Water for Balochistan **Policy Briefings**

Volume (3), No. 7, 2007

Restructuring National Agricultural Research System (NARS) – the Case of NARS Balochistan (NARS-B)

Dr. Shahid Ahmad

1. State of Agricultural Research and Extension in Balochistan

1.1. Devolution of Agriculture Department

Devolution of power at the district level in the provinces including Balochistan has been in place since the last six years. ***The basic aim of the devolution is to empower local people at the district level through integration of activities of the line departments. In the agriculture sector, activities of Agriculture Extension, On-Farm Water Management, Agriculture Engineering, Livestock and Fisheries have been devolved. Irrigation and Power Department in the provinces was not devolved because the canal districts and/or hydrological basins do not follow the administrative boundaries***.

Devolution in the overall sector of agriculture can be seen in the framework of service provision to the farmers and rural communities. The activities of the devolved department could be reasonably organized to address needs of the farmers, who are direct clients of agriculture department in the province. ***It is important to note, that farmer is not the direct client of agricultural research, although, research has to be conducted in the real-life operating systems with active participation of farmers but even then farmer is not the direct client.***

Executive District Officer (EDO) Agriculture coordinates activities of all the line departments relevant to the agriculture sector. The devolved institutional arrangement provided an effective mechanism to coordinate development and extension activities in a given district. The research institutions must associate EDO (Agriculture) in research planning and implementation so that research is demand-oriented and findings are effectively disseminated to the farming communities in a given district. However, this mechanism is currently not in place.

Agriculture in this paper covers commodities like crops, fruits, vegetables, livestock, fisheries and forestry; and resources like water, land and genetic resources. Thus the word agriculture is used in the broader context of commodities and resources covering all the related disciplines like IT, biological sciences, farm machinery and processing.

1.2. Clients of Agricultural Research

For agricultural research, the clients are the devolved line departments at the district level, NGOs and the private sector. The concept of client is always misunderstood by the researchers and research institutions. Therefore, there is an urgent need to clearly define the concept of client in agriculture in the context of devolution at the district level.

One of the limiting factor is that how research institutions and the National Agricultural Research System (NARS) have to be re-oriented to address the needs of the devolved concept of nation building departments at the district level. Therefore, backward and forward linkages have to be evolved. Furthermore, once the devolution is fully in place the needs for knowledge and information for the line departments and clients would increase tremendously.

1.3. Devolution of Agricultural Research

Devolution of agricultural research in the present context of devolution at the district level is not possible due to the complex problems of ecology, hydrologic boundaries, climatic considerations and global changes. The financial problems also demand that research should be undertaken at few locations to address issues of various agricultural environments. Agricultural environments do not follow the administrative boundaries.

2. National Agricultural Research System

2.1. Pakistan Agricultural Research Council

PARC was established in 1981 as an apex scientific body at the federal level to undertakes, aids, promotes and coordinates agricultural research in the country by setting up and strengthening of research establishments, high level training of scientific manpower, acquiring and disseminating the agricultural research information that helps promote expeditious utilization of research results.

PARC since its inception was involved in the Coordinated Commodity Research Programmes, where all the cooperating scientists from all the four provinces, AJK and Northern Areas are involved in priority-setting and planning of annual research for a given commodity. This system of coordinated commodity research has helped the country to get self-sufficiency in rice and wheat. Rather country is now having surpluses in wheat and rice. Cotton is not included in this activity, as research establishments of the PCCC (Pakistan Central Cotton Committee) are mandated to conduct research on cotton. However, cotton like other commodities is part of the NARS.

Hardly any significant breakthrough was made in the area of horticulture. Private sector is largely responsible for having major contribution in the horticulture sector. The contribution made by the private nurseries at Patoke, Haripur and Quetta and the processing industry is significant. Important to note is that small scale agro-industrial and processing research is currently not addressed fully by the NARS.

The coordinated commodity research system supported by the Plant Genetic Resources has provided a sustainable mechanism for addressing the crises like crop diseases, pest and insect infestations, etc. mainly in rice and wheat. The country has faced crises situation in wheat (rust), cotton (leaf curl virus) and banana (bunch-top) in the past.

2.2. State of NARS

National Agricultural Research System (NARS) established by the PARC includes all the provincial and federal agricultural research and educational institutions. In fact the biological systems are dynamic in nature and thus the type and extent of the problems change continuously. Therefore, there is a need to further strengthen and focus the NARS in line with the Agricultural Research Service (ARS) of the United States Department of Agriculture (USDA) and the Indian Council of Agricultural Research. ***The USDA-ARS is a good example, where states enjoy full devolution; even then they have established and maintained a strong federal service for agricultural research.***

PARC establishments are now fully functional in special ecologies addressing the gap areas like dry and wet mountains, Barani areas, arid zones and coastal areas. In addition, a first rate facility in terms of manpower and laboratory-support has been established at NARC, Islamabad to address issues of high-tech and strategic research.

PARC is fully aware of the need for further strengthening the NARS through effective role of coordination, planning and priority-setting in agricultural research. PARC has to establish and maintain research in new and emerging areas like climate change, WTO, country's objective of import substitution and export orientation. Furthermore, ***high-tech and high value agriculture has to be initiated in the country through strong backstop support***.

The federal government recently assigned highest priority for strengthening and re-invigorating NARS and for this purpose more autonomy has been accorded to PARC both in administrative and financial matters. Adequate funding along with incentives for scientists are also being provided. Now it is a challenge for PARC management and scientists to deliver the required outputs as per country's expectations.

2.3. NARS Coordination

NARS of Pakistan is quite complex, as agricultural research is being done by a number of provincial and federal research and educational institutions. The most prominent are the provincial Agricultural Research Institutes (ARIs) and Agricultural Universities/Colleges in the provinces, Agriculture Research Centres under the Pakistan Atomic Energy Commission and institutions under the Pakistan Central Cotton Committee. The other research institutions are conducting research in areas of water, soil, forestry, livestock and social sciences. The conduct of research under commodity, discipline and resource perspectives further adds to the complexity and demands effective system for coordination of research at the provincial and federal levels.

Coordinated Research Programmes helped to coordinate the activities of scientists engaged in commodity research, but it was not possible to extend this concept to cover research related to natural resources and disciplines. Furthermore, it was not possible to link the activities of the commodity research programmes with the knowledge and resource-based research. The provincial research institutions regarded these commodity programmes as PARC programmes and till today most of the salaries are being paid by PARC for the scientists and employees of the

coordinated programmes. The past experiences of the coordinated research efforts indicated that there is a need to review the overall research agenda of various provinces and individual institutions instead of handling the issue of coordination merely from the perspective of commodity, discipline or resource perspectives.

Coordination in true sense will come through owning the total research system and then building the research agenda for each province jointly rather than just addressing the PARC funded activities. This needs reversal in thinking among the PARC scientists, as PARC in the past had a very narrow focus of looking at NARS, because PARC was looking at research funded by PARC and not the provincial research system, HEC, institutions under the Ministries of Science and Technology and Water and Power, and projects financed by other donors.

2.4. Issues faced by the NARS

The major issues faced by NARS are:

- How to address the provincial needs of agricultural research while developing the long- and short-term research agenda(s);
- How to link various components of research (commodity, discipline and resource-based) in the provinces and within PARC;
- How to link the provincial and federal research institutions while preparing the national research agenda;
- What mechanisms are effective for coordination of NARS to avoid unnecessary duplication and to have more planned duplication to address aspects of ecological diversity and environmental constraints?
- How to develop national and provincial policies for agricultural research and to develop effective mechanisms for priority-setting in agricultural research.

2.5. Recommendations for Building NARS

The recommendations for NARS coordination are:

- Development of short- and long-term strategic plans for each province and then develop federal research agenda to address the gaps and trans-provincial issues;
- Development of Annual Research Agenda for provinces, PARC and other federal institutions;
- Assessment of need for operational research funds for each partner institution based on their annual research plan;
- Allocation of research operational funds to meet the requirements of various partners so that each partner is given annual work plan along with adequate funding. The provinces will be responsible to provide funds for establishment and routine operational expenses related to maintenance (rent, utilities, etc.).
- The project approach has not produced desired results demanding adoption of programme approach.
- Effective monitoring and evaluation of research results and their expeditious utilization by agricultural extension and development institutions.
- Translate research outputs into information supporting decision making process at policy and management levels.

3. Reorganizing NARS – the Conceptual Framework

The conceptual framework of reorganizing NARS is:

- **PARC** – ***Policy Formulation, Priority Setting, Research Planning, Funding and Coordination***
- **NARC** – ***Knowledge Generation, Technology Development, and Process Formulation***
- **Other Federal Institutions including PARC** – ***Knowledge Application, Technology/Process Testing and Adaptation, and Testing of Innovative Methodologies for Technology Transfer***
- **Provincial ARI's** – ***Knowledge Application; Technology Development, Testing and Adaptation; and Process Formulation and Adaptation***.
- **Universities** – ***Development of Training Products including Training-of-Trainers; Academic Research; and Basic Research***.

4. NARS-Balochistan (NARS-B)

4.1. Current Institutional Setting

4.1.1. ARI, Balochistan

ARI, Quetta was established during mid 60s with its headquarters at Quetta and field stations in major ecological zones. The infrastructure of field research is now being strengthened by PARC under the PSDP Project entitled "Restructuring and Strengthening of National Agricultural Research

System of Balochistan". At ARI, Quetta, research is organized under following Directorates:

- Headquarter and Coordination
- Fodders, Pulses and Special Crops
- Temperate Fruits
- Tropical Fruits
- Soil and Water Testing
- Plant Protection
- Water Management and High Efficiency Irrigation Systems
- Crops
- Oilseeds and Cotton
- Vegetables
- Economics and Marketing

The ARI, Quetta also maintains following Field Research Facility:

- Fruit Station, Loralai
- Date Research Centre, Turbat
- Agriculture Research Farm Wayaro, Uthal
- Agricultural Research Station, Usta Mohammad
- Dryland Research Centre, Kharan
- Viticulture Centre, Pishin

Project entitled "Restructuring and Strengthening of NARS-B" funded under the federal PSDP is now establishing following field stations:

- Horticulture Research Station, Turbat
- Agriculture Research Station, Nautal
- Agricultural Research Station, Khuzdar
- Horticulture Research Station, Qila Saifullah

The NARS-B Project is also establishing the following stations:

- Range/Forestry Research Station, Hazarganji
- Livestock Research Institute, Sibi
- Small Ruminant Research Station, Shoran

The NARS-B Project is going to strengthen the existing research infrastructure in Balochistan but the real issue would remain un-attended, as there is a major limitation of research planning, priority setting and capacity building of the research staff in the NARS-B.

4.1.2. Arid Zone Research Centre (AZRC), Quetta

AZRC is one of the three Centres under the PARC and it is located at Quetta. AZRC also has established two field facilities at Mastung and Tomagh. In addition, the Centre is involved in participatory research under the AZRC-ICARDA (International Centre for Agricultural Research in Dry Areas) Project using an integrated approach in the real-life situation in the districts of Mastung, Loralie and Qila Saifullah. AZRC headquarters are organized into five sections: a) Crops; b) Soil and Water; c) Range; d) Livestock; and e) Socio-economics.

The manpower is limited and most of the sections are having 1-4 scientists except the crops, where 5-6 scientists are working. The Centre is implementing number of research projects under PSDP and ALP, which include Production of Herbs, Livestock Fattening and Animal Health and Water Management.

4.1.3. Other Research Institutions in Balochistan

The other research institutions involved in research related to agricultural sciences and engineering are:

- Centre of Advance Sciences for Vaccines and Biotechnology, University of Balochistan, Quetta.
- Geophysical Centre, Pakistan Meteorological Department, Quetta.
- Geo-science Laboratory, Geological Survey of Pakistan, Quetta.
- Pilot Plants and Development Division, PCSIR Laboratories, Quetta.
- Geological Survey of Pakistan, Quetta.
- Water Resources Research Centre, PCRWR, Quetta.
- Agriculture College, Balili, Quetta.
- University of Balochistan, Quetta.
- University of Engineering and Technology, Khuzdar.
- University of Agriculture, Water and Marine Sciences, Uthal.
- Balochistan University of Information Technology and Management Sciences, Quetta
- Sardar Bahadar Khan Women University, Quetta.

4.2. Land Use Systems of Balochistan

Total cultivated area in Balochistan is around 2.0 million ha, representing 6% of the geographical area. Out of this, 58% was irrigated during the year 2004-05 (**Table 1**).

Balochistan is unique in terms of land use systems due to extreme diversity in climatic and ecological conditions, which are:

- Indus basin canal commands
- Perennial minor irrigation schemes – surface and groundwater (springs, dugwells and Karezes)
- Tubewells irrigated agriculture
- Sailaba farming – Spate irrigation
- Khushkaba farming – rainfall and localized runoff farming
- Coastal and desert farming

Table 1. Land use of Balochistan, Pakistan.

Land Use	Area (million ha)	Percent of Cultivated Area
Geographical Area	34.72	-
Cultivated Area	1.99	6
Irrigated Area	1.16	58
Sailaba Area	0.70	35
Khushkaba Area	0.13	7

Source: Agriculture Statistics of Pakistan, 2005

Around 54% area is under surface irrigation and rest under groundwater irrigation (**Table 2**).

Table 2. Irrigated land by type of irrigation system, Balochistan, Pakistan.

Type of Irrigation System	Irrigated Area (million ha)	Percent of Irrigated Area
Government Canals	0.55	47
Private Canals	0.08	7
Tubewells	0.37	32
Wells	0.04	4
Others	0.12	10
Total	1.16	100

Source: Agriculture Statistics of Pakistan, 2005.

4.3. Agro-ecological Regions of Balochistan

Agro-climatic information provides basis for developing agro-ecological zones. The broad agro-ecological zones are easily understood by the development and extension experts. Five distinct agro-ecological zones have been categorized under the Master Research Plan of Balochistan. The basis of this characterization was largely the altitude. Information regarding source and availability of water for irrigated agriculture within each zone was not provided.

The increase in cropped area mainly occurred due to the development of already existing sources of irrigation water like Karezes, springs or exploiting groundwater using dugwells and tubewells or construction of canals (Pat Feeder) and storage dams (Hub Dam).

Orchard farming is an important income generating activity of the highlands and sub-highlands and it occupies an important place in the current cropping patterns, therefore, in the ADB TA Grant Project a study on "Irrigated Farming Systems" was undertaken where six instead of five previously established agro-ecological zones were recommended considering climatic factors like altitude, winter temperature, late spring and early winter frost and hailstorms. The proposed agro-ecological zones indicating precipitation and sources of perennial irrigation systems are summarized in **Figures 1** and **2**, and **Table 3.**

Figure 1. Broad agro-ecological zones of Balochistan (ADB 2006[1])

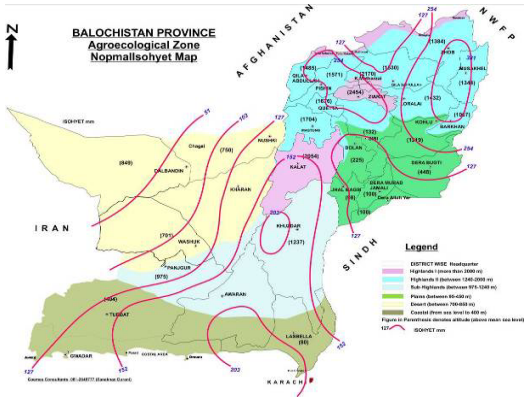

Figure 2. Agro-ecological zones with mean rainfall isohyets of Balochistan

Table 3. Agro-Ecological Zones of Balochistan (ADB 2006[1])

[1] *Dr. Muhammad Saeed. 2006. Promising crops and water efficient cropping pattern for irrigated farming systems of Balochistan. Study Report (1), 2006. Asian Development Bank. 130 p.*

Ecological Zone (altitude)	Perennial Irrigation System	Climate and Rainfall	Districts
Highlands-I (> 2000 m)	Springs, Karezes, dugwells, tubewells	Severe winter and cool summer with temperature rarely over 30 ^{O}C; annual rainfall 200 to 300 mm.	Pishin (Toba Kakari, Barshore), Killa Saifullah (Kanmetherzai, Muslim Bagh), Killa Abdullah (Toba Achakzai), Ziarat, Kalat
Highlands-II (1200m to 2000m)	Tubewells, Karezes, springs, river diversions and infiltration galleries.	Cold winter and mild summer with temperature rarely over 35 ^{O}C; rainfall 200-300 mm	Quetta, Pishin, Loralai, Zhob, Killa Saifullah, Killa Abdullah, Chaman and Khuzdar, Musa Khel, Mastung, Barkhan.
Sub-highlands (900m to 1200m)	Tubewells, Karezes, dugwells, springs, and river diversions.	Frost during winter and warm summer with low and variable rainfall	Barkhan, Kohlu, Khuzdar.
Plains	Canal commands, river diversions and tubewells.	Hot in summer and pleasant in winter; average annual rainfall 110 mm.	Nasirabad, Jafferabad, Bolan, Sibi, Jhal Magsi.
Desert	Dugwells, springs, river diversions and tubewells.	Mild winter and hot summers with variable summer; annual rainfall less than 200 mm.	Kharan, Awaran, Nushki, Dalbandin, Kech, Panjgur, Dera Bugti, Bolan (Kacchi, Jhal Magsi, Mach), Harnai, Kharan, Sibi.
Coastal	Tubewells, springs, river diversions and dams.	Mild to warm winters and very hot summer. Hot arid with low annual rainfall.	Bela, part of Turbat

5. Reorganizing NARS-B

5.1. Reorganizing AZRC

AZRC can be re-structured as "High Performance Technology Testing, Adaptation and Transfer Institution for Problem-oriented Research in the Agriculture Sector" to provide service to the extension and development agencies. Thus, it must be re-organized to conduct research under the real-life operating systems.

5.1.1. Situational Analysis

Currently, the AZRC is organized on the basis of discipline and commodity. The size of the scientific manpower is less than any of the institute located at NARC. Thus critical mass of manpower is not available to conduct any meaningful research within the traditional concept of organizing the commodity and discipline groups. The experience at NARC and many other smaller institutions in the country indicated that when the financial and human resources are limited the institutional set up on discipline or commodity basis is not cost-effective. The provincial ARI is also organized on a similar pattern. ***The financial and human resources will always be a limitation in Balochistan, as sustained funding for research would depend on the outcome of the research projects. Funding for research can be sustained if research contributes to the agricultural economy of the province or country.*** The issues related to commodity or discipline orientation are:

- Coordination is difficult as commodity and discipline groups intend to work independently and in isolation due to social and cultural reasons prevailing in the society;
- Implementation of integrated projects in real-life operating systems become difficult even it is hard to implement strategic research in different ecosystems, as scientists tend to work in isolation and hesitate to work as a team because it is hard to clearly spell the responsibility and authority in the current system. Everyone likes to be the leader. Credit sharing is difficult and most of the coordination efforts fail because most of the scientists do not like to share the credit.
- Among the scientists, there is a tendency to work in laboratory or at experimental station and thus research is not addressed to the needs of clients and not being conducted in the real-life operating systems.

- Lack of research relevance to the real issues faced by the agriculture sector in the province or in the country is a major constraint hindering development of meaningful outputs.

AZRC has reasonable size of field facility at Quetta where station level research can be conducted. The other two field stations at Mastung and Tomagh need critical analysis. The Mastung station is located in tubewell irrigated area in the Pishin-Lora basin, which is heavily over-drawn. Farmers are now pumping beyond the depth of 300 m and even in certain cases are getting saline water. The incident rainfall is so scarce that it can not support any type of biomass and irrigation is essential for establishment of plants and shrubs.

There are perceptional problems regarding the definition of arid zone. The arid zone described as per UNESCO definition is "an area having the ratio of rainfall and crop evapotranspiration of less than 0.25". In simple words, nature provides less than 25% of crop water needs in the form of precipitation. In Mastung, it is hardly 0.1.

AZRC by definition can conduct research in all zones and land use systems including irrigated agriculture. But for the purpose of research coordination, canal and tubewell irrigated areas and horticulture were left for the provincial research system and Sailaba and Khushkaba farming systems were assigned to AZRC for conducting research. Using the same logic it is hard to support maintaining the Mastung Farm.

Mastung Farm has been with AZRC since the last 25 years and hardly any significant development was made except installation of fencing and plantation of range shrubs i.e. salt-bush. Even if the AZRC install a deep tubewell, it is not economical to grow crops, forages, fuelwood plants and arid horticulture. It is important to note that the AZRC has to pay 100% bill of the electricity consumed by the tubewell, whereas farmers are paying only 10% of the bill. It is estimated that atleast Rs. 2.0 million would be required to install a deep tubewell with energy efficient pump and Rs. 0.75 millions per annum to run it for agricultural purposes.

Tomagh Farm is in a relatively high rainfall area, where both winter and summer rainfall is received and AZRC has spent significant resources for range and livestock research. This station can be maintained even after reorganizing AZRC, if resources permit to implement an operational research programme.

5.1.2. Experience of AZRC-ICARDA-FAO

AZRC-ICARDA-FAO project has already started working on Programme approach, where integrated research sites have been established and the multi-disciplinary team is involved in strategic research in operating systems. The experience is rewarding, where scientists started learning the issues of Sailaba and Khushkaba systems and issues faced by the farming community.

AZRC management and research team with the support of ICARDA have made a major breakthrough under this project and research experiences in the real-life situation can be used to re-organize AZRC research in an integrated and inter-disciplinary fashion.

5.1.3. Reorganizing AZRC's Research Programme

The research at AZRC can be effectively designed based on land use systems under a Programme Approach. This is a cost-effective way of organizing research and demonstrating the results in ecologies where no other institution is involved in research. This would also help to build manpower trained in specialized fields. This would also create a flat system of organizing the manpower where Team works in a coordinated fashion and research is targeted and focused. Funding can be made more focused and result-oriented. The following four Programmes are suggested for AZRC:

- Sailaba Farming System
- Khushkaba Farming System
- Range and Livestock
- Minor Groundwater Schemes – springs, dugwells, Karezes, etc.

Each of the Programme can be headed by a Programme Manager and a multi-disciplinary Team designed to conduct strategic, pragmatic and inter-disciplinary research in real-life operating systems – catchment or command areas with active partnership of farming communities. The members of Programme Team may vary from programme to programme but, in general, the following scientists will be part of each team.

- Agronomist
- Water management engineer
- Range management and forestry specialist
- Socio-economist

- Arid-horticulturist
- Livestock production specialist

Each Programme will be having six scientists headed by a Programme Manager.

5.1.4. Technical Support Services at AZRC

Support services at AZRC need to be reorganized in to:

- Laboratory support facility headed by SSO in soils responsible to provide analysis support to all the programmes for plants, crops, soils, insects, diseases, etc. A state-of-the-art facility is needed to provide support to NARS-B.
- Computing and reproduction support facility headed by SO in computer science and provide support to all the programmes – printing, plotting, mapping, binding, Xeroxing, internet search, fax, etc.
- Statistical section headed by SO in statistics and providing support in experimental design, tabulation of data and analysis
- Farm operation and services headed by an Agricultural Engineer to provide support to all programmes regarding field activities – farm machinery and irrigation

5.2. Reorganizing ARI, Balochistan

The research at ARI, Sariab Quetta is currently designed under various Directorates covering commodities, disciplines and resources. This is a major accomplishment of the ARI management and scientists to have a multi-disciplinary focus in organizing research at ARI, Quetta. The provincial government has also accorded higher priority for agricultural research. These Directorates can be maintained to have disciplinary teams to motivate scientists to develop professional competence.

The field research may be organized based on irrigated land use systems under a Programme Approach. This is a cost-effective way of organizing research and demonstrating the results in irrigated ecologies. This would help to build manpower trained in specialized fields and would create a flat system of organizing the manpower where Programme Team works in a coordinated fashion and research is targeted and focused. Funding can be made more focused and result-oriented. The following four Programmes are suggested for ARI, Quetta:

- Canal Irrigated Areas of the Indus basin (Pat Feeder, Khirther and Kachhi Canals)
- Minor Perennial Surface Irrigation Schemes (river diversions, infiltration galleries and storage dams);
- Tubewell Irrigated Agriculture
- Coastal Irrigated Farming Systems

Each of the Programme can be headed by a Programme Manager and a multi-disciplinary Programme Team designed to conduct strategic, pragmatic and inter-disciplinary research in real-life operating systems – irrigated command areas having active partnership with farming communities. The members of Programme Team may vary from programme to programme but, in general, the following scientists will be part of each team.

- Crop Breeder
- Agronomist
- Horticulturist
- Plant Pathologist
- Entomologist
- Water Management Engineer
- Socio-economist

Each Programme will be having seven scientists headed by a Programme Manager.

6. Researchable Issues

The researchable issues for the eight selected land use systems of Balochistan are:

Canal Irrigated Areas of Indus Basin

- In-equitable distribution of canal water resulting in waterlogging at the head reaches and salinity at the tail-end reaches;
- Low cropping intensity due to shortage of freshwater during Rabi and early Kharif seasons especially at the tail-end reaches
- Waterlogging at the head reaches of canal affects crop yields adversely
- Shortage of canal water at the tail-end reaches resulted in soil salinity and reduced crop productivity
- Shortage of surface water during Rabi and early Kharif seasons forces farmers to use drainage water causing secondary salinization.
- Rice is a dominant crop during the Kharif season, which is one of the reasons for causing waterlogging. Some of the farmers are using "Punchoo" system, where freshwater is flowing with a concept to drain the water with

higher temperature and salinity but it certainly is a loss of water and soluble nutrients.
- Water productivity of major crops (rice, chickpea and wheat) is extremely low due to low crop yields and higher level of water use.
- Low crop yields are due to inefficient use of non-water inputs, salinity and waterlogging.
- Cropping pattern (rice-chickpea mix) is not water efficient and profitability is low.

Minor Perennial Surface Irrigation Schemes

- Water conveyance and application losses result in low irrigation efficiency at the scheme level
- Low crop yields due to in-appropriate crop cultivars and in-efficient production practices.
- In-appropriate cropping pattern as farmers are using high delta crops and fruit plants
- Shortage of water due to inefficient use of water with an added loss of soluble nutrients
- Lack of market access and isolated schemes result into low returns of crops

Tubewell Irrigated Agriculture

- Subsidy on electric tariff results in wasteful use of groundwater
- Lowering of water table and mining of groundwater
- Inefficient pumping system coupled with low irrigation efficiency result in loss of water and energy
- In-appropriate crop cultivars and lack of true-to-type fruit plants
- Use of high delta fruit plants, crops and fodders
- Low crop yields and low water productivity
- Crop and fruit diseases and infestation of insects and pests
- Inappropriate grading, packing and storage facility for fruits, vegetables and crops

Coastal Irrigated Farming Systems

- Intrusion of saline or seawater into groundwater due to indiscriminate abstraction of groundwater
- Shortage of freshwater resources
- High crop water requirement due to high wind speed and temperatures
- Low crop yields due to inappropriate crop cultivars, lack of true-to-type plants, and inefficient production practices, etc.
- Inefficient use of water and low irrigation efficiency
- Low water productivity due to low crop yields and inefficient use of water
- Crop and fruit diseases and infestation of insects and pests
- Inappropriate grading, packing and storage facility for fruits, vegetables and crops

Sailaba Farming System

- Sailaba farming is dependent on floodwater, which is diverted into waterways and distributed among the users based on the water rights. The system operates under both the high- and low-flow regimes affecting Spate irrigation and watering intensity.
- Watering intensity is low due to inadequate diversion and control of floodwater especially during the high-flow regimes.
- Low-flow year poses serious constraints on watering intensity and productivity of crops, fodders, forages, fuelwood and livestock.
- Fields are unleveled and thus heavy irrigation is practiced because farmers are not sure when they will receive the next flood.
- In a normal year hardly two irrigations are available to raise wheat crop. A normal irrigation of 0.6 to 1.5 m is practiced resulting in wetting of deep profile.
- Deep-rooted crop varieties are not available which can extract water from deeper depths. Cultivation of fruit and forest plants is also limited although these plants can extract water from deeper depths and provide some income to the farmers during the dry spells or drought periods.
- Cropping system is not integrated with the needs of livestock and the extension service helping the farmers is mainly focused on crop culture.
- Multi-purpose storage ponds for storage of floodwater are limited to provide water for stockwater, domestic and agriculture purposes.
- Stockwater facilities available in the Sailaba area provide water for maximum duration of six months. Farmers and their families have to travel long distances to fetch water.

Khushkaba Farming System

- Incident rainfall is inadequate and uncertain to grow successful crops.
- Runoff from adjacent slopes is essential to supplement incident rainfall, which is not sufficient to grow crops.
- Fields are unleveled but graded and these provide opportunity for generating runoff

within the field. The runoff-runon systems designed by AZRC-ICARDA were not adopted by the farming community, because farmers' preferences were not fully considered while developing the technology.
- Fruit and forest plants are hardly cultivated and farmers are dependent solely on crops.
- Storage facility for stockwater is limited and stored water in earthen ponds is hardly available for 3-4 months
- Drought tolerant cultivars of crops, fodders and forages are not available, as scientists hardly worked for development of such cultivars, even the protocols for crop improvement considering drought tolerance were hardly developed. The varieties selected in dry regions are considered drought tolerant.
- Khushkaba farming is not integrated with livestock, forest and fruit plants. Farmers use to grow almonds in Khushkaba area and the number of plants are now reducing. There is hardly any priority assigned to develop almond plants which are suitable for drought conditions.

Range-Livestock System

- Unplanned and untargeted grazing due to lack of any social binding on the grazing of livestock is a major reason for degradation of rangelands
- Decline in productivity of rangelands due to persistent drought
- Stockwater facility is limited and animals have to travel long distances in search of water resulting in loss of weight
- Quality of stockwater is poor and quality standards are not defined.
- Overgrazing resulted into loss of surface cover and vegetation
- Stocking density is higher than the carrying capacity of rangelands
- Limited feed sources and lack of integration with the cropping systems
- Animal diseases and lack of health facilities
- Inadequate facilities for livestock reproduction and production

Minor Groundwater Schemes (Springs, Dugwells, Karezes)

- Lack of information regarding hydrological potential of shallow groundwater and development of technology for harnessing of this water. Very little improvement has been made for construction and operation of dugwells.
- Groundwater experts and data do not include information regarding shallow groundwater, as aquifer conditions do not permit the installation of tubewells and only harnessing technology is the dugwells. Furthermore, prediction of yield of shallow groundwater is extremely difficult due to localized behaviour. Most of groundwater information is regarding the deep aquifer – alluvial and hard rock.
- Karezes and springs are degrading and getting dry due to indiscriminate installation of deep tubewells and persistent drought.
- Past experience of last 30 years indicated that exploitation of deep groundwater is not sustainable and any recharge effort is going to recharge shallow groundwater.
- Lack of information and motivation for integration of supplemental irrigation with Sailaba and Khushkaba farming. Irrigation is always considered as an alternate to Sailaba and Khushkaba farming systems.
- Water of minor groundwater schemes is of high value but farmers are still practicing traditional approaches for cropping patterns, cropping intensity and water use.
- Water productivity is extremely low.
- Lack of research regarding supplemental irrigation and integration with Sailaba and Khushkaba farming systems.

7. Coordination of NARS-B and Linkages

Coordination of NARS-B and linkages needed are:

- Establish NARS-B Research Advisory Committee having members from the partner institutions and eminent experts, farmers and representatives of NGOs and private sector
- PARC may appoint Coordinator NARS-B for coordinating research activities of the federal and provincial research institutions – the partners of NARS-B. The Coordinator may also work as Member/Secretary of the Research Advisory Committee.
- The Coordinator NARS-B will be responsible to have effective linkages with the provincial Coordinator of the Research Coordination Board and other partners.
- Coordinator NARS-B shall maintain database of research activities, research and development projects being implemented in the province under the federal and provincial PSDP and by other donors. He would be made responsible to maintain library of the reports

and publications of the institutions involved in NARS-B covering both the digital and print medium.

- Provide a link between NARS-PAK and NARS-B through building forward and backward linkages.
- Arrange Missions with the support of federal and provincial scientists and engineers for identification, formulation and appraisal of integrated and inter-disciplinary research projects.
- NARS-PAK may extend support to NARS-B for Capacity Building Programmes with active participation of national scientists and engineers. Also provide support for the NARS-B scientists and engineers for improving their academic qualifications. This would require series of training programmes especially in Balochistan so that young scientists and engineers are motivated and upgraded so that they can compete and get admission in universities of repute.

The Policy Briefings is a Series of Issues, which will be prepared and circulated to the policy and decision makers in the province of Balochistan and in other provinces of the Country with an objective to synthesize and disseminate the studies outputs under the TA-4560 (PAK).

The TA Project entitled "Supporting the Public Resource Management in Balochistan is being implemented by the ADB with the Department of Irrigation and Power, Government of Balochistan under the Balochistan Resource Management Programme.

The funding is being provided by the Royal Government of Netherlands.

The Policy Briefings are also based on the research work done by other national and international institutions with an objective to get benefit of the work done elsewhere.

The comments and suggestions can be sent at the following address:

Project Coordinator,
TA 4560 (PAK),
Arid Zone Research Centre,
P.O.Box.63, Brewery Road,
Quetta, Pakistan.

Email: dr_shahidahmad2001@yahoo.com
Phone No. 0321-9561517/0300-9561517
Fax: 081-2853616

Website: http://brmp.gob.pk

Reference: Ahmad, S. 2007. Restructuring National Agricultural Research System (NARS) – the Case of NARS Balochistan (NARS-B). Vol. (3), No. (7), TA-4560 (PAK), Quetta.

The topic to be addressed in the next Issue of Policy Briefings is: "Mogha Command Management for Enhancing Water Productivity and Sustainability of Indus Basin Canals in Balochistan". The topic include: a) background of the study; b) study findings; c) innovative interventions for Mogha command management; d) participatory scheme development process; e) institutional framework for PSDP; f) investment guidelines for Mogha command management projects; g) investment needed and possible donors; and h) policy issues and reforms.