACRONYMS

FAO	Food and Agriculture Organization
FFC	Federal Flood Commission
FMWP	Federal Ministry of Water & Power
GDP	Gross Domestic Products
I&P	Irrigation and Power
MDP	Ministry of Planning and Development
MOE	Ministry of Environment
UNICEF	United Nations Children's Fund
UNWWAP	United Nations World Water Assessment Programme
NEQS	National Environmental Quality Standard
NWFP	North West Frontier Province
UNDP	United Nations Development Programme
PCRWR	Pakistan Council of Research on Water Resources
PEPA	Pakistan Environmental Protection Act
PIEDAR	Pakistan Institute for Environment Development Action Research
Pak-SCEA	Pakistan; Strategic Country Environmental Assessment
PSLM	Pakistan Social and Living Standards Measurement Survey
RDC	Raasta Development Consultants
SOE	State of environment
UN	United Nations
WWD	World Water Day
WAPDA	Water and Power Disappearance Authority
WASA	Water and Sanitation
WHO	World Health Organization
WWF	World Wide Fund (for nature)
WASP	Water and Sanitation Program