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# ASSESSMENT OF NATIONAL PROGRAM FOR IMPROVEMENT OF WATER-COURSES FOR FOOD SECURITY IN BALOCHISTAN PROVINCE OF PAKISTAN

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**Abstract:**

*Present study sought to assess the "National Programme for Improvement of Water-courses/water Storage Tanks" project in Baluchistan province of Pakistan. The study selected purposively five districts of Balochistan province namely (1) Loralai, (2) KillaSaifullah, (3) Pishin, (4) Mastung and (5) Sibi. Sample of 300 farmers; sixty (60) farmers from each district were selected by using simple random sampling method. The quantitative data thus collected were statistically analyzedusing Statistical Package for the Social Sciences (SPSS). Results indicated that per hectare yield of various crops, fruits, and vegetables was increased to a greater extent due to the improved irrigation practices in the area. Farmers' knowledge regarding latest irrigation methods was enhanced. However, only the farmers of Mastung district were satisfied with the construction and maintenance of watercourses/tanks whereas other four districts farmers were not satisfied. Farmers indicated that their income level was also increased. Results further depicted that farmers also faced problems in adopting the latest improved technologies of irrigation such as rough lining of water courses, improper utilization of raw material and low competency of EFS which affect the farmers understanding of improved irrigation practices in their area.*

**Key words:** Assessment, Balochistan, Impact, NPIW, water-courses

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## INTRODUCTION:

In Balochistan, agriculture is the major and most important sector followed by industries and mining. Almost 75% people of the province are dependent on agriculture and livestock, the sector employs about 65% of the work force. Orchards contribute to the provincial economy more than any other crop, as the climatic conditions in the upland areas of the province are very suitable to grow high quality fruits like apples, grapes, pomegranates, almonds, plums, apricots, and cherries. The production of orchards per land unit fetches three to four times more income when compared to the conventional grain and vegetable crops [1].

In spite of having seven unique ecological zones, Balochistan province is frequently losing its potential and productivity due to various reasons, some of these identified include arid weather, depletion of underground water, desertification, un-wise use of available resources. Further, drought spill during the years 1998 to 2004, and indiscriminate over-grazing in the natural pastures have damaged agriculture sector and rangeland. Besides, the thrashing of upper surface and nutrient content of soil due to natural calamities consequently damage human life; property, crops and fertile agricultural lands in considerable amount consequently profound negative impact on socio-economic status of rural communities. In Balochistan, water has always been a scarce-product; the constant abuse of resources since the last many decades is posing a challenge to environmentalists and policymakers. Whereas, mining of limited resource water aquifer is causing depletion of water table at an alarming rate mostly in the entire province [2]. Mostly, in coastal belt due to floods and runoff land gets erode as a result losses (40%) of irrigation practices.

Water has been an essential component of the development process in the past, and most probably will continue to be so in forthcoming future. Water is the single most important natural resource having linkages with almost every sector of environment. Notwithstanding the persistent of efficient irrigation canal system in Pakistan but still suffer paucity and wastage of vast quantity of water in the agriculture and irrigation purpose. Proficient irrigation system is an indispensable for higher agricultural yield as it helps in increasing the crop intensity. The present irrigation mechanism has reportedly functioning on 40 to 45 percent efficiency. The overall surface water accessibility is only 104 MAF per annum, and is consecutively falling due to siltation in reservoirs. The National Water Strategy (NWS) predicts increasing irrigation proficiency to fifty (50%) from the current level of (40%) aiming to made efficiency the present system. Water is not only essential input for agriculture but also significant for industries and urban development. Therefore, government focused and given major concentration water sector in the development programs in order to gain the targets of Millennium Development Goals (MDGs) and rooted out the poverty [3].

Despite the prime irrigation system in Pakistan the national average yields of different crops are far below their potential. The canal system which consisted 1,00,000 outlets and length of farm channels of water courses that measured about 1.6 million km. In fact, crop production of major crops such as wheat, rice, cotton and sugarcane are not sufficient. Even every year thousand of tonnes of wheat and other agriculture products are imported from other countries [4].

There was prerequisite not only to line water courses but also construct water storage tanks, so that farmers will be able to save existing water and consume water in time regimes in their field as per requirements. Beside this there was high demand of water storage tanks. Hence, there were dire need to promote optimal and suitable strategies in order to overcome the water related issues such as incorporated water resource development; conservation measures through lining of watercourses; proper maintenance lining of channels; rehabilitation of irrigation system; surface drainage; remodeling of existing irrigation system; promoting high efficiency irrigation system and on-farm water resources development in water sector.

The government of Pakistan takes imperative footstep to protect irrigation water and to promote the national program for On-Farm Water Management, lining of watercourses, and precision land leveling (lazar) systems in country. In this regard the National Program for Improvement of Watercourses was initiated in all over the country including Balochistan. The total cost of Rs. 2.8 billion was utilized in order to order to upgrade irrigation system through the NPIWM program and Water Conservation High Efficiency Irrigation System [5].

The present study carries out additional realistic in-depth quantitative as well as qualitative monitoring and evaluation of the project impact. The impact evaluation regarding the sequential crop productivities, crop diversification; impact on livelihood and income of employment, on equity distribution basis impact on water use efficiency, irrigation, and drainage systems of

sustainability.Therefore, keeping in view the above mentioned problems, the present study aimed at to identify the areas of water management practices, farmer training on livelihood and effectiveness of water management activities and to assess the projects impact (National Programme for Improvement of Watercourses/Water Storage Tanks Project) on crop productivity in Balochistan province of Pakistan.

**Objectives**

**General objective**

To determine the extent of the achievement of the "National Program for Improvement of Watercourses/water Storage Tanks" in Balochistan province of Pakistan.

**Specific objectives**

Following were the specific objectives of the study.

1.To assess the impact of improved watercourse and water storage tanks on sequential crop productivity as perceived by farmers.

2.To identify the areas of trainings as imparted by extension filed staff and their effectiveness as perceived by farmers.

3.To determine the level of farmers participation in water management activities and improved irrigation practices in the study areas.

## METHODOLOGY:

The study was based on primary data concerning effectiveness and achievements of "National Programme for Improvement of Watercourses/ Water Storage Tanks" and subsequent impacts on the economies and socio-economic growth of the rural communities of project areas of Balochistan province. The primary data were collected through a watchfully prepared and pre-tested interview schedule

**Research design**

Research design used in this study was descriptive survey because descriptive survey design is suitable for getting group perceptions and opinion on social facts concerning the current status of phenomena and describing the nature of existing conditions in a situation [5]. Descriptive survey research design plays a prime function in educational and behavioral research; descriptive statistics point out ongoing existing situation of phenomena in order to know the behavior of subject without any influence. Nevertheless, descriptive research engages gathering data that describes recent events then organizes, tabulates, depicts, and describes the data collection methods in explicit way [6].

**Selection of study area**

The study was conducted in the five purposively selected districts of Balochistan (1) Loralai, (2) KillaSaifullah, (3) Pishin, (4) Mastung and (5) Sibi.

**Sample Size of the study**

Sample of three hundred (300) farmers; sixty (60) farmers from each district were randomly selected. The sample size was determined using table of [7] for "determining the sample size from a given population". Multistage cluster sampling methodwas used for the present research study. Multi-stage cluster sampling procedure technique was used normally when entire list of all members of the population does not subsist and is inappropriate. Because in fact multi-stage sampling easier to realize and can generate a more representative sample of the population than sampling technique.

**Data collection and Analysis**

A comprehensive detailed questionnaire was developed and pre-tested. Researchers personally conducted face to face communication and interview with the farmers in five purposively districts of the province. The response rate was 86.66% which is adequate for comparison and data analysis technique. The quantitative data thus collected were analyzed using software Statistical Package for Social Sciences (SPSS).

## RESULTS:

Demographic Profile:

Demographic charactoristics of respondents play impreative role with the term of decussion-making process and adoption of technology.

Age: Most (45.0%) of the farmer respondents belong to 41 to 50 years of age while 32.6% of farmers had above 50 years of age as shown in table-1.

**Table 1: Distribution of the farmers according to age**

| Age (years) | Frequency | Percentage |
|---|---|---|
| Up to 20 | 2 | 0.8 |
| 21 to 30 | 15 | 5.8 |
| 31 to 40 | 41 | 15.8 |
| 41 to 50 | 117 | 45.0 |
| above 50 | 85 | 32.6 |
| **Total** | **260** | **100.0** |

Educational Level: The data in table-2 present the educational level of the farmer respondents which indicated that half (50%) of the respondents had no educational level at all. Among the literate only 14.6% of the respondents had received education up to primary (5$^{th}$ grade) level.

**Table 2: Distribution of the farmers according to education**

| Educational level | Frequency | Percentage |
|---|---|---|
| No Formal Education | 130 | 50.0 |
| Primary (5$^{th}$ grade) | 38 | 14.6 |
| Middle (8$^{th}$ grade) | 27 | 10.3 |
| Matric: (10$^{th}$ grade) | 16 | 6.2 |
| Intermediate (12$^{th}$ grade) | 16 | 6.2 |
| Graduation (14$^{th}$ grade) | 20 | 7.7 |
| Master and above (16$^{th}$ grade) | 13 | 5.0 |
| **Total** | **260** | **100.0** |

Farming Experience: Most (36.2%) of the respondents had 20 to 30 years of farming experience, followed by 30% of the respondents who had 31-40 years farming experiences as shown in table-3.

**Table 3: Distribution of the farmers according to farming experience**

| Farming experience (years) | Frequency | Percentage |
|---|---|---|
| Up to 19 | 62 | 23.8 |
| 20 to 30 | 94 | 36.2 |
| 31 to 40 | 78 | 30.0 |
| 41 to 50 | 23 | 8.8 |
| above 50 | 03 | 1.2 |
| **Total** | **260** | **100.0** |

**Table 4:District-wise comparison between farmers perceptions regarding increasein crop productivity by NPIWM project**

| Categories | Districts | | | | | | | | | | MS | *f*-value | Sig* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Loralai | | KillaSaifullah | | Pishin | | Mastung | | Sibi | | | | |
| | M | SD | M | SD | M | SD | M | SD | M | SD | | | |
| Apple | 1.27[2] | .536 | 2.79[4] | .459 | 2.53[2] | .616 | 2.74[3] | .530 | 1.02[1] | .144 | .239 | 148. | .000** |
| Apricot | 1.21[1] | .410 | 2.65[2] | .565 | 2.55[2] | .580 | 2.70[2] | .507 | 1.02[1] | .144 | .221 | 151. | .000** |
| Grapes | 1.00[1] | .000 | 1.04[1] | .202 | 2.47[2] | .581 | 2.77[3] | .560 | 1.00[1] | .000 | .138 | 270. | .000** |
| Almond | 2.75[3] | .565 | 1.27[2] | .449 | 1.08[1] | .277 | 1.26[2] | .441 | 1.00[1] | .000 | .158 | 159. | .000** |
| Wheat | 2.56[2] | .542 | 2.77[3] | .425 | 2.53[2] | .544 | 2.15[1] | .465 | 2.81[3] | .491 | .246 | 13.3 | .000** |
| Cumin | 1.17[1] | .377 | 1.27[1] | .494 | 1.35[1] | .481 | 1.28[1] | .452 | 2.50[1] | .652 | .250 | 59.4 | .000** |
| Sorghum | 1.00[1] | .000 | 1.00[1] | .000 | 1.00[1] | .000 | 1.00[1] | .000 | 2.75[2] | .484 | .047 | 628. | .000** |
| Oil seed | 1.02[1] | .144 | 1.21[3] | .410 | 1.41[2] | .497 | 1.06[2] | .323 | 2.79[4] | .504 | .159 | 163. | .000** |
| Onion | 2.79[3] | .410 | 1.71[1] | .651 | 1.76[1] | .778 | 2.30[2] | .623 | 2.42[2] | .498 | .368 | 27.7 | .000** |
| Tomato | 2.56[3] | .542 | 2.52[2] | .652 | 2.18[1] | .905 | 2.21[1] | .690 | 2.81[3] | .445 | 3.31 | 7.46 | .000** |
| Potatoes | 1.00[1] | .000 | 1.58[3] | .647 | 1.39[2] | .492 | 1.13[1] | .397 | 1.33[2] | .476 | 2.49 | 11.8 | .000** |
| Cauliflower | 2.79[4] | .544 | 1.71[1] | .651 | 1.82[2] | .905 | 2.02[3] | .675 | 2.25[3] | .565 | .465 | 19.1 | .000** |

**Scale:**Not at all =1 To some extent = 2 To a greater extent = 3 **SD** = Standard: **MS =** Mean square: **M** =Mean* Significant * * Highly Significant

Farmers were further inquired about the increase in the crop productivity of various fruits, crops and vegetables grown in their area due to the NPIWC project activities. Results about the increase in the crop production due to lined water-courses/water storage tanks are presented in table-4. The result of One-way ANOVA showed highly significant differences between the perceptions of the farmers in their production of various fruits, vegetables, and crops. However, it is evident that most of the farmers perceived that the production of various crops, fruits and vegetables was increased due to the NPIW project activities.

**Table-5: District-wise comparison between farmer's satisfactions of construction and maintenance of water course/tanks**

| Categories | Districts | | | | | | | | | | MS | *f*-value | Sig* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Loralai | | KillaSaifullah | | Pishin | | Mastung | | Sibi | | | | |
| | M | SD | M | SD | M | SD | M | SD | M | SD | | | |
| Existing condition of water course/tanks | 4.02[3] | .144 | 3.44[2] | .712 | 3.84[3] | .426 | 3.45[2] | .619 | 3.71[2] | .582 | .285 | 10.66 | .000** |
| Maintenance of water course/tanks | 3.92[3] | .404 | 3.23[2] | .751 | 2.94[2] | .626 | 2.79[1] | .778 | 3.17[2] | .834 | .483 | 18.67 | .000** |
| Regular cleanliness of water course/tanks | 3.92[3] | .404 | 3.40[2] | .765 | 3.43[2] | .791 | 3.19[1] | .825 | 3.49[2] | .760 | .529 | 6.414 | .000** |
| Control over the salinity and water logging | 3.92[1] | .404 | 3.33[2] | .753 | 3.59[2] | .814 | 3.00[1] | .808 | 3.50[2] | .851 | .554 | 9.76 | .000** |
| Ready availability of water at the field | 3.94[2] | .433 | 3.42[1] | .739 | 3.49[1] | .820 | 3.32[1] | .783 | 3.58[1] | .739 | .513 | 5.25 | .000** |

**Scale:**Not satisfied at all =1 Slightly satisfied=2 Moderately satisfied=3 Very satisfied=4 Extremely satisfied=5**SD** = Standard: **MS =** Mean square: **M** = Mean* Significant * * Highly Significant

The farmers were further inquired to provide their level of satisfaction on water courses/tanks that were established/build in their areas. Farmers of all the districts were very satisfied with the construction and maintenance of water courses/tanks in their area as shown in table-5.

**Table-6: District-wise comparison between farmer's perceptions regarding training activities arranged by the project staff**

| Categories | Districts | | | | | | | | | | MS | *f*-value | Sig* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Loralai | | KillaSaifullah | | Pishin | | Mastung | | Sibi | | | | |
| | M | SD | M | SD | M | SD | M | SD | M | SD | | | |
| Water management practices | 3.35[1] | .758 | 3.52[2] | .922 | 3.90[2] | 1.17 | 3.53[2] | .804 | 3.52[2] | 1.20 | .984 | 1.98 | .098 |
| Soil testing and soil sampling | 2.04[1] | .202 | 2.17[1] | .953 | 1.90[1] | 1.04 | 2.79[2] | 1.08 | 2.02[1] | 1.04 | .859 | 6.80 | .000** |
| Plant protection measures | 2.04[1] | .202 | 2.21[1] | .922 | 2.02[1] | .520 | 2.55[2] | 1.01 | 2.17[1] | .883 | .592 | 3.67 | .006* |
| Water logging remedies | 2.04[2] | .202 | 2.54[3] | 1.09 | 1.67[1] | .826 | 2.64[3] | 1.07 | 2.06[2] | 1.040 | .827 | 9.16 | .000** |
| Crop intensity techniques | 3.50[3] | .875 | 2.60[2] | .984 | 2.10[1] | .684 | 2.64[2] | 1.00 | 2.67[2] | 1.03 | .857 | 14.26 | .000** |
| Water seepage remedies | 3.50[4] | .875 | 3.15[4] | 1.07 | 1.88[1] | .927 | 3.02[3] | .967 | 2.63[2] | 1.23 | 1.04 | 17.83 | .000** |

**Scale:**Not satisfied at all =1 Slightly satisfied=2 Moderately satisfied=3 Very satisfied=4 Extremely satisfied=5**SD** = Standard: **MS =** Mean square: **M** = Mean* Significant * * Highly Significant

The important aspects of the present research were to record the farmers' perception about the quality of the trainings as received by them. Farmers' assessment about most of the activities as received by them during the trainings was ranging from poor to average (table-6).

**Table-7: District-wise comparison between farmer's perceptions regarding advantages of water courses/tanks**

| Categories | Districts | | | | | | | | | | MS | *f*-value | Sig* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Loralai | | KillaSaifullah | | Pishin | | Mastung | | Sibi | | | | |
| | M | SD | M | SD | M | SD | M | SD | M | SD | | | |
| Per hectare yield is increased | 3.73[2] | .494 | 3.54[2] | .849 | 3.35[1] | .903 | 3.34[1] | .815 | 3.52[2] | .799 | .671 | 2.01 | .094 |
| Water saving/ saved | 3.50[1] | .875 | 3.56[1] | .796 | 3.43[1] | .866 | 3.32[1] | .837 | 3.50[1] | .923 | .741 | .553 | .697 |
| Water management application was improved in terms of labor employed | 3.50[1] | .875 | 3.60[1] | .818 | 3.43[1] | .979 | 3.43[1] | .927 | 3.50[1] | .923 | .821 | .309 | .872 |
| Cost effective | 3.50[1] | .875 | 3.54[1] | .849 | 3.45[1] | .867 | 3.36[1] | .895 | 3.50[1] | .923 | .778 | .291 | .884 |

**Scale:** 1= Strongly disagree, 2= Disagree, 3= Undecided, 4= Agree, 5=Strongly agree **SD** = Standard: **MS** = Mean square: **M** = Mean* Significant * * Highly Significant

Farmers were further inquired about the advantages of water course/tanks over their previous irrigation water courses. Results are presented in table-7. The results indicated that farmers agreed that their per hectare yield is increased, water was saved, water management practices were improved and the method was cost effective.

**Table-8: District-wise comparison between farmer's perceptions regarding irrigation techniques**

| Categories | Districts | | | | | | | | | | MS | *f*-value | Sig* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Loralai | | KillaSaifullah | | Pishin | | Mastung | | Sibi | | | | |
| | M | SD | M | SD | M | SD | M | SD | M | SD | | | |
| By lining water courses with scientific methods | 4.08[4] | .794 | 3.50[2] | .744 | 3.92[4] | .997 | 3.19[1] | 1.014 | 3.60[3] | 1.047 | .860 | 6.851 | .000** |
| By renovation of water storage tanks | 4.04[2] | .967 | 3.58[1] | .710 | 3.45[1] | 1.062 | 3.36[1] | .895 | 3.54[1] | .967 | .862 | 3.866 | .005* |
| By precision land leveling | 2.04[1] | .683 | 2.02[1] | .978 | 2.82[2] | .950 | 2.02[1] | 1.053 | 4.13[3] | 1.123 | .938 | 42.826 | .000** |
| By demonstration centers | 3.50[3] | .899 | 3.42[3] | .846 | 2.84[1] | .943 | 3.66[3] | .700 | 3.15[2] | .945 | .761 | 6.664 | .000** |
| By enough water supply throughout the season | 1.38[1] | .531 | 1.96[2] | 1.051 | 1.61[2] | .885 | 1.81[2] | .851 | 3.35[3] | 1.000 | .779 | 37.178 | .000** |
| Water saving | 3.54[1] | .824 | 3.52[1] | .772 | 3.94[2] | 1.088 | 3.74[2] | .736 | 3.73[2] | 1.026 | .813 | 1.742 | .141 |

**Scale:** 1= Strongly disagree, 2= Disagree, 3= Undecided, 4= Agree, 5=Strongly agree **SD** = Standard: **MS** = Mean square: **M** = Mean* Significant * * Highly Significant

Districts-wise comparison about irrigation techniques revealed that farmers agree to strongly agree that most of the irrigation practices learnt through the NPIW project had increased their crop production. The significant differences were found on 5 out of 6 statements regarding farms irrigation techniques (table-8).

## CONCLUSIONS:

On Farm Water Management project was based on largely objectives and operational procedures and responsive to present needs for greater water use efficiency and high crop yields. On Farm Water Management (OFWM) regarding renovation of watercourses, water shortage tanks, precision of land leveling and water users association has now been started to diverse parts of the province in order to saved water or increased crop production. The low land areas particularly rice belt of the province continuously faced the water logging and salinity. Due to undertake the water logging and salinity problems, On Farm Water Management were in low land areas was initiated to investigations the control of water logging and salinity problems so that achieving the highest potential agricultural output. Based on the outcomes of these investigations the project was developed for recommendation to farmers regarding the control of water logging and salinity.

Inadequate training regarding project initiatives, lack of competency level was foremost constraint regarding water management activities. It was further observed that training of extension staff is needed for lining water courses with scientific methods; renovation of water storage tanks; information regarding precision of land leveling, extension staff could impart training to farmers for latest information regarding irrigation techniques, plant protection measures, soil testing and soil sampling, fertilizers and their application, training on land management etc. The above findings clearly indicate that the extension staff is weaker in these aspects and how it is possible that the desired results from the project are achieved.

While asking the farmers to perceive on benefits of NPIWM project, there were significant variation in the responses and majority emphasized that NPIWM project have overcome conveyance losses, save application losses, save water; easy availability of water to the field, increased productivity, better management of water, reduced the seepage losses and evapo-transpiration rate, reduced spread of weed seed in the field, increased the cast benefit ratio, time saving to irrigate an acre, labor saving. Significant differences were observed 7 out of 13 categories related to the benefit of the project. Covalla *et al.* (2001) and Khan *et al.* (2001) [8,9] indicated that there is a time saving of 1 hour 33 minutes to irrigate a hectare after watercourse improvement. The researchers reported that cropping intensity was found to increase by 20% after improvement. They suggested that growers change to their cropping pattern so as to grow crops requiring higher quantity of water.

Mirani *et al.* (2003) [10] found that water logging, salinity conditions and seepage of canal irrigation was increased at alarming rate. They observed that the on-farm water management project-Phase III was scale-up by owing to improvement of water courses, maximizing the cropping intensities and provides the and enhances the major crops yields. But, OFWM Watercourses and Water Storages Tanks project did not thrive due to lack of farmers' participations in the program activities. It was recommended earthen watercourses should be renovated, laser technology and farm machinery for better precision land leveling should be carried on in future OFWM program, there are series of seminars, farmers meetings, demonstration plots, and training sessions should be conducted at all level and farmers' participation should be enhanced n project activities.

**Recommendations**

The study recommended that in-service training and capacity building programs for EFS should be imparted to achieve the target of sequential crop productivity goals. The preferred level of increased interest among farmers community at province level was not achieved as measured in the present study. Without intended farmer contribution, most enhancement programs did not achieve a reasonable level of achievement; therefore, the study recommends that the farmer's participation in the water management practices should be enhanced using participatory approach in order to achieve the desired goals of sustainable agriculture development. Farmers are the first and last stair in development process, therefore proficiency and training of farmers should be ensured at all levels. Itis also suggested that small farmers should be encouraged in decision-making process as well as frequent meetings with farmers should be conducted in order to identify the water requirement in their field. Formerly executing of the any water management programs, the consequences should be debated with the farmer's community in order to encourage the farmer's participation with the term of decision-making process.

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