Water and Nature Initiative: Issues of the Upper Catchments of HKH Region of Pakistan

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The area of water and nature is going to be critical in future with the continuation of the prevailing paradigm of water resources development for various sub-sectors of water use in the country. Further, the increase in population would further demand additional water resources for agriculture, industrial and domestic purposes. Thus pressure on the requirements of water for nature and ecosystems would be increased in the near future.

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Abbreviations and Acronym

ADB	Asian Development Bank
AKRSP	Aga Khan Rural Support Programme
APN	Asia Pacific Network
BRMP	Balochistan Resource Management Programme
CC	Climate Change
CD	Compact Disc
CSU	Colorado State University, USA
DSS	Decision Support System
EA	Ecosystem Approach
FFA	Framework for Action
EIA	Environmental Impact Assessment
FOs	Farmers Organizations
GCISC	Global Change Impact Study Centre
GIS	Geographic Information System
GOP	Government of Pakistan
GWP	Global water Partnership
HKH	Himalayas, Karakuram and Hindu-Kush
ICIMOD	International Centre for Integrated Mountainous Development
IUCN	International Union for the Conservation of Nature
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
JBIC	Japan Bank for International Cooperation
MAF	Million Acre Feet
MIS	Management Information System
NACS	Northern Area Conservation Strategy
NARC	National Agricultural Research Centre
NDP	National Drainage Project of WAPDA
NESPAK	National Engineering Services of Pakistan
NGOs	Non-Governmental Organizations
NRSP	National Rural Support Programme
NWFP	North Western Frontier Province
O&M	Operation and Maintenance
OFWM	On-Farm Water Management
PARC	Pakistan Agricultural Research Council
PATA	Provincially Administered Tribal Areas
PCRWR	Pakistan Council of Research in Water Resources
PRSP	Provincial Rural Support Programme
PWP	Pakistan Water Partnership
RS	Remote Sensing
Sailaba	Spate Irrigation Farming System
SCARP	Salinity Control and Reclamation Project
USAID	United State Agency for International Development
VO	Village Organizations
WAPDA	Water and Power Development Authority
WCD	World Commission on Dams
WRRI	Water Resources Research Institute of the NARC
WUAs	Water Users Associations

Executive Summary

Background

Country is divided into 10 broad agro-ecological regions considering physiography as basis for characterisation. Ecology and resources in these regions vary considerably. Main limitation is water shortage because of arid climate. Development of the country's economy is dependent mainly on the development of water resources, which, in turn, is more capital intensive than any other development. The examples of leaky eco-systems are: geologic and water erosion; sediment transport; sedimentation in reservoirs, rivers and channels; pollution of water resources; loss of biodiversity and especially the aquatic life; desertification; and over-grazing. Indigenous water harvesting systems are mostly located in northern dry mountains, wet mountains, *Barani* tract, Sulaiman piedmont, western dry mountains and dry western plateau. The water harvesting systems include mountain irrigation, runoff farming, torrent-spate-irrigation and perennial-spate-irrigation. These systems provide livelihood for a large number of ecologically and economically marginal people in Pakistan.

Northern Areas and Wet Mountains are selected for the **WANI Initiatives Study** covering the upper basins of the HKH region of Pakistan. For the study there is a need to cover both the major ecosystems, as the environment of these systems is significantly different. Mountain water conveyance systems are unique in the study area and used for meeting domestic and agricultural needs. The water diverted from the sources of snow- and glacier melt brought the water to the valley along the mountain contours through water channels in the Northern Areas, which are constructed and managed by the water users' institutions. The Aga Khan Rural Support Prgramme has developed over 600 village organizations in the Northern Areas with rehabilitation of water channels. In the wet mountains, large streams and waterways are used and in most cases these are natural waterways to divert water for domestic and agricultural needs. In certain cases, water is also diverted from the major channels by constructing gabion-type diversion structures and then conveyed to the command area.

Issues of Upper Catchments of the HKH Region of Pakistan

General Situation in the Country

IWRM concept is well known all over the world but it is hardly put into practice in the developing countries in the real life systems. The Water for Nature and Ecosystem Mainstreaming in IWRM is relatively a new concept in Pakistan. The principles of IWRM are well understood in Pakistan by some of the experts but the real challenge is how to put these principles in to practice. The "Water for Nature" as a concept was first put together as a part of the Framework for Action (FFA) for achieving the Pakistan Water Vision 2025. The environmental issues impacting on water resources are: a) the degradation of the surface and groundwater resources; b) the denudation of the watersheds; c) waterlogging and salinization of the lands; d) ecological changes in the wetlands; and e) groundwater depletion or mining.

To improve and sustain the ecosystem and environment and to conserve the natural resources, the requirement is controlling water pollution, prevention of waterlogging and salinity, safe disposal of drainage effluents, protection and management of watersheds, preserving the groundwater resource, protection of the wetlands and allocation of additional water to improve and sustain ecosystems. Following the strategies that are considered to be most relevant, the FFA proposed the immediate actions: a) set-up a basin-wide body to undertake regular monitoring of the quality of effluents, groundwater and changes in ecosystem and environment; b) reduce drainable

surplus; c) enact and enforce laws to regulate groundwater abstraction; d) promote conjunctive use of water for agriculture; e) treat and recycle drainage effluents for irrigated agriculture; f) ensure stakeholders and community participation; and g) raise awareness of stakeholders and educate people to protect natural resources and improve environment.

Critically evaluating the concept put in the FFA indicate that still the approach is to suggest interventions to minimize the impact on environment for the water development activities. The approach is of still supporting water development without considering the overall framework of the IWRM. The real challenge is how to include the concept of "Water for Nature and Ecosystem Mainstreaming" as part of the overall planning process of water related developments. However, there are certain concepts of integration between the sources of water (surface and groundwater) and practices (irrigation and drainage), which are now part of the conjunctive water use strategy being implemented in the country, but the IWRM approach is hardly followed in its own right. Some of the institutions like IUCN might claim that they have started work on IWRM but it is at the level of awareness regarding the concept of IWRM, so it can be regarded as a beginning.

The recent effort is the Pakistan Water Strategy and the National Water Policy, where environment focus has been given due consideration but still the ecosystem focus and the IWRM approach is yet to adopt. The most recent effort is by the ADB for developing water policy for Balochistan, where emphasis has been placed on the adoption of IWRM and the basin as a planning unit. This is a step in the right direction and if this policy completed and adopted by the provincial government will become a model for other provinces. It is important to mention that mountainous area of Balochistan is part of the HKH region.

The Pakistan Water Strategy and the National Water Policy do emphasize the water-environment focus and the basin approach for development and management of water resources. But there is no specific mention to follow the IWRM approach with EA mainstreaming. The existing water laws do not have any mention of IWRM and EA Mainstreaming. There is hardly any institutional mechanism in place among water sector development institutions, which support IWRM in the public sector. There do not exist any river basin authorities.

The Planning Commission now made it mandatory for every project to have EIA as part of the project document. In most of the cases the EIA is very general in nature. Hardly few projects have EIA with a comprehensive methodology leading towards quantification of the environmental impacts and the valuation and costing is hardly made for the environmental services. The cost for environmental impacts like deforestation, water pollution, groundwater mining and salinization is hardly computed and included in the project. There is still an emphasis on development of water and irrigated agriculture; therefore the environmental cost is always overlooked.

Contribution to Livelihoods

Pakistan today has less than 4% of its area under cover. Without proper development of the watersheds, the forest resources of the country, found mostly in the North, will be depleted. At a rate of 4% of depletion on an annual basis, there may hardly be any forests in the country by 2025. This would lead to further erosion of silt and the sedimentation levels in the rivers, which will increase further eroding the storage capacity of the reservoirs thereby posing additional problems in the ultimate disposal of the silt. The reduction in forest resources could reduce the carbon sinks in the uplands and add to higher temperatures. The increased temperature could speed up the snowmelt in the summer and add greater flows being discharged during short periods in the Indus river system. This would increase seasonal variability and add to the wastage of water to the sea, as additional storages are unlikely to be put in place.

The first comprehensive statement in the FFA is still tilted towards water development although it is part of the section on Water for Nature. The use of water for agriculture and people will have serious implications on ecology and environment. The Section of FFA for Ecological and Environmental Security highlights those aspects of water use and management, which impact upon the ecology and environment. The topics covered in this section include water quality, water pollution, waterlogging and salinity, regulation of groundwater abstraction, disposal of saline effluent, watershed management and wetlands. However, this section does not suggest any framework how to ensure ecological security.

The Poverty Reduction Strategy Papers now exist in all the provinces and have been approved by the provincial governments. But water-poverty-ecosystem framework is even not being discussed at the conceptual level what to talk about its application. The poverty-reduction programmes are now being implemented in all the provinces, but these programmes are still largely concentrated around the development of water resources for small-scale agriculture. The good example is the water channels rehabilitation programmes of AKRSP, NRSP, PRSPs and the public sector Area Development and Livelihood programmes for the poor.

Pakistan's HKH region especially the Northern Areas of Pakistan are the pioneer in documenting the large-scale experimentation rather development where the water channel rehabilitation was the major intervention as an entry point, which brought the rural communities to the level where their social organizations become functional and sustainable. Water is the only element (as an entry point) in these areas and in Pakistan in general, which can bring communities on a common platform to initiate rehabilitation programmes. These communities are now active in the natural resources management programmes, which not only improved their livelihoods but also helped to maintain the ecosystems. But all this was done even before the birth of IWRM and EA mainstreaming under the framework of natural resources management. Similar interventions have been tried under the "On-Farm Water Management Programmes" in the provinces rather they were the pioneer as these programmes were started during 1978, whereas AKRSP intervention was initiated in 1982.

There is hardly any study that water development and management efforts improved the environmental goods and services that support livelihood. Water development and management supported the livelihood but it also deteriorated the environment in general.

There are institutions like the fisherman associations, community participation in hydropower projects like Ghazi Brotha Power Project, anti dam movements like Rivers and People Networks, which are quite active. Rather these institutions are in plenty. These institutions are by and large driven by Water Politics and they never gone beyond advocacy.

Economics and Finance

Ministry of Environment, provincial Departments of Environment and Water Section of the federal Planning Commission are the institutions dealing with water and environmental issues in the country. Planning Commission has introduced EIA as a part of every development project but the valuation and costing of environmental services is not yet in place. There are some individuals who started talking for valuation and costing of water but it is just the beginning. There is a very strong lobby in Pakistan hindering the valuation and costing for water and environmental services. Politicians and farmers (i.e. the feudal) are the main lobbyists. There are some popular articles on this subject, which are of general nature and do not specifically include environmental assessment addressing valuation and costing of environmental impacts. There is a social gap in having sustainable development and financial resources are not constrained. It is hard to cite any

example where PES has been applied. However, there are potential locations in the HKH region where water management and natural resources management programmes have been implemented successfully.

Ministry of Planning and Development and other Planning Institutions hardly use valuation and costing of water as a part of the planning process. Such valuation and costing exercises are however part of the academic exercises. There does not exist any mechanisms to pay for the environmental services. There are no institutionalised systems for benefiting communities from the environmental services. Recently, trophy hunting has been institutionalised in all the four provinces, where the communities are being benefited with the income received from trophy hunting. Forestry Departments of the provinces in collaboration with NGOs dealing with resource conservation have developed mechanisms to advertise trophy hunting in the newspaper to invite bids. The legal framework has been provided to support trophy hunting and channelized income for the communities involved in conservation of wild life.

Resource Situation

Pakistan is facing persistent drought since the last 6 years (1998-2004). The reduction in river flows of over 40% was observed during this period. During the current year, there was a failure of monsoonal rains and due to low temperatures in the glacier zones; the glacier-melt was relatively less during the summer season. There is reasonable contribution by the mass media and the civil society regarding the identification of issues but hardly any course of action has been suggested.

Climate change assessment and adaptation is a very recent phenomenon in Pakistan. However, water and watershed management institutions yet have to adapt these. In fact, there is hardly any institution in the HKH region directly responsible for water and watershed management because still the emphasis is on water development.

People are very clear to respond to floods and droughts as their livelihoods are attached to agriculture. They are always ready to participate in actions related to drought mitigation and flood management. However, the drought is still seen in the context of drought relief measures and drought mitigation concepts still have to be included in the development process. Floods in the HKH region are relatively less as water drains into the river and concentrates in the plain where all the rivers have combined effects.

The environmental flows can be described in two broad categories, namely the flows for the upper ecosystems and the flows for the lower ecosystems (delta and coastal areas). There is sufficient awareness in the stakeholders of the coastal and delta areas regarding the environmental flows at downstream of the Kotri Barrage – the last barrage on the Indus basin irrigation system. They are much aware of the effects and impacts of seawater intrusion, effects on estuaries regarding the breeding space for the fish and the prawn. They are also aware regarding the effects of reduced or poor quality flows like the drainage disposal into the freshwater lakes in the Sindh province. These NGOs and civil society forums voice their demands quite well, rather some over done have been made in this regard. Because still there is no agreed value for the minimum environmental flows required below the Kotri Barrage.

Groundwater resources in the Indus basin are not limited in terms of quantity but in terms of quality. Outside the Indus basin irrigation system the groundwater resources are limited both in terms of quantity and quality. The use of groundwater is indiscriminate in terms of quantity and quality. The groundwater Act is not in place and thus there is no restriction to consider the environmental issues of groundwater exploitation. The redistribution of salts in the freshwater zone and intrusion of brackish groundwater into the freshwater zone due to excessive pumping

using deep tubewells is now a common phenomenon. The exploitation of groundwater in the freshwater zone is left primarily for the private sector, whereas public sector still invest in programmes dealing with brackish groundwater zone in an effort to lower the water table and reduce waterlogging due to inefficient irrigation. Government is now also giving attention on the mining of groundwater in Balochistan and other parts of the country, but still the subsidy on electric tariff is distorting the balance between resource depletion and resource use.

There are number of efforts being made to manage water availability and use due to the climate change. The most promising is adjusting the canal diversions to address the issue of shortages. The challenge being faced by the provincial Irrigation and Power Departments is that how canals are operated in shortage periods and also maintain the canal hydraulic regime to have reasonable level of efficiency and equity. Punjab Irrigation and Power Department has adapted a rotation of 14 days instead of 7 days to distribute the water shortages and having reasonable level of water efficiency and equity in water distribution. The command area thus was reduced in the Indus basin. Similar adaptations were observed in non-irrigated areas, where command area was either reduced or completely fallow due to lack of rainfall, runoff and hill-torrents. Water harvesting works, if there is rain. But there are some good efforts in rainwater harvesting in the area of domestic and agriculture water uses.

There does not exist any alternative model to the large infrastructural dam in Pakistan. If any such example exists in the world, Pakistan will be the first beneficiary of it and the experts promoting IWRM and EA mainstreaming would certainly be advocating it in Pakistan. The question of alternative agriculture needs rethinking until such examples exist. In reality it is not possible to have alternative model in a short-term and for areas where farming is linked with livelihood. In the watershed area of Tarbela dam, Shinkiari, tea plantations are hard to introduce because farmers could not adopt this perennial plantation, which provides harvests after 5 years instead of seasonal crops like wheat and maize, on which smallholders' livelihood is dependent. This is a hard task and until there are political and governmental commitments, such examples are hard to create.

There are no mechanisms available for studying and managing the environmental flows by the public sector institutions, as they are still measuring flows as a routine exercise without considering the environmental context. These measurements are being made still in the concept of either water availability or water use.

Local Empowerment

There are number of research papers on the concept of decentralization and participatory processes leading to better water management, but these are related to the schemes for canal command areas, AKRSP and small-scale isolated schemes outside the Indus Basin Irrigation System.

Presently, participation of water users and beneficiaries are now part of the project planning process. No project is approved until participation is part of the project. The public sector institutions, NGOs, the civil society and all other stakeholders are now advocating participation as a part of the water management and development process. However, the major advocate in the public sector is the Agriculture Department, whereas the Irrigation and Power Departments in the provinces are still trying to maintain the status quo, where they think they are going to loose the authority in the near future.

The question of gender and equity issues is complex. The participation of gender is yet to achieve. There is no example of participation, gender and equity in water and nature and EA

mainstreaming. However, in general water management schemes, there is an example to quote, where women organizations were organized separately to have their participation in the Scheme Development Process in the Malakand agency. Although, the Malakand Agency represents very traditional Pashtoon society, but with the Scheme Development Process it was possible to generate women participation in the irrigation schemes. But there was no EA mainstreaming element. In AKRSP's NRM activity, there is active women involvement in the management of the natural resources particularly the forests. IWMI and IUCN have also done considerable research on gender mainstreaming.

The beginning of participatory approaches in water management in Pakistan was initiated with the support of the research field party in Pakistan, where Colorado State University Water Management Field Party was given the contract for initiating research in Pakistan. Based on the support provided by USAID, the ever first project on "On-Farm Water Management" was initiated in all the provinces. In these projects community was organized with an objective of watercourse improvement where the Water Users' Associations (WUAs) were involved in cost-sharing and joint working. Even certain experts regard it as a failure due to lack of sustaining the WUAs but this was the beginning in 1978. Later a similar approach was adopted by the AKRSP during 1983, where more homogeneous communities are living, belonging to the Ismaeeli's sect, the participation was relatively more effective and institutions were more sustainable in a relative term. But still this model was not cost-effective for large-scale adoption. Later on the similar Village Organizations (VOs) approach of AKRSP was followed by the NRSP and PRSPs in the provinces, but was not that successful as the communities are not homogeneous and sometime number of villages owns a watercourse. However, the VOs were very successful in having credit-saving schemes. The recent experience is the institutional reforms in the irrigation sector where such organizations were scaled-up at the distributary level and social organization process was used for the formation of such Farmers Organizations (FOs) and now part of the Institutional Reforms Agenda under the NDP. This experiment is now being made at the pilot scale at 6 canal commands in the country. But there is still hesitation to transfer the Irrigation Management to these FOs.

In the area of traditional water development and management activities the users institutions are active. The most important and effective water institution in the Indus basin is the Warabandi, which is a water distribution and water allocation institution below the Mogha command of the watercourse. These institutions ensure time equitable water distribution among the landholders. These farmers were later on further organized to conduct the watercourse improvements and renamed as Water Users' Associations under the provincial Acts and Ordinances of the Water Users' Associations, since 1981.

There are now well-established mechanisms to foster participation in water management. At the federal level, the Water Section of the Planning Commission ensures that participation in water sector projects is an essential element of the institutional responsibilities and their organizations also contribute in financial terms. At the provincial level, the On-Farm Water Management Directorates of the Department of Agriculture, Departments of Finance, and Planning and Development also ensure that effective participation is ensured in water management.

The national water policy does emphasize the equity and gender mainstreaming concepts, but the policy is still in the approval process since the last two years. But the past experience is that equity and gender concepts are hard to introduce in Pakistan until there is political commitment. The ADB is presently, helping the Government of Balochistan in the formulation of the IWRM Policy, if it is accepted by the Government of Balochistan then this would be the first policy in the water sector based on the IWRM framework, where EA approach is recommended for the preparation of the basin management plans. The framework adopted in this policy is the water-

environment-poverty reduction, whereas water-watershed-farming framework is proposed for the formulation of the agricultural planning at the basin level. The IWRM Policy draft was well received by all the stakeholders because water is now scarce and resource depletion and degradation is also severe in the province due to the persistent drought since the last 6 years.

Information Systems to Support EA in IWRM

There does not exist any information system for applying the EA in the country. The first thing to note here is that Information Systems even does not exist for the water management even without considering the EA. The stakeholders in the workshops and conferences do talk about the need for information systems and there are some efforts being made by different institutions in developing the information systems for water availability, management and use. The most effective system is the Pakistan Water Gateway, as a website organized by the IUCN, Pakistan, where all the important publications related to water are available including the government policy and strategy documents.

Regarding the EA mainstreaming, there is a need to initiate the IWRM Information system including the EA as a starting point. The need for an information system in water sector named as Water Informatics is presented as a Chapter in the Book on "Water and New Technologies" recently published by the Global Change Impact Study Centre.

There is hardly any effort made for the use of DSS and MIS in catchment planning, except GIS and remote sensing techniques have been used as a research tool. The GIS and remote sensing techniques have also been used in the formulation of the Forestry Sector Planning. Similar techniques have been used in the development of the Drainage Master Plan and the Atlas on Drainage. WAPDA, IWMI, NESPAK, PARC and PCRWR have developed the databases, GIS and Remote Sensing applications in water management. Being an international institution, the IWMI is not cost-effective. The national institutions are cost-effective in the development of database and the application of GIS/RS activities due to better access to data and manpower availability beyond the project support.

Recommendations

- IWRM approach is relatively new in Pakistan. Concepts and principles of IWRM are well understood by the experts, but the real challenge is how to put these principles and concepts into practice. The beginning can be made by conducting a series of Case Studies in Pakistan and in other countries to evaluate Participatory Water Management and Natural Resources Management initiatives in the Northern Areas, Watershed Management in the Wet Mountains and Water Harvesting and Integrated Land Use in the rainfed areas of Pothwar Plateau, representing the HKH region of Pakistan. These Case Studies should be aimed to collect primary and secondary data within the framework of IWRM so that existing examples can be viewed and upgraded to meet the objectives of IWRM and EA mainstreaming.
- Based on the output of Case Studies, one Pilot be selected each in Northern Areas, Wet Mountains and Pothwar Plateau to declare these as IWRM Pilot Field initiatives. In collaboration with PARC, AKRSP, WAPDA, IWMI and NWFP-OFWM, IUCN may develop a Project for the introduction of IWRM with EA mainstreaming activities.
- There is a good chance of getting funding from national and international donors. The World Bank recent initiative for building the Country Assistance Strategy on Water might have focus on the ecosystem approach with IWRM framework, at least at the conceptual and strategy level. The growing awareness among the national institutions and the donor agencies provide an opportunity for funding in this area. The presence of AKF

in Northern Areas and the AKRSP water development initiatives in the last 20 years provide an opportunity for local ownership of such an initiative by the IUCN in collaboration with the national partners. The IUCN must view this initiative as an activity in the real life situation instead of routine desk study or field surveys to identify problems or to build strategies. IUCN initiative has to be owned fully by the national collaborators. Therefore a joint proposal should be prepared with active participation of the national collaborators.

- Initiative is needed to review the existing sectoral policies (water, agriculture, forestry, livestock and environment) with an objective to evaluate the strengths and weaknesses of policies in terms of IWRM and EA mainstreaming.
- Study is needed at the planning level to include IWRM and EA as a part of the planning process for sectoral development in the country. Strengths and weaknesses of the existing sectoral development process should be reviewed so that IWRM and EA mainstreaming becomes part of the routine planning process. Similar recommendation was made in the National Communication on "Climate Change for Pakistan".

- A National Forum be constituted on IWRM and EA mainstreaming by extending membership to experts, civil society, NGOs, private sector, local administration, political leadership, etc. The aim of organizing such a Forum is to create understanding and ownership of the IWRM and EA concepts at the national level. The federal Water section of the Planning Commission can provide leadership for this forum. Such a forum must be located within the national system instead of the IUCN. The Water Forum developed by IUCN-Balochistan has little ownership by the national institutions, as it is viewed as an IUCN Forum, even having good participation by stakeholders.

1. Country's Background and WANI Target Area

1.1. Physiographic Regions of Pakistan

Country is divided into 10 broad agro-ecological regions (**Figure 1**) considering physiography as basis for characterisation (PARC 1980). Ecology and resources in these regions vary considerably. Main limitation is water shortage because of arid climate. Development of the country's economy is dependent mainly on the development of water resources, which, in turn, is more capital intensive than any other development. The examples of leaky eco-systems are: geologic and water erosion; sediment transport; sedimentation in reservoirs, rivers and channels; pollution of water resources; loss of biodiversity and especially the aquatic life; desertification; and over-grazing. This requires an ecological approach for socio-economic development rather than a hardware approach presently being followed.

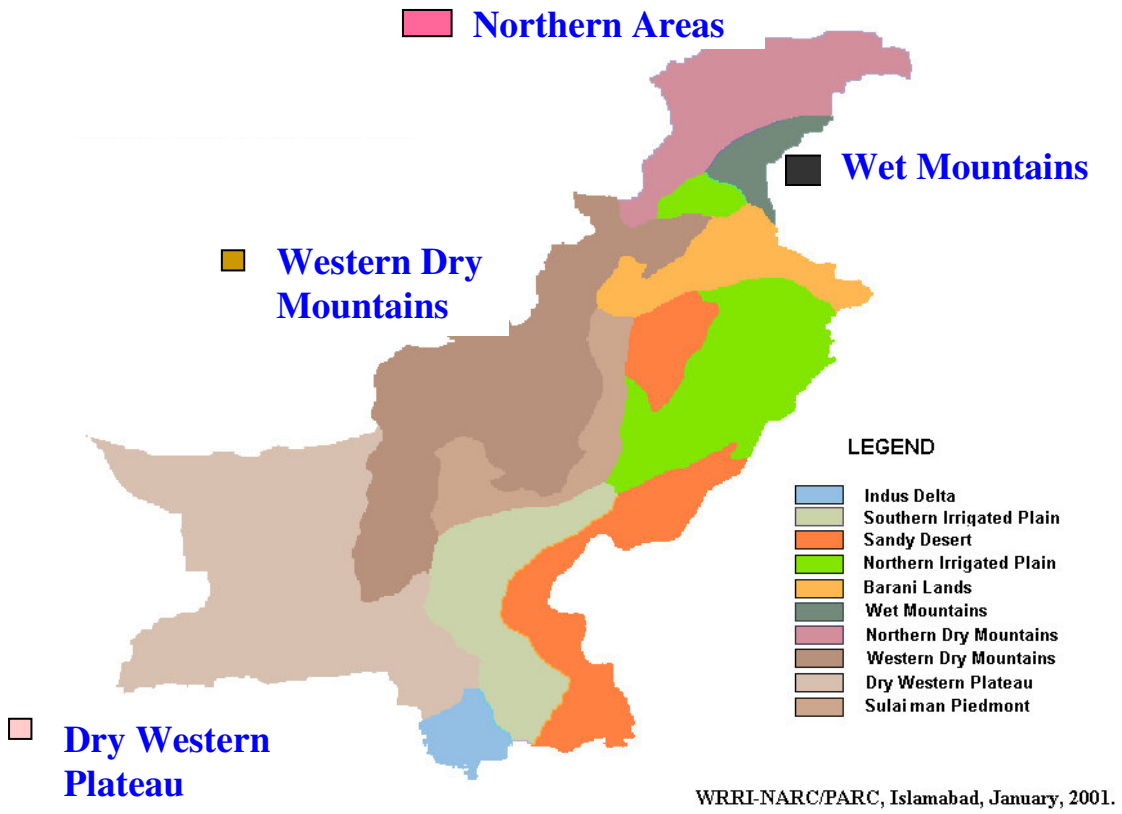


Figure 1. Physiographic Regions of Pakistan with Selected Areas for WANI Initiatives

The total cultivable area of Pakistan is 24.6 million hectare (mha). Around 12 mha are under forage and forests (GOP 2003a,b). This makes 36.6 mha suitable for agriculture and forestry. Rest 43 mha is not suitable for agriculture and forestry within existing framework except for rough grazing in certain places. Sustainable development of water in this area is one of the major limitations for expansion of agriculture and forestry to meet the growing needs of people and poverty reduction.

Out of cultivable area of 24.6 mha, 18 mha are under irrigation from canals, tubewells, wells, springs, streams, etc. Rest 6.6 mha is under rainfed (*Barani)* and indigenous water harvesting systems. Out of this,

2.0 mha are under torrent-spate-irrigation system (Khan, 1987; PARC, 1995). In addition to this, there are around 1.25 mha are under riverflood-spate-irrigation. This leaves around 3.35 mha, which solely depend on rainwater and/or runoff.

Indigenous water harvesting systems are mostly located in northern dry mountains, wet mountains, *Barani* tract, Sulaiman piedmont, western dry mountains and dry western plateau. The water harvesting systems include mountain irrigation, runoff farming, torrent-spate-irrigation and perennial-spate-irrigation. The riverflood-spate-irrigation systems are located along the River Indus. These systems provide livelihood for a large number of ecologically and economically marginal people in Pakistan.

1.2. WANI Initiatives Target Area

Northern Areas and Wet Mountains are selected for the WANI Initiatives Study (**Figure 1**) covering the upper basins of the HKH region of Pakistan. For the study there is a need to cover both the major ecosystems, as the environment of these systems is significantly different. Mountain water conveyance systems are unique in the study area and used for meeting domestic and agricultural needs. The water diverted from the sources of snow- and glacier melt brought the water to the valley along the mountain contours through water channels in the Northern Areas. The beauty of these systems is that these are constructed by the community and managed by the water users' institutions. The Aga Khan Rural Support Prgramme has developed over 600 village organizations in the Northern Areas with rehabilitation of water channels as major infrastructural development programme.

In the wet mountains, large streams and waterways are used and in most cases these are natural waterways to divert water for domestic and agricultural needs. In certain cases water is also diverted from the major channels by constructing a gabion-type diversion structures and then conveyed to the command area.

1.3. Mountain Watersheds of the Selected WANI Region of Pakistan

Northern Areas

Definition of a "mountain" or a "mountain watershed" must be determined by the purposes for which the definition is required. The classical definition has emphasized botanical zonation (Messerli 1983), but this is not particularly useful for hydrological studies.

For hydrological purposes, the mountain watersheds of the Northern Areas are best considered in geophysical, rather than botanical terms, reflecting variations in water and energy exchange as a function of topography and meteorology rather than zonation of vegetation (Alford 1992). In mountainous terrain of the Northern Areas, the interaction between topography and meteorology produces a situation in which the following takes place.

- In the Northern Areas, precipitation varies complexly with the aspects of altitude and terrain i.e. it varies from 120 mm to 2000 mm. There is commonly an "orographic" gradient, in which precipitation amounts vary along altitudinal gradients. Generally, "windward" slopes will be wetter than "leeward" slopes. With increasing altitude, the percentage of precipitation falls as snow increases.
- In the Northern Areas, the evaporation losses decrease with altitude as available energy decreases (Lambert and Chitrakar 1987).
- Steep mountain slopes of the Northern Areas cause water produced by rain or snowmelt on the surface to run off quickly into stream channels (Petts and Foster 1985).

- In many cases, shallow mountain soils and impermeable geologic formations of the Northern Areas can provide little storage for soil moisture and groundwater, as the soils are normally of extremely coarse textured.
- Vegetation of the Northern Areas may be zoned based on both altitude and aspect, limiting the hydrological impact of either removal or replacement to within narrow geographical limits for any single mountain watershed of the region.

Wet Mountains

The Wet Mountains of Pakistan cover the area of Northern Punjab and NWFP, which borders the Northern Areas. Wet Mountains receive monsoonal precipitation and it ranges from 750 mm to 1700 mm per annum. Out of that, around 60% is received in the brief monsoon season covering the period of July to September. The high intensity rains causing serious problems of water erosion and sediment transport. These areas are thickly populated and human interference has resulted in indiscriminate cutting of trees and shrubs further aggravating the problem of erosion and sediment transport.

The Mountain Watersheds have relatively higher surface cover compared to the Northern Areas, which are completely denuded, but it is continuously on the decline. The sub-basins are well defined and watersheds for both the Tarbela and Mangla dams fall in the Wet Mountains. The Siran River contributes to the reservoir of the Tarbela dam, whereas the Jhelum River contributes to the reservoir of the Mangla dam.

The tourism is very common in these mountains and the major load of local and foreign tourists is in this mountainous region, which creates environmental hazards due to pollution by solid and liquid wastes. Use of dynamite is very common to catch the cold-water fish including the trout fish, which is of prime value among the tourists.

The urbanization in these mountains is another problem causing serious concerns for the sustainability of the mountain ecosystems including the freshwater ecosystems and aquatic life. Most of the springs are now polluted completely by the human ecoli. The safe drinking water for the tourists is the bottled water. However, the local resource-poor and deprived inhabitants have to depend on the water of springs and streams to meet their domestic and agricultural needs.

The climate change studies conducted in the country indicated that there is warming in the last thirty years (1961-90) compared to the 30 years prior to this (1931-60). The reduction trend in precipitation was also observed during the same period (GOP-MOE 1998).

2. Issues of Upper Catchments of the HKH Region of Pakistan

2.1. General Situation in the Country

2.1.1. Discourse

The IWRM concept is well known all over the world but it is hardly put into practice in the real life system of the developing countries. The Ecosystem Mainstreaming in IWRM is relatively a new concept in Pakistan. The principles of IWRM are well understood in Pakistan by some of the experts but the real challenge is how to put these principles in to practice. The so-called examples of IWRM referred in Pakistan and many other countries are by and large still focussed on the concept and hardly put to practice under the real-life operating systems. Even if it is put to practice, it is still at a scale that it can be hardly cited as a model for application in the operating systems. Therefore, the concept of mainstreaming EA into IWRM has to be seen in this context, while referring to the Pakistan Case.

The "Water for Nature" as a concept was first put together as a part of the Framework for Action (FFA) for achieving the Pakistan Water Vision 2025 (GOP 2001a; PWP-GWP 2000; Mohtadullah 1993). The environmental issues impacting on water resources are: a) degradation of surface and groundwater resources; b) denudation of watersheds; c) waterlogging and soil salinization; d) ecological changes in wetlands; and e) groundwater depletion or mining.

To improve and sustain the ecosystem/environment and to conserve the natural resources, the requirement is controlling water pollution, prevention of waterlogging and salinity, safe disposal of drainage effluents, protection and management of watersheds, preserving groundwater resource, protection of wetlands and allocation of additional water to improve and sustain ecosystems (GCISC 2002; NACS 2002; GOP and ADB 2002; PWP-GWP 2000).

Following the strategies that are considered to be most relevant, the FFA (PWP-GWP 2000) proposed the following immediate actions.

- Set-up a basin-wide body to undertake regular monitoring of effluents quality (agriculture, domestic, industrial and drainage), groundwater and changes in ecosystem and environment;
- Reduce drainable surplus;
- Enact and enforce laws to regulate groundwater abstraction;
- Promote conjunctive use of water for agriculture;
- Treat and recycle drainage effluents for irrigated agriculture;
- Ensure stakeholders and community participation; and
- Raise awareness of stakeholders and educate people to protect natural resources and improve environment.

Critically evaluating the concept put in the FFA (PWP-GWP 2000) indicates that still the approach is to suggest interventions to minimize the impact on environment for water development activities. The approach is of still supporting water development without considering the overall framework of IWRM (GOP 2001b; GOP and ADB 2002). The real challenge is how to include the concept of "Water for Nature and Ecosystem Mainstreaming" as part of the overall planning process of water related developments. In fact, there is still a need to include ecosystem as an approach in the planning process and makes it work for the water development and management projects. This can be achieved if the water development is seen within the context of IWRM (BRMP 2004).

The donor agencies are still preferring the project approach within the context of sectoral development because the ecosystem mainstreaming into IWRM require a programme approach rather than project approach (ADB 2001; ADB 2003; World Bank 1992; World Bank 2004a,b). Donors' agencies main

focus is lending the financial support and they want to follow a simple and practical approach, which works for implementation of the loan agreements, and have a strong believe that project approach is still practical in the developing countries because the recent initiatives tried under programme approach could not be implemented effectively. The good example is the recent experiment of implementing the programme approach under the National Drainage Programme (NDP) resulted in slow implementation because the line departments (GOP 2002a) never owned the institutional reforms. The donors of this programme (World Bank, ADB and JBIC) have declared NDP as a problem project. But there is now growing awareness among the donor agencies like the ADB and the World Bank that water-environment-poverty reduction focus should be used as a criteria for evaluating the water sector project interventions. EIA is now an essential part of any project (ADB 2001; ADB 2003; World Bank 1992; World Bank 2004b).

The recent effort is the Pakistan Water Strategy and the National Water Policy, where environment focus has been given due consideration but still the ecosystem focus and the IWRM approach is yet to adopt (GOP and ADB 2002 and GOP 2003a).

The most recent effort is by the ADB for developing water policy for Balochistan, where emphasis has been placed on the adoption of IWRM and the basin as a planning unit (BRMP 2004). This is a step in the right direction and if this policy completed and adopted by the provincial government will become a model for other provinces. It is important to mention that mountainous area of Balochistan is part of the HKH region. Water Experts of PWP, PARC and IUCN are now advocating the IWRM approach in the country.

The following issues are now under discussion in the mass media, workshops and conferences (PARC-ICIMOD 2001):

- Degradation of watersheds, forest lands, mountains and wetlands due to over-cutting and over-grazing, pollution of water, and reduced environmental flows;
- Siltation of large dams and loss of live storage capacity;
- Pollution of freshwater streams and groundwater due to the agricultural effluents, sewage and industrial effluents; and
- Persistent drought and climate change due to global warming.

2.1.2. Practice

The elements of EA Mainstreaming to IWRM are hardly practiced in Pakistan. The reason is that the water sector development and management projects are still being implemented under a project approach. However, there are certain concepts of integration between the sources of water (surface and groundwater) and practices (irrigation and drainage), which are now part of the conjunctive water use strategy being implemented in the country (GOP and ADB 2002, GOP 2003a; World Bank 1992), but the IWRM approach is hardly followed in its own right. Some of the institutions like IUCN might claim that they have started work on IWRM but it is at the level of awareness regarding the concept of IWRM, so it can be regarded as a beginning.

The concept will be successful only if it is accepted and adopted by the real actors, the line departments, the water users, farmers, civil society, etc. The author is not aware of any practical effort in the country where the concept of IWRM and EA mainstreaming has been adopted. The whole system concept has been adopted in terms of technological interventions followed by participation but the concept of water, as an economic good is never adopted. Participation is yet in a consultative form only. Women participation is very much limited. Basin approach hardly considered as a unit for planning of water projects whether under IWRM framework or in relation to EA. However, Indus basin is considered as a unit for planning and little emphasis was placed on planning at sub-basin levels.

The root-cause is that the owner of the EA is the Forest and Environment Departments in the provinces and the Ministry of Environment of the federal Government and their culture is completely different than of the water sector institutions. Merely putting IWRM and EA as an Annex to the traditional approaches would not lead us anywhere. The existing institutional set-up and too much emphasis on the sectoral approaches is one of the major constraints hindering the adoption of IWRM and the EA. The beginning requires an Island of Success based on the IWRM and EA approach. The believers of the IWRM and EA have to demonstrate their concept into practice.

The most practical and feasible option is to develop a pilot-scale demonstration in the real-life situation of the HKH region, where IWRM framework is used with EA Mainstreaming using water-environment-poverty reduction as a criterion for the selection of interventions. The problems of rural communities have to be addressed using a phase-wise approach.

- 1st phase - addressing social and civic issues of rural communities of immediate nature;
- 2nd phase - addressing income generation through productivity enhancement in terms of water productivity and through other means, as an intermediate phase;
- 3rd phase - addressing issues of sustainability and environmental control using IWRM and EA mainstreaming framework, as a long term phase.

The point to be considered is that if the experts of IWRM are serious to include EA Mainstreaming in IWRM, then the real issues of immediate and intermediate nature should be addressed. The real issue should be to address the needs of the rural communities and water users only then they will adopt the IWRM and EA. This can be viewed from the experiences of the failures of the environmental control projects, which were aimed for long-term benefits and ignored the issues related to the immediate and intermediate nature. For example, the watershed management projects fail because they do not address the fuel wood and timber needs of the local communities and benefits of plantation of slow growing pine trees are not available to the communities in the near future. Therefore, the entry point should be to address the immediate needs of the local communities.

2.1.3. Governance

The Pakistan Water Strategy and the National Water Policy do emphasize the water-environment focus and the basin approach for development and management of water resources (GOP 2003a; GOP and ADB 2002; Pradhan 1999).

The First Comprehensive **National Water Policy** was formulated to optimize the development of water resources (surface and groundwater resources) and to enhance productivity and sustainability of water in agriculture and other sub-sectors of water use, which is yet to be approved by the federal government. Around 93% of annual available water is being used for the agriculture sector, therefore, the emphasis of the National Water Policy is to contribute to food security and poverty reduction by fostering sustainable increases in productivity of water through optimal supply and effective management at the basin level. The First Comprehensive **National Water Policy** is **aimed** to achieve the followings:

- Efficient management and conservation of existing water resources;
- Optimal development of potential water resources;
- Steps to minimize time and cost overruns in completion of water sector projects;
- Equitable water distribution in various areas and canal commands;
- Measures to reverse rapidly declining groundwater levels in low-recharge areas;
- Increased groundwater exploitation in high-recharge areas;
- Effective drainage interventions to maximize crop production;
- Improved flood control and protective measures.

- Steps to ensure acceptable and safe quality of water;
- Minimization of salt build-up and other environmental hazards in irrigated areas; and
- Institutional reforms to make the managing organizations more dynamic and responsive.

The **National Water Policy** articulated that the water resources management and development in Pakistan faces immense **challenges** for resolving many diverse problems. The most critical of these is a very high temporal and spatial variation in water availability. The temporal variation is indicated from the fact that highest annual flows are double of the lowest flows based on the last 70 years flows data. In addition, there is a considerable seasonality in flows. Nearly 81 % of river flows and 65% of precipitation occurs during the three monsoon months, while quality of groundwater largely varies with depth and location. The spatial variations are in terms of precipitation, groundwater quality and availability of canal supplies. The variation in rainfall is in the range of 100-750 mm per annum in the Indus basin.

Ever expanding water needs for the growing economy and the population for meeting its food and fiber requirements, and the advent of frequent floods and droughts, add to the complexity of water management. The **Key Issues** related to the sustainability of irrigated agriculture and its further expansion were identified in the First Comprehensive **National Water Policy** and are listed as under:

- Growing need of water to meet requirements of rising population besides socio-economic demands;
- Very high variations, both in terms of space and time, in the availability of water resources;
- Reduction in the availability of surface water, due to silting of dams;
- Lack of proper maintenance of the canal system leading to unsatisfactory service;
- Waterlogging and salinization of areas in various canal commands of Indus Basin System;
- Lack of commitment by various organizations on the need for provision of drainage network as a part and parcel of the irrigation network;
- Over exploitation of groundwater resources, thus, rendering large areas out of reach of poor farmers and exhaustion of groundwater aquifers;
- Pollution of aquifers due to lateral movement of saline water or upward movement of highly mineralized deep water;
- Lack of proper disposal of saline effluent;
- Contamination of river water due to disposal of industrial waste, household wastewater and field overflows contaminated with fertilizers and pesticides;
- Inadequate participation of consumers;
- Frequent floods and droughts and climate change impacts on water availability;
- Lack of inter-provincial consensus on developmental strategy and mistrust between provinces on equitable water distribution;
- Proper pricing/valuation of water; and
- Quality of water in all sub-sectors.

The **Guiding Principles,** which formed the basis for formulating the First Comprehensive **National Water Policy**, are listed as under:

- By the year 2025, Pakistan should have adequate quantity as well as quality of water, equitably distributed to meet the needs of all users through an efficient management, institutional and legal system that would ensure sustainable utilization of its water resources;
- Water has to support economic and social development with due consideration to the environment, quality of life, economic value of resources, ability to pay and the participation of all stakeholders;
- National water-resource development and management should be undertaken in a holistic, determined, and sustained manner;

- Insofar as is feasible, planning, development, and management of water resources should be decentralized to appropriate levels responding to basin boundaries and/or canal systems;
- Delivery of specific water services should be delegated to autonomous and accountable public and/or cooperative agencies providing water services in a defined geographical area to their customers and members for an appropriate charge, but with proper and effective regulatory functions to be performed by an independent body;
- Water use in society should be sustainable with appropriate incentives, regulatory controls, public education, promoting economic efficiency, conservation of water resources, and protection of environment, within a transparent policy framework;
- Shared water resources within and between provinces should be appropriately allocated, delivered equitably and efficiently for the mutual benefit of all riparian users;
- Water sector activities should be participatory and consultative at each level, leading to commitment by stakeholders and action that is socially acceptable; and
- Successful water sector reforms require sustained capacity building, monitoring, evaluation, research, and learning at all levels, to respond effectively to changing needs at the national, basin, project, service entity, and community level.

But there is no specific mention to follow the IWRM approach with EA mainstreaming. The existing water laws do not have any mention of IWRM and EA Mainstreaming. There is hardly any institutional mechanism in place among water sector development institutions, which support IWRM in the public sector. However, some of the research institutions like PARC, IWMI, etc. now advocate the IWRM approach. The PWP is the major institution in the private sector supporting the IWRM approach but their efforts are restricted mainly to the concept and awareness and serve as a post box to the GWP. Until the main actors accept this approach, the small actors cannot make any difference at the ground level.

There do not exist any river basin authorities. The recent initiative by ADB might be the first attempt to accept basin as a unit for preparing the Management Plans as part of the IWRM Policy for Balochistan BRMP 2004). In fact, first time the IWRM framework has been used for the Water Policy, and it is the first documented Water Policy for the province of Balochistan, which is a part of the HKH region.

The Planning Commission now made it mandatory for every project to have EIA as part of the project document. In most of the cases the EIA is very general in nature (GOP 1997). Hardly few projects have EIA with a comprehensive methodology leading towards quantification of the environmental impacts and the valuation and costing is hardly made for the environmental services. The cost for environmental impacts like deforestation, water pollution, groundwater mining and salinization is hardly computed and included in the project. There is still an emphasis on development of water and irrigated agriculture; therefore the environmental cost is always overlooked. Beginning has been made but still there is long way to go.

2.2. Contribution to Livelihoods

2.2.1. Discourse

The Water Vision for Pakistan, as prepared through a process of consultation, by the Pakistan Water Partnership (PWP) has presented in the Pakistan Country Report: Vision for Water for the 21st Century (PWP 1999a). This document was used for the formulation of the FFA. The GWP-SASTIC, in close collaboration with the respective Country Water Partnerships, has developed the South Asia Regional Water Vision 2025, which contains the common and country specific vision elements, the major drivers and the country scenarios. The FFA was the first document, which specifically brought the concept of Water for Nature in Pakistan.

Pakistan today has less than 4% of its area under cover. Without proper development of the watersheds, the forest resources of the country, found mostly in the North, will be depleted (GCISC 2002; PARC-ICIMOD 2001; PWP-GWP 2000). At a rate of 4% of depletion on an annual basis, there may hardly be any forests in the country by 2025. This would lead to further erosion of silt and the sedimentation levels in the rivers, which will increase further eroding the storage capacity of the reservoirs thereby posing additional problems in the ultimate disposal of the silt. The reduction in forest resources could reduce the carbon sinks in the uplands and add to higher temperatures. The increased temperature could speed up the snowmelt in the summer and add greater flows being discharged during short periods in the Indus river system. This would increase seasonal variability and add to the wastage of water to the sea, as additional storages are unlikely to be put in place.

The first comprehensive statement in the FFA is still tilted towards water development although it is part of the section on Water for Nature. The use of water for agriculture and people will have serious implications on ecology and environment. The Section of FFA for Ecological and Environmental Security highlights those aspects of water use and management, which impact upon the ecology and environment. The topics covered in this section include water quality, water pollution, waterlogging and salinity, regulation of groundwater abstraction, disposal of saline effluent, watershed management and wetlands. However, this section does not suggest any framework how to ensure ecological security.

In fact, still the concept of IWRM and EA are hardly accepted in their own right. The specific papers on the identification and quantification of ways that ecosystem services support local livelihoods are non-existent. There are number of papers indicating that water development do add to the livelihoods (Malik and Wood 2003; Ali and Tahir 1992).

The poverty reduction strategy papers (PRSP) now exist in all the provinces and have been approved by the provincial governments (GOP 2003b; GOP 2003c; Jafri 1999). The PRSP represents an adequate framework for the country's efforts towards achieving sustainable growth and poverty reduction. It has been prepared in a participatory manner and through consultation with all tiers of government, civil society, and the broader international community. The strategy is coherent and comprehensive, but to some extent lacks specificity. The assessment made by the World Bank (World Bank 2004a) highlights the many challenges that remain and this form an agenda for further work. It is recommended that the next annual progress report include the following:

- An explicit and prioritised roadmap of reform and policy actions envisaged in the medium term with a clear timeline, especially in priority areas such as power and rural development, and indicting clear priorities for donor coordination;
- Updating of the macroeconomic framework to include a low-case growth scenario, incorporating key risks and implications for poverty;
- Addressing the critical issues related to governance, especially in the area of devolution;
- Completing the costing exercise planned in the priority social sectors and progress towards developing the mid-term evaluation;
- Implementing the surveys and finalizing broader institutional arrangements for monitoring and providing timely feedback into the policy process, including poverty and social impact analysis of planned policy reforms, for example in the area of energy pricing.

But water-poverty-ecosystem framework is even not being discussed at the conceptual level what to talk about its application. The poverty-reduction programmes are now being implemented in all the provinces, but these programmes are still largely concentrated around the development of water resources for small-scale agriculture. The good example is the water channels rehabilitation programmes of AKRSP, NRSP, PRSPs and the public sector Area Development and Livelihood programmes for the poor.

There does not exist any model, which can be cited as a success story and is of the size and extent that it becomes a model for the sectoral agencies and rural communities to follow. In fact, the IWRM and EA advocators are still by and large advocating the concept.

2.2.2. Practice

Pakistan's HKH region especially the Northern Areas of Pakistan are the pioneer in documenting the large-scale experimentation rather development where the water channel rehabilitation was the major intervention as an entry point, which brought the rural communities to the level where their social organizations become functional and sustainable. Water is the only element (as an entry point) in these areas and in Pakistan in general, which can bring communities on a common platform to initiate rehabilitation programmes. These communities are now active in the natural resources management programmes, which not only improved their livelihoods but also helped to maintain the ecosystems (Malik and Wood 2003; PARC-ICIMOD 2001; Malik 1996; Streefland et al. 1995). But all this was done even before the birth of IWRM and EA mainstreaming under the framework of natural resources management.

Similar interventions have been tried under the "On-Farm Water Management Programmes" in the provinces rather they were the pioneer as these programmes were started during 1978, whereas AKRSP intervention was initiated in 1982 (Ahmad 2004; Ahmad 2001; Ahmad 1999; Chaudhary 1996).

There is hardly any study that water development and management efforts improved the environmental goods and services that support livelihood. Water development and management supported the livelihood but it also deteriorated the environment in general (Malik and Wood 2003).

There is not a single model in the country, which can be cited as an alternative model of agriculture development having beneficial effects and impacts on "Water and Nature". The reason of absence of such a model is that those who have the capacity to develop the alternative agricultural development models lacks appreciation for water and nature. Those who have appreciation for water and nature do not have the capacity to develop models in the real-life situation, as they hardly cross the conceptual boundary and not successful in building real-life models or they are not mandated to do it.

2.2.3. Governance

There are institutions like the fisherman associations, community participation in hydropower projects like Ghazi Brotha Power Project, anti dam movements like Rivers and People Networks, which are quite active. Rather these institutions are in plenty. These institutions are by and large driven by Water Politics and they never gone beyond advocacy. The elements contributed in the formation of these institutions, are as under:

- Associations of the Affectees of the Tarbela dam and Ghazi Brotha hydro-power project were formed because their land settlement issues took so much time and they were deprived of their rights and justice;
- The construction of dams resulted in the loss of riverine recession agriculture due to reduced peaks of river flows, thus these communities were supportive to NGOs active in the lower Sindh area;
- The NGOs, which voice the demands of these communities, were formed by the support of notables of the area and their financial sustainability is largely due to the donors support programme for the small scale NGOs. In fact, hardly any NGO was formed with the initiative of the affected communities themselves – means these are not community based organization so more inclined towards water politics rather resolving the issues of the affectees;

- Very few Associations exist which were formed voluntarily and were mandated by the community to fight for their rights and they hardly have any stake in the system.
- Majority of NGOs are also formed by external influences rather than voluntary motives.
- Funding available form the donors, public and private sectors was also a motivation
- Un-employment among the youth was another factor contributed in the formation of such NGOs.

2.3. Economics and Finance

2.3.1. Discourse

Ministry of Environment, provincial Departments of Environment and Water Section of the Planning Commission are the institutions dealing with water and environmental issues in the country. However, the Planning Commission has introduced the EIA as a part of every development project but the valuation and costing of environmental services is not yet in place. There are some individuals who started talking for valuation and costing of water but it is just the beginning. There is a very strong lobby in Pakistan hindering the valuation and costing for water and environmental services. Politicians and farmers (i.e. the feudal) are the main lobbyists. There are some popular articles on this subject, which are of general nature and do not specifically include the environmental assessment addressing the valuation and costing of environmental impacts. There is a social gap in having sustainable development and financial resources are not constrained (Easterly 2001; AKDN 2000).

The good example is that one of the donor in Balochistan is supporting resource management policies and water developments where water-environment-policy focus is an essential part of the IWRM policy, but at the same time the same donor and/or other donors are investing in additional tubewells as a part of the drought mitigation project in basins where groundwater mining is at alarming rates. In fact, there is hardly any coordination among various donors and among different projects. Thus one project is in clash with the concept of the other. But there are some logical reasons to address drought emergent relief measures along with drought mitigation measures. There is a politics of drought relief and mitigation measures, where the provincial governments are equally responsible for installation of new tubewells, even the donors indicated that these tubewells be installed only in case of replacement tubewells. Thus the issue is complex because of the politics of drought mitigation and relief measures.

2.3.2. Practice

It is hard to cite any example where PES has been applied. However, there are potential locations in the HKH region where water management and natural resources management programmes have been implemented successfully. The AKRSP Target Area is the excellent example to initiate the IWRM and EA mainstreaming approach.

2.3.3. Governance

Ministry of Planning and Development and other Planning Institutions hardly use valuation and costing of water as a part of the planning process. Such valuation and costing exercises are however part of the academic exercises. There does not exist any mechanisms to pay for the environmental services. There are no institutionalised systems for benefiting communities from the environmental services. Recently, trophy hunting has been institutionalised in all the four provinces, where the communities are being benefited with the income received from trophy hunting. The Forestry Departments of the provinces in collaboration with NGOs dealing with resource conservation have developed mechanisms to advertise trophy hunting in the newspaper to invite bids. The legal framework has been provided to support trophy

hunting and channelized income for the communities involved in conservation of wild life. Similar, models can be developed for the IWRM and EA Mainstreaming.

2.4. Resource Situation

2.4.1. Discourse

Pakistan is facing persistent drought since the last 6 years (1998-2004). The reduction in river flows of over 40% was observed during this period. During the current year, there was a failure of monsoonal rains and due to low temperatures in the glacier zones; the glacier-melt was relatively less during the summer season (IWMI 2004; Ahmad et al. 2003; GOP 2002b). The following issues are being discussed in the media:

- Low-melt of glaciers
- Failure of the monsoonal rains
- Persistent drought
- Reduction in river flows
- Watershed degradation
- Loss of storage capacity
- Need for building additional storages
- Managing the shortages in canal diversions for irrigated agriculture in the Indus basin
- Groundwater mining and lowering of water table
- Seawater intrusion due to reduced or no flows into the delta areas
- Loss of biodiversity in the delta area – mangrove forests
- Shortage of fresh drinking water in coastal areas

The media is by-and-large emphasizing on the shortages of water and environmental impacts of water development without considering the environmental impacts. As generalists do write articles in the media so coverage of their articles is much more than the scientific articles written by experts. For example, the media was very active in creating awareness regarding the need for storage of water to meet the shortfall in irrigation water and the negative impacts of large dams on the lower riparians. The other issue normally covered by the media is the negative impacts of the drainage in the Indus basin. The deforestation and water pollution is another area on which media is very active. The problem with media and NGOs is that they are excellent in the identification of problem but hardly address the development paradigm of water which is faulty and does not include the IWRM framework or EA mainstreaming.

The issues identified by various research institutions and the experts are listed as under (Ahmad 2004; NACS 2002; WCD 2000; Benskota 1999; Ahmad and Ahmad 1999; Pradhan 1999; Wescoat and Leichenko 1992; Meyers 1986):

- Tarbela dam has changed the ecosystem of the mountain upstream; converting it into a deep, narrow oligotrophic lake. The productivity of this lake is low, and there is no emergent vegetation due to operational drawdown. The lake is a staging point for migratory birds, but is not suitable for over-wintering birds.
- Tarbela dam has also prevented the migration of *mahseer* (*Tor putitora*) into the cooler waters upstream during summer, and the occasional operational peak releases can wash out the substrate and fish immediately below the dam, causing a loss to local fishermen.
- Tarbela dam has contributed significantly to the increased storage and abstraction of water from the Indus, so that whilst the abstraction of water has increased by about 10%, the patterns of water flowing down the Indus has changed more dramatically. This is especially apparent in the increased frequency of low floods, which cover less than 25% of the flood plain.

- Many forested islands in the river – the belas – used to be refuges for wildlife, but with reduced flooding in the river, access to these belas has been made easier with the result that many forests have been cleared and increasingly the land on the belas is being used for agriculture.
- Reduction in flooding also causes losses in the fish populations, and whilst inland fisheries have shown increases in production over the years, the proportion of indigenous fish caught has declined in comparison to aquaculture.
- Reduction in the sediment discharge has meant that the balance between erosion due to high-energy waves and sediment deposition has changed towards erosion. The delta is expected to become transgressive and with the rise in sea level, inundation of the delta may be as high as several metres per year.
- Management and up-gradation of wetlands to maintain the natural aquatic systems.

There is reasonable contribution by the mass media and the civil society regarding the identification of issues but hardly any course of action has been suggested.

Climate change assessment and adaptation is a very recent phenomenon in Pakistan. However, water and watershed management institutions yet have to adapt these. In fact, there is hardly any institution in the HKH region directly responsible for water and watershed management because still the emphasis is on water development (Ahmad et al. 2003; GOP 1998; Chalise 1994).

People are very clear to respond to floods and droughts as their livelihoods are attached to agriculture. They are always ready to participate in actions related to drought mitigation and flood management (IWMI 2004). However, the drought is still seen in the context of drought relief measures and drought mitigation concepts still have to be included in the development process. Floods in the HKH region are relatively less as water drains into the river and concentrates in the plain where all the rivers have combined effects.

On the issue of large infrastructure like dams there is a mix opinion of various stakeholders. The people of the irrigated agriculture are relatively supporter of dams, whereas the HKH region and lower riparians have their reservations. Now on the issue of building any new dams the conflicts between provinces and among various stakeholders is rather deepened (WCD 2000). The larger infrastructures in the hydropower sector will be hard to build, as there is a conflict among the provinces, stakeholders and the civil society. Further there does not exist any effort to resolve the conflict where every stakeholder feels that it is a win-win situation. Until there is a mechanism among various stakeholders to build consensus on how the large dams are built and the environmental issues are taken care at the same time, there is hardly any chance of further construction of dams in the country.

The environmental flows can be described in two broad categories, namely the flows for the upper ecosystems and the flows for the lower ecosystems (delta and coastal areas). There is sufficient awareness in the stakeholders of the coastal and delta areas regarding the environmental flows at downstream of the Kotri Barrage – the last barrage on the Indus basin irrigation system. They are much aware of the effects and impacts of seawater intrusion, effects on estuaries regarding the breeding space for the fish and the prawn. They are also aware regarding the effects of reduced or poor quality flows like the drainage disposal into the freshwater lakes in the Sindh province. These NGOs and civil society forums voice their demands quite well, rather some over done have been made in this regard. Because still there is no agreed value for the minimum environmental flows required below the Kotri Barrage. The Water Apportionment Accord refers to 10 MAF for the environmental flows below the Kotri Barrage. In fact, the issue is rather more complex than thought by the national water experts and the civil society in the delta and coastal areas, because due to high variability in annual and seasonal flows, the question is how to ensure environmental flows in the dry periods or during the non-monsoonal period (October to July covering period of 10 months). Environmental flows below the Kotri Barrage can be ensured only during the monsoon season without having sufficient storage capacity. The question is not what is the current

awareness and thinking on the environmental flows but how to put this concept in practice in dry years when the river flows are even less than the average canals diversions in a dry year. There is hardly any awareness on that issue. The lower riparians are handling this issue from the angle of insisting on their own viewpoint and not ready to resolve it within the physical limitations of the river-flow type irrigation system.

Groundwater resources in the Indus basin are not limited in terms of quantity but in terms of quality. Outside the Indus basin irrigation system the groundwater resources are limited both in terms of quantity and quality. The use of groundwater is indiscriminate in terms of quantity and quality. The groundwater Act is not in place and thus there is no restriction to consider the environmental issues of groundwater exploitation. The redistribution of salts in the freshwater zone and intrusion of brackish groundwater into the freshwater zone due to excessive pumping using deep tubewells is now a common phenomenon. The studies at the WRRI, NARC have shown that in a period of 30 years (1967-98), around 16 % of the freshwater zone has changed to marginal quality zone (IWMI 1999; Ahmad et al. 2000; Ahmad et al. 2001). However, government policies are very clear on this issue (Steenbergen 1997). The exploitation of groundwater in the freshwater zone is left primarily for the private sector, whereas public sector still invest in programmes dealing with brackish groundwater zone in an effort to lower the water table and reduce waterlogging due to inefficient irrigation (GOP and ADB 2002). Government is now also giving attention on the mining of groundwater in Balochistan and other parts of the country, but still the subsidy on electric tariff is distorting the balance between resource depletion and resource use (BRMP 2004).

2.4.2. Practice

There are number of efforts being made to manage water availability and use due to the climate change (Ahmad et al. 2003; Qureshi 2003; GOP 2002b,c; Shaheen 2002; PWP 1999b; GOP 1998; Kijne and Van der Velde 1992; Wescoat and Leichenko 1992). The most promising is adjusting the canal diversions to address the issue of shortages. The challenge being faced by the provincial Irrigation and Power Departments is that how canals are operated in shortage periods and also maintain the canal hydraulic regime to have reasonable level of efficiency and equity. Punjab Irrigation and Power Department has adapted a rotation of 14 days instead of 7 days to distribute the water shortages and having reasonable level of water efficiency and equity in water distribution. The command area thus was reduced in the Indus basin (Haq 2001). Similar adaptations were observed in non-irrigated areas (Sailaba, Khushkhaba, Barani, etc), where command area was either reduced or completely fallow due to lack of rainfall, runoff and hill-torrents. Water harvesting works, if there is rain. But there are some good efforts in rainwater harvesting in the area of domestic and agriculture water uses (Ahmad 2004; Benskota 1999; Ahmad and Ahmad 1999; Uchida et al. 1994). This area is now having growing awareness.

The rainwater harvesting techniques in rainfed areas of the Pothwar plateau were developed by PARC using a soil-scaping approach. The concept of land use was integrated with water management. The integrated land use includes crops, forest/fruit plants, grasses and forages. Micro-catchments were used to harvest the runoff to supplement the incident rainfall. The ponding of runoff in the micro-catchments resulted in growth of cover grasses, which reduced the splash and sheet erosion. The deposition of thick leave mulch also helped to improve the soil structure and infiltration was increased by many-fold. The land slope and soil type dictated the selection of land use. Thus this can be regarded as a first effort using the ecosystem approach. Similar activities were also conducted in dry mountains of the Balochistan province (PARC 1986; PARC-ICIMOD 2001).

The recharge of groundwater is a difficult and complex area. There is now some awareness regarding the lowering of water table and mining of groundwater. Reduced abstraction is difficult because farmer's livelihood is dependent on groundwater use. The good example is the Balochistan province where average lowering of water table is now around 12 feet per year. Delay action dams have been constructed to recharge groundwater in Balochistan and mountainous areas but there was drought in the last 6 years,

thus these efforts contributed non-significantly. However, there is now growing demand for recharging the groundwater. But community based participatory actions are still missing. The communities are solely implementing such programmes without any major contribution. There is a need to have reversal in the whole concept of groundwater use. Until the Sailaba (Spate Irrigation) system is given due attention so that floodwater is spread for agriculture, which will ultimately contribute to the regional groundwater recharge. The delay dams only contribute to the shallow groundwater under localized situations (BRMP 2004).

Environmental flows studies have been undertaken for the Indus River. These studies are more concentrated for the flows below the Kotri Barrage – the last Barrage on river Indus. Such studies were part of the National Drainage Programme (NDP). Recently, the Government of Pakistan has constituted a Parliamentary Committee on "Water", which was assigned the task to conduct further studies representing: a) the lower riparians (flows below the Kotri Barrage); b) the uplands environmental flows; and c) water pollution issues. These studies are now in the process of being initiated. In addition to the NDP, IUCN, WCD and other institutions have done studies. The studies made by IUCN and WCD have little acceptance in the water sector institutions, as still there is a need to build ownership and understanding of the concept of water and nature.

There are some experiences of managing the droughts and floods in the country. Some of the experiences are listed as under (Ahmad 2004; IWMI 2004; Haq 2002; IWMI 2001; GOP 2001a,b; WCD 2000; IWMI 1999; Steenbergen 1997):

Drought

- Strategizing the releases of water from the Mangla and Tarbela storage reservoirs in line with the demand and critical periods of crops. Different provinces authorises indents for releases from the reservoirs based on their critical water demand during the extreme shortage periods of water (Haq 2002);
- Managing the shortages in canal water diversions by having rotation of 14 days instead of 7 days and also according higher priority for the brackish groundwater zone. Punjab province has even closed the canal water supplies in the extreme shortage periods to the fresh groundwater areas as these farmers can meet their demand from pumping of groundwater (Haq 2002). This strategy of managing canal diversions is now being adopted by all other provinces due to persistent drought since the last six years;
- Managing the canal operations and the O&M of the canals as a Crash Programme to reduce the losses by improving the capacity and rehabilitation of the engineering design to have reasonable hydraulic regime – organized under the monitoring of the Army Engineering Corps. The desilting programme conducted during 1999-00 was the nationwide programme with active participation of the water users, where the Water Users Associations pooled their tractors and machinery and worked with the Army Engineers corps. The government provided the fuel for the farmers' tractors and the working lunch to the water users. This was an excellent example of participatory Crash Desilting Programme.
- Awareness prgramme based on the studies conducted by IWMI, PARC and other institutions dealing with evapotranspiration using the remotely sensed data, where the impact of drought has positive results in reducing the waterlogging and increased productivity, such studies have shown that over-irrigation is a common practice in irrigated agriculture. Based on these studies the government has launched an extension campaign for farmers how to schedule their irrigations. The Working Group constituted for the development of the next Five-Year Plan (2005-10) for Agriculture further constituted a Sub-Committee to consider the Cropping Pattern and Water Use Efficiency, which suggested a strategy of how to adjust cropping pattern with water availability. The major intervention is to reduce the cropped area and increased water productivity (PARC 2004).

- Skimming wells technology has been widely adopted to skim the thin layer of fresh groundwater without disturbing the brackish groundwater layer. Around 60,000 skimming wells have been installed in the last 6 years. The private sector hand pump drilling companies turned into Skimming Wells companies. This was a breakthrough due to the drought adaptation efforts. The IWMI, PARC and WAPDA jointly conducted a research project, where skimming well technology was developed and small discharges of freshwater were used with drip and sprinkler irrigation (IWMI 1999). The skimming well is a multi-strainer shallow well, where pumping is strategized with an objective to control or avoid the upcoming of brackish groundwater into the freshwater zone.

Floods

- The Vision 2025, which includes development of new canals i.e. Thal, Rainee and Katchee with an objective to divert the floodwater and the summer season flows to grow the crops like rice, maize and sorghum during the brief monsoon season to bring additional area under command. The major part of these canals during conveyance section is being lined, whereas in the command area sections most of the canals are earthen if the area does not have excessive seepages. Therefore, it will also recharge the groundwater.
- Although dams are not designed to attenuate the flood peaks but the Tarbela Dam Case Study have shown possibility of managing the flood peaks through effective operation of the reservoirs (WCD 2000). The Tarbela Study recommended that the flexibility available in attenuating the flood peaks through adjusting the reservoir releases be used as an operational strategy in the future.
- Spate irrigation systems are now getting higher priority among the farming communities as the rainfed systems (Barani and Khushkhaba) are at risk due to the drought and failures of rainfall. Farmers are now rather keen to divert floodwaters for spreading into the command area. The government has also given high priority to the Sailaba systems in the Pakistan Perspective Development Plan for the years 2001-2011. PARC conducted a national research project in all the four provinces where technologies were developed for the development and management of spate irrigation systems. The hill-torrents water was utilized through a strategy of water spreading (PARC 2001). This traditional and indigenous system of water harvesting was neglected with the introduction of tubewells, which resulted in reduced recharge to the groundwater, whereas abstractions of groundwater were increased many-fold.
- Projects are being financed for Spate irrigation, which will consume some of the floodwater and water spreading into larger area would also result in groundwater recharge. Spate irrigation institutions are also being strengthened or being formed. Now a specialized website on Spate-irrigation exists, reflecting the Pakistan case (PARC-ICIMOD). PARC has recently submitted a Project on "Improving water management of Spate irrigation system in Rod-Kohi areas of Pakistan", which will be implemented through active participation of the water users.

There does not exist any example in the country, where real-life model exists as an alternative model to the large infrastructural dam in Pakistan. If any such example exists in the world, Pakistan will be the first beneficiary of it and the experts promoting IWRM and EA mainstreaming would certainly be advocating it in Pakistan. The question of alternative agriculture needs rethinking until such examples exist. In reality it is not possible to have alternative model in a short-term and for areas where farming is linked with livelihood. In Pakistan, in the watershed area of the Tarbela dam, Shinkiari, tea plantations are hard to introduce because farmers could not adopt this perennial plantation, which provides harvests after 5 years instead of seasonal crops like wheat and maize, on which smallholders' livelihood is dependent. This is a hard task and until there are political and governmental commitments, such examples are hard to create.

2.4.3. Governance

During 1998, National Committees were formed to oversee the process of conducting research on the assessment of the climate change and adaptation of management strategies. These Committees were later active in the process of formulation of the National Communication on "Climate Change and Adaptation" (GOP 1998; GOP 2002b). But these committees neither given the mandate to see the CC adaptations in the national development process nor they are active on this front.

There are no mechanisms available for studying and managing the environmental flows by the public sector institutions, as they are still measuring flows as a routine exercise without considering the environmental context. These measurements are being made still in the concept of either water availability or water use.

The EIA is now part of the formulation of the large water development projects and is essential for every project. The Ministry of Environment at the federal level started organizing the Environmental Audit meetings where the executing agencies are supposed to defend the EIA and the Environmental Management Plans. Recently the Ministry of Environment organized a meeting where Drainage Master Plan was discussed in the presence of all the stakeholders. The Ministry of Environment, NGOs and civil society is now more involved in the environmental issues and the management plans.

There does not exist any institution, which deals with the floods and droughts using the EA mainstreaming or even the IWRM. The institutions and mechanisms are well established for the drought relief measures and very limited for the drought mitigation measures (IWMI 2004).

2.5. Local Empowerment

2.5.1. Discourse

There are number of research papers on the concept of decentralization and participatory processes leading to better water management, but these are related to the schemes for canal command areas, AKRSP and small-scale isolated schemes outside the Indus Basin Irrigation System (Latif 2002; Khan and Latif 2002; Steenbergen 1997; Chaudhary 1996; GOP 1995; Pretty et al. 1995; Mumtaz 1993; Khan 1989; World Bank 1987). The participatory approaches in water management started during late 70s with the start of the On-Farm Water Management (OFWM) Programmes in all the four provinces, where the entry point was to establish Water Users' Association (WUA) at the watercourse level in the canal command area. Once the WUA was established the OFWM Specialist enter into an agreement with the WUA where government provide 70 to 80 % of the material cost and the rest 20-30% material cost is provided by the members of the WUA. The WUA also provide all the labour cost. During late 90s, the concept from the tertiary level irrigation system (watercourse level) was expanded to the secondary canal level (distributary canal) where Farmers' Organizations (FOs) were established with an objective to transfer the irrigation management at the secondary canal level. The WUAs become inactive once the watercourse improvements are completed; therefore, there is now emphasis to have continuity in the activities of the FOs, to have sustainability of users' institutions.

The decentralized and participatory approaches are limited to the improvement in water conveyance system at the tertiary and secondary levels. Hardly any such example exists for the alternative concept of irrigated agriculture.

Presently, participation of water users and beneficiaries are now part of the project planning process. No project is approved until participation is part of the project. The public sector institutions, NGOs, the civil society and all other stakeholders are now advocating participation as a part of the water management and development process. However, the major advocate in the public sector is the Agriculture Department,

whereas the Irrigation and Power Departments in the provinces are still trying to maintain the status quo, where they think they are going to loose the authority in the near future (GOP 2002a).

The question of gender and equity issues is complex. The participation of gender is yet to achieve. There is no example of participation, gender and equity in water and nature and EA mainstreaming. However, in general water management schemes, there is an example to quote, where women organizations were organized separately to have their participation in the Scheme Development Process in the Malakand agency, which is a typical tribal culture society (PATA 1996). Although, the Malakand Agency represents very traditional Pashtoon society, but with the Scheme Development Process it was possible to generate women participation in the irrigation schemes. But there was no EA mainstreaming element. In AKRSP's NRM activity, there is active women involvement in the management of the natural resources particularly the forests. IWMI and IUCN have also done considerable research on gender mainstreaming (Arial et al. 2004; Mumtaz 1993; Bandaragoda and Firdousi 1992).

2.5.2. Practice

The beginning of participatory approaches in water management in Pakistan was initiated with the support of the research field party in Pakistan, where Colorado State University Water management Field Party was given the contract for initiating research in Pakistan (CSU 1976). Based on the support provided by USAID, the everfirst project on "On-Farm Water Management" was initiated in all the provinces. In these projects community was organized with an objective of watercourse improvement where the Water Users' Associations (WUAs) were involved in cost-sharing and joint working to have watercourse improvements. Even certain experts regard it as a failure of sustaining the WUAs but this was the beginning in 1978. Later a similar approach was adopted by the AKRSP during 1983, where more homogeneous communities are living, belonging to the Ismaeeli's sect, the participation was relatively more effective and institutions were more sustainable in a relative term. But still this model was not cost-effective for large-scale adoption. Later on the similar Village Organizations (VOs) approach of AKRSP was followed by the NRSP and PRSPs in the provinces, but was not that successful as the communities are not homogeneous and sometime number of villages owns a watercourse. However, the VOs were very successful in having credit-saving schemes. The recent experience is the institutional reforms in the irrigation sector where such organizations were scaled-up at the distributary level and social organization process was used for the formation of such Farmers Organizations (FOs) and now part of the Institutional Reforms Agenda under the NDP (World Bank 1994; WAPDA 1996). This experiment is now being made at the pilot scale at 6 canal commands in the country. But there is still hesitation to transfer the Irrigation Management to these FOs.

There is no per say activity in the area of IWRM and EA mainstreaming in the country at least in the knowledge of the author. However, in the area of traditional water development and management activities the users institutions are active. The most important and effective water institution in the Indus basin is the Warabandi, which is a water distribution and water allocation institution below the Mogha command of the watercourse. These institutions ensure time equitable water distribution among the landholders. These farmers were later on further organized to conduct the watercourse improvements and renamed as Water Users' Associations under the provincial Acts and Ordinances of the Water Users' Associations, since 1981. The Water Users' Association Acts and Ordinances allow registering the Water Users' Associations as an NGO, who can enter into participatory irrigation management at the watercourse command level. These Associations are very active in the watercourse rehabilitation programmes but loose interests once the watercourses are improved. The real question is how to achieve sustainability of Water Users Associations in terms of financial and administrative autonomy in actions.

Recently, the provincial Irrigation and Drainage Acts were promulgated in the provinces during 1997, where distributary level management is supposed to be transferred to Farmers Organizations representing the water users at the distributary canal command. IWMI and OFWM have worked on three Pilot FOs in

the Fordwah Eastern Sadiqia canal command under the support from the World Bank and the Netherlands government. IWMI was able to establish a social organization process for organizing the FOs. These organizations are still by and large involved in the quantity aspect of management and no involvement in the quality. The environmental mainstreaming would come at the moment when these users institutions start responding both the quantity and quality aspects of water.

The basis of the dialogic process developed by IWMI is given as under:

- Interactive process which enhanced interactions in a series of meetings with water users which culminated in formation of FOs;
- Stepwise approach and building on the steps already taken;
- Process advances on mutual trust, sharing information, consulting for consensus, developing options, implementing an appropriate organizational design.

The five-step dialogic process is presented in the **Figure 2**.

Figure 2. Five Step Dialogic Process developed by IWMI for Social Organization at the Distributary Canal Level Farmers Organization.

2.5.3. Governance

There are now well-established mechanisms to foster participation in water management. At the federal level, the Water Section of the Planning Commission ensures that participation in water sector projects is an essential element of the institutional responsibilities and their organizations also contribute in financial terms. At the provincial level, the On-Farm Water Management Directorates of the Department of Agriculture, Departments of Finance, and Planning and Development also ensure that effective participation is ensured in water management.

The national water policy does emphasize the equity and gender mainstreaming concepts, but the policy is still in the approval process since the last two years. But the past experience is that equity and gender concepts are hard to introduce in Pakistan until there is political commitment (GON 2003a,b). The ADB is presently, helping the Government of Balochistan in the formulation of the IWRM Policy, if it is accepted by the Government of Balochistan then this would be the first policy in the water sector based on the IWRM framework, where EA approach is recommended for the preparation of the basin management plans. The framework adopted in this policy is the water-environment-poverty reduction, whereas water-watershed-farming framework is proposed for the formulation of the agricultural planning at the basin level (BRMP 2004). The IWRM Policy draft was well received by all the stakeholders because water is now scarce and resource depletion and degradation is also severe in the province due to the persistent drought since the last 6 years.

2.6. Information Systems to Support EA in IWRM

2.6.1. Discourse

There does not exist any information system for applying the EA in the country. The first thing to note here is that Information Systems even does not exist for the water management even without considering the EA. The stakeholders in the workshops and conferences do talk about the need for information systems and there are some efforts being made by different institutions in developing the information systems for water availability, management and use. The most effective system is the Pakistan Water Gateway, as a website organized by the IUCN, Pakistan, where all the important publications related to water are available including the government policy and strategy documents.

Regarding the EA mainstreaming, there is a need to initiate the IWRM Information system including the EA as a starting point. The need for an information system in water sector named as Water Informatics is presented as a Chapter in the Book on "Water and New Technologies" recently published by the Global Change Impact Study Centre (Ahmad et al. 2002).

2.6.2. Practice

There is hardly any effort made for the use of DSS and MIS in catchment planning, except GIS and remote sensing techniques have been used as a research tool in the area of catchment planning. The GIS and remote sensing techniques have also been used in the formulation of the Forestry Sector Planning. Similar techniques have been used in the development of the Drainage Master Plan and the Atlas on Drainage.

2.6.3. Governance

At present, WAPDA, IWMI, NESPAK, PARC and PCRWR have developed the database, GIS and Remote Sensing applications in water management. Being an international institution, the IWMI is not cost-effective. The national institutions are cost-effective in the development of database and the application of GIS/RS activities due to better access to data and manpower availability beyond the project support. The broad outline of the datasets being maintained by the major institutions are listed as under (Ahmad et al 2002):

Water and Power Development Authority

- Spatial and temporal data of river flows, rainfall, snow, canal diversions, groundwater use
- Spatial and temporal data of salinity and water table depths in the Indus basin
- Spatial and temporal data of groundwater quality in the Indus basin and in Pakistan

- Glaciers and snow melt in the HKH region
- Releases from storage reservoirs
- Floods and drought

IWMI

- Integrated database development for the Rechna Doab – a benchmark basin;
- Assessment of salinity and waterlogging in selected canal commands; and
- Assessment of variability in crop evapotranspiration under irrigated wheat in the Indus basin.

WRRI, NARC, PARC (official node of the ICIMOD for the database)

- River flows database of Pakistan – available on CD;
- Integrated GIS format database development for the HKH region of Pakistan;
- Delineation of drought prone areas for the Drought Relief Programme of the GOP;
- Rural poverty and natural resources endowments of Balochistan – dry mountains of the HKH region – available on CD;
- Watershed management in Barani areas;
- Recharge potential zones in Barani Lands;
- Vegetation cover analysis for the Shahpur dam;
- Hydrological potential of dugwells in six Tehsils of the Pothwar;
- Analysis of natural vegetation cover and types in Pakistan;
- Agroclimatic characterization of Pakistan;
- Agro-environmental Atlas of Pakistan;
- Groundwater quality analysis of MONA SCARP;
- Spate irrigation systems of the HKH region; and
- Glaciers and glaciers lakes inventory as part of the ICIMOD-APN Project – completed the three basin of the HKH region of Pakistan and database is available on CD.

In addition to the above-mentioned three institutions, there are few activities being conducted by the scientists and engineers of the Engineering and Agricultural Universities. NESPAK is also having the capacity in GIS/RS and few other consulting companies are also interested in this activity.

3. Institutions and Existing Institutional Arrangements

3.1. Federal Ministries and Allied Institutions

3.1.1. Ministry of Environment, Local Government and Rural Development

Ministry of Environment, Local Government and Rural Development are responsible for policy and programmes related to environment both in urban and rural areas, rural development and local government. The Ministry also supervises the work of following agencies and centres related to environment and rural development.

- National Conservation Strategy Unit
- National Centre for Rural Development and Municipal Administration
- National Council for Conservation of Wildlife in Pakistan
- Pakistan Environmental Protection Agency
- Pakistan Forest Institute

3.1.2. Ministry of Water and Power

Ministry of Water and Power is responsible for policy and programmes related to Water and Power. The Ministry also supervises the work of following agencies and centres related to water and power.

- Chief Engineering Advisor
- Federal Flood Commission
- Indus River System Authority
- Water and Power Development Authority

3.1.3. Ministry of Food, Agriculture and Livestock

Ministry of Food, Agriculture and Livestock is responsible for policy and programmes related to agriculture and livestock, in addition to food. The Ministry also supervises the work of following agencies and centres related to agriculture and livestock.

- Federal Water Management Cell
- Pakistan Agricultural Research Council

3.1.4. Ministry of Scientific and Technological Research

Ministry of Scientific and Technological Research is responsible for policy and programmes related to scientific and industrial research. The Ministry also supervises the work of following agencies and councils related to science and technological research.

- National University of Science and Technology
- Pakistan Council of Research in Water Resources
- Pakistan Council of Science and Technology
- Pakistan Science Foundation
- Pakistan Scientific and Technological Information Centre

3.1.5. Ministry of Kashmir Affairs and Northern Areas and State and Frontier Regions

Ministry of Kashmir Affairs and Northern Areas and State and Frontier Regions is responsible for dealing with all the affairs of Azad Jammu and Kasmir and Northern Areas. The Ministry also supervises the work of the Azad Jammu and Kashmir Council Secretariat.

3.1.6. Ministry of Planning and Development

Ministry of Planning and Development is responsible for planning of development programme of the country and for the formulation of national development plans, including the long-term perspective plans. The Ministry also supervises the work of the Pakistan Institute of Development Economics.

3.1.7. Ministry of Education

Ministry of Education is responsible for policy and programmes related to education in the country. The Ministry also supervises the work of following Universities.

- Allama Iqbal Open University
- Bahria University
- Quaid-a-azam University
- Fatima Jinnah Women University
- Higher Education Commission

3.1.8. Ministry of Women Development, Social Welfare and Special Education

Ministry of Women Development, Social Welfare and Special Education is responsible for policy and programmes related to women, social welfare and special education in the country.

3.2. Provincial Departments

The four provincial governments are responsible for the implementation of the development programmes and also provide public sector services to the people of their provinces. The departments under the provincial governments, which directly or indirectly have relation with the water and nature initiative, are as under:

- Department of Planning and Development
- Department of Irrigation and Power
- Department of Agriculture
- Department of Livestock
- Department of Fisheries
- Department of Forest

3.3. District Governments

The following departments have been part of the devolution plan implemented by the federal and provincial governments. The district governments are now in place and budget of the district has been allocated, which is being implemented by the district government headed by the District Nazim. The district governments are implementing the development programme. The process of decentralization will further go down to the grass-root level.

- Department of Agriculture

- Department of Livestock
- Department of Fisheries
- Department of Forest

3.4. NGOs

The major NGOs of the Punjab, Islamabad, NWFP and Northern Areas were selected considering their relevance to the Water and Nature initiatives and the list of their names is presented in **Annexure-I**.

3.5. Azad Jammu and Kashmir

The departments and organizational structure of the Azad Jammu and Kashmir is presented in the **Annexure II.**

3.6. Northern Areas

3.6.1. Northern Areas Governance Structure

The Northern Areas have the status of a Federally Administered Area. This means that the chief executive authority for the Northern Areas is vested in the Federal Minister for Kashmir Affairs, Northern Areas, States and Frontier Regions. Assisting him is a Deputy Chief Executive who is appointed by the Chief Executive from amongst the members of the Northern Areas Legislative Council, who shall be elected by majority vote by the members of the Council. The Deputy Chief Executive enjoys the status of a Minister of State. Advisors, who are appointed by the Chief Executive, in consultation with the Deputy Chief Executive, from amongst the members of the Northern Areas Legislative Council, assist the Deputy Chief Executive. The Advisors are entitled to the status of a Provincial Minister (**Figure 3**).

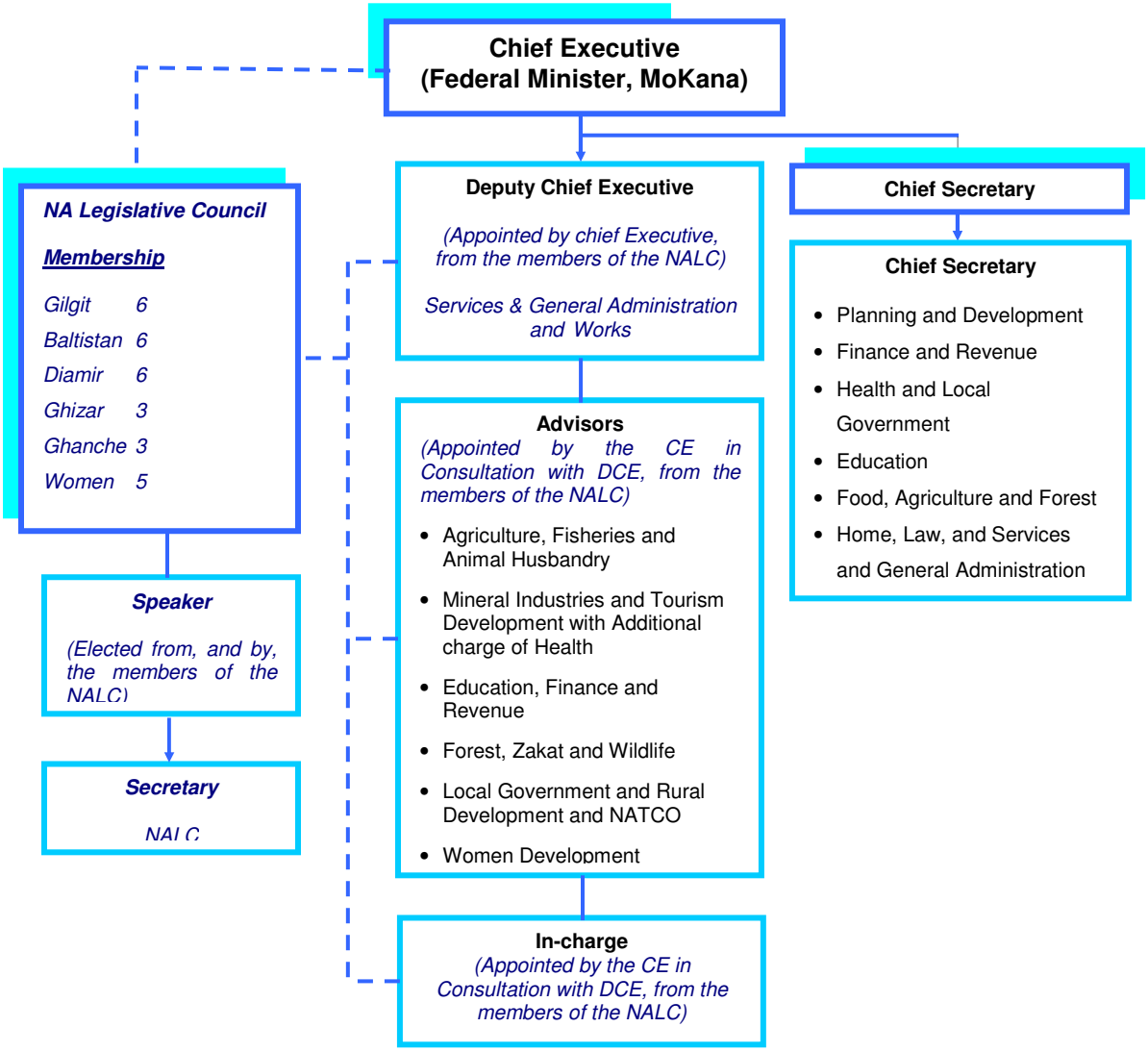
3.6.2. Departments

The principal civil servant in the Northern Areas is the Chief Secretary, and Secretaries head the departments. "Government" is defined by the Northern Areas Rules of Business, 1994 as meaning the Chief Executive, the Deputy Chief Executive and the Chief Secretary, Northern Areas.

3.6.3. Northern Areas Legislative Council

The Northern Areas Legislative Council is an elected body, having the following representation; six each from the three districts of Gilgit, Diamir and Baltistan, and three each from the two districts of Ghizar and Ghanche. There are five reserved seats for women, one from each district. The 24 directly elected representatives in the Council will elect the women members on these seats. The Federal Minister for Kashmir Affairs is a member of the Council. The Council elects from amongst its members a Speaker, who enjoys the status of a Provincial Minister. Schedule II to the Northern Areas Council Legal Framework Order, 1994 lists the matters with respect to which the Council may make laws. The Chief Executive's assent to the bill is required after passage in Council, without which assent it cannot become law. The Government of Pakistan may also by order make laws with respect to matters not enumerated in Schedule II. The annual budget allocated to the Northern Areas is presented before the Council in the form of a statement.

Figure 3. Organogram of the Northern areas Governance Structures



3.6.4. Judiciary

Each district has a court of District and Sessions Judge. There are ten civil judges also exercising the powers of judicial magistrates. There is a Chief Court, comprising of one Chairman and two members, which acts the court of appeal from the decisions of the District and Sessions Judge. The Northern Areas Council Legal Framework Order, 1994 provides for the Court of appeals as the apex court of the Northern Areas, and provides for its establishment as soon as possible. Such a Court of Appeals has so far not been set up, and therefore the decision of the Chief Court is final.

3.7. Water Informatics Institutions

Data is an essential requirement for application of IT in the water sector and for initiating systematic Water Informatics in Pakistan. Normally, institutions involved in data collection maintain their data

registers, which can be regarded as records because these could not be used in functional or relational form. Therefore, the pre-requisite is to initiate the development of databases, which are functional and relational in nature. The institutions collecting the data have the first right to build their own databases so that they can improve the quality of data to be collected in the future. In fact, the effort of building databases can help the data collection institutions to identify gaps and limitations in the collected data and develop strategy for improvement in the future. The quality of data is a real concern, because the use of IT and informatics can only be justified if the quality of data is reasonable.

The informatics is an essential element for having a systematic effort for the water and nature initiative in Pakistan or elsewhere. Therefore, a more detailed presentation is made for the data collecting and It application institutions in this report.

3.7.1. Data Collecting Institutions in Pakistan

In Pakistan, the remotely sensed satellite data are available from LANDSAT™ and SPOT satellites, and are received at the Earth Satellite Receiving Station of the Space and Upper Atmosphere Research Commission (SUPARCO) located in Islamabad. SUPARCO has also embarked upon the application of satellite data for better management of the country's natural resources and contributed reports on Remote Sensing applications related to agriculture, water resources, terrain mapping and geology, land use and coastal landforms. SUPARCO provides the digital satellite data to users on payment. Cost of LANDSAT™ digital data is Rs. 92,000 per scene, covering an area of 185x170 km, whereas cost of SPOT Multi-spectral XS digital data is Rs. 43,000 per scene covering an area of 60x60 km. The cost of data is very high for education and research institutions to have extended application of space informatics as part of education leading to MS and Ph D programmes.

Survey of Pakistan is a national agency dealing with survey and topographic maps covering a planning scale of 1:250,000 to detailed maps of the scale of 1:20,000. The country is divided into a grid system and survey sheets are available for each grid. Limited topographic data are available in digitized form, which is either scanned or digitized.

WAPDA is responsible for measurement of river flows and sediments data at Rim Stations and other selected points mainly concentrated in the watershed areas. The hydro-meteorological network of the Hydrology Division is the largest in the country maintaining over 200 stations. They collect data of groundwater table, groundwater quality, soil salinity (surface and profile), soil texture and land use. Basin wide printed Atlas is available based on the surveys completed in 16.4 million ha up to the period of 1979 (WAPDA 1981). SCARP Monitoring Organization (SMO) is monitoring the depth to water table and groundwater quality in the irrigated areas of the Indus basin twice a year (pre- and post-Monsoon periods). It is also involved in a study to assess the current situation of soil salinity in the Indus basin with an objective to update the 1981 Salinity and Waterlogging Atlas using the remotely sensed data. The data will be classified by projects/units, canal commands and districts and will be published for the entire irrigated area of the Indus basin.

Pakistan Meteorological Department collects daily meteorological data at around 60 locations in the country. Historical data are available with the department and they have published climatic normal (mean values) for 1930-60 and 1960-90. The Department has also conducted studies on climate change and drought.

Economic Wing of the Ministry of Food, Agriculture and Livestock publishes annually the Agricultural Statistics of Pakistan, which includes data related to area and production of crops, crop yields, inputs availability including water, groundwater, machinery, fertilizers, imports and exports, livestock, fisheries, farm and land use statistics. Recently, the Economic Wing in collaboration with the Water Resources Research Institute of the National Agricultural Research Centre (WRRI-NARC) included some of the GIS

based information related to agro-climates, cropping patterns, etc. in the Agriculture Statistics (GOP 2001b).

4. Recommendations

The recommendations related to Study WANI initiative for Pakistan are given as under:

- The IWRM approach is relatively new in Pakistan and mainly known to the experts of water management. The concepts and principles of IWRM are well understood by the experts. But the real challenge is how to put these principles and concepts into practice. The beginning can be made by conducting a series of Case Studies in Pakistan and in other countries of the Region to evaluate the Participatory Water Management and Natural Resources Management initiatives in the Northern Areas, Watershed Management in the Wet Mountains and Water Harvesting and Integrated Land Use in the rainfed areas of the Pothwar Plateau, representing the HKH region of Pakistan. These Case Studies should be aimed to collect the primary and secondary data within the framework of IWRM and EA mainstreaming so that existing examples can be viewed and upgraded to meet the objectives of IWRM and EA mainstreaming.

- Based on the output of the Case Studies, one Pilot be selected each in the Northern Areas, Wet Mountains and Pothwar Plateau to declare these as IWRM Pilot Field initiatives. In collaboration with PARC (including its Karakuram Agricultural Research Institute, Gilgit; Water Resources Research Institute, NARC, Islamabad), AKRSP, WAPDA, IWMI and NWFP-OFWM, IUCN may develop a Project for the introduction of IWRM with EA mainstreaming activities.

- There is a good chance of getting the funding support from the national sources and the international donors. The World Bank recent initiative for building the Country Assistance Strategy on Water might have focus on the ecosystem approach with IWRM framework, at least at the conceptual and strategy level. The growing awareness among the national institutions and the donor agencies provide an opportunity for funding in this area. The presence of AKF in Northern Areas and the AKRSP water development initiatives in the last 20 years provide an opportunity for local ownership of such an initiative by the IUCN in collaboration with the national partners. The IUCN must view this initiative as an activity in the real life situation instead of routine desk study or field surveys to identify the problems or to build strategies. IUCN initiative has to be owned fully by the national collaborators. Therefore a joint proposal should be prepared with active participation of the national collaborators.

- Another initiative is needed at the Policy level, where a study is initiated to review the existing sectoral policies (water, agriculture, forestry, livestock and environment) with an objective to evaluate the strengths and weaknesses of the sectoral policies in terms of IWRM and EA mainstreaming.

- Study is needed at the planning level to include IWRM and EA as a part of the planning process for sectoral development in the country. Strengths and weaknesses of the existing sectoral development process should be reviewed so that IWRM and EA mainstreaming becomes part of the routine planning process. Similar recommendation was made by the author while contributing in the National Communication on “Climate Change for Pakistan”.

- A National Forum be constituted on IWRM and EA mainstreaming by extending membership to experts, civil society, NGOs, private sector, local administration, political leadership, etc. The aim of organizing such a Forum is to create understanding and ownership of the IWRM and EA concepts at the national level. The federal Water Section of the Planning Commission can provide leadership for this forum. Such a forum must be located within the national system instead of the IUCN. The Water Forum developed by IUCN-Balochistan has little ownership by the national institutions.

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Annexure-I

Inventory of NGOs Relevant to Water and Nature

Punjab & Islamabad

1. Pakistan Institute for Environmental Development Action Research,
2. Trust for Voluntary Organization (TVO)
3. South Asia Partnership Pakistan (SAP-Pk)
4. Association for Network for Community Empowerment (ANCE)
5. Bedari
6. Strengthening Participatory Organization (SPO)
7. Pattan Development Organization
8. Development for Education, Environment, Population Welfare and Poverty Alleviation Organization (DEEPP)
9. Pakistan Academy of Social Sciences (PASS)
10. National Rural Support Programme (NRSP)
11. Sustainable Development Policy Institute (SDPI)
12. Aga Khan Foundation (AKF)

NWFP and Northern Areas

13. Frontier Resource Centre (FRC)
14. Sarhad Rural Support Corporation (SRSC)
15. Islamic Relief Agency-Pakistan (ISRA-Pak)
16. Sungi Development Foundation
17. Human Resource Management and Development Centre (HRMD)
18. Environmental Protection Society (EPS)
19. Aga Khan Rurual Support Programme (AKRSP)

Annexure-II

Table 1. Secretariat Departments, Attached Departments & Autonomous Bodies in AJK

Secretariat Departments	Attached Department
Agriculture, Livestock and Food	Agriculture
	Animal Husbandry (Livestock)
	Food
Finance	Audits & Accounts
	Co-operatives
	Excise & Taxation
	Local Fund Audit
Forestry	Archeology, Fisheries, Wildlife
	Forests
Information, IT & Tourism	IT
	Public Relations
	Tourism
Local Govt. & Rural Development	Local Govt.& Rural Development
	Election Commission Local Bodies
Planning and Development	Land Use Planning
	Environmental Protection Agency

Table 2. Autonomous bodies of the Azad Jammu and Kashmir

Autonomous Bodies	Secretariat Department
Azad Kashmir Logging & Sawmills Corporation	Forestry
ESMA	Agriculture, Livestock and Food
Local Government Board	Local Govt. & Rural Development