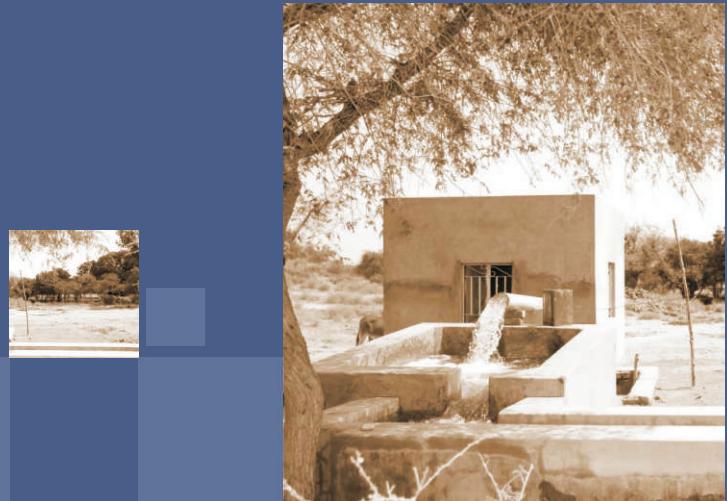

ASSESSMENT OF OUTCOMES

Drought Mitigation & Preparedness Program
Khipro Project



PAKISTAN POVERTY ALLEVIATION FUND



Pakistan Poverty Alleviation Fund

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A C R O N Y M S

CO	Community Organization
CPI	Community Physical Infrastructure
DMPP	Drought Mitigation and Preparedness Program
ERD	Evaluation, Research and Development
NGO	Non-Government Organization
NRSP	National Rural Support Program
PO	Partner Organization
PPAF	Pakistan Poverty Alleviation Fund
SAFWCO	Sindh Agriculture and Forestry Workers Coordinating Organization
UC	Union Council
USDA	United States Department of Agriculture
WMC	Water Management Centre
OECD	Organization for Economic Co-operation and Development

Foreword

The water and infrastructure interventions of PPAF are an integral part of its mandate for poverty reduction and improvement in quality of life. In this perspective, Drought Mitigation and Preparedness Program (DMPP) explicitly addresses vulnerabilities resulting from large parts of the country being categorized as high 'water stressed' areas. Typically focused on a union council, a drought mitigation project adopts an integrated approach with a range of micro investments in development, conservation and sustenance of water resources, along with the provision of basic infrastructure at the village level. As part of a sequenced approach, the program in the first instance seeks to capacitate poor communities in terms of preparedness and mechanisms for coping with drought and water deficiency. Subsequently, second generation value adding interventions are incorporated for optimizing agricultural productivity, diversifying cropping patterns, water balancing, watershed and rangeland management along with market linkages and early warning systems.

This study aims to measure and assess outcomes of DMPP interventions in four union councils of Khipro, district Sanghar in Sindh province. In mid 2007 Evaluation, Research and Development unit of PPAF carried out a baseline survey of 224 households (control and treatment) in 16 villages. The initial exercise was followed up in 2009, when the same households were revisited and outcomes were gauged.

The study was designed and conducted by Muhammad Masood Khalid, while data analysis and report writing was undertaken by Syed Hassan Akbar and external input was provided by Rana Muhammad Sarwar. Editorial assistance was extended by CSO Office, Sindh Agriculture and Forestry Workers Coordinating Organization, generously facilitated conduct of the surveys.

Kamal Hyat
Chief Executive/Managing Director

Executive Summary

The community-based demand driven approach for infrastructure development has the potential of significantly contributing towards improving micro-level economic development and poverty reduction. However, the final impact of this approach relies heavily on the quality and nature of the service provided. In the last eight years PPAF has tested different models of water delivery systems, based primarily on community-based demand driven approach, for irrigation in diverse agro-ecological zones of Pakistan.

The scarcity of water for irrigation necessitates using available water resources in an integrated, efficient and effective manner. The Drought Mitigation and Preparedness Plan (DMPP) adopts an innovative approach to agricultural irrigation systems and. It aims to reduce water conveyance losses, increase water conservation and implement modern pressurized irrigation techniques. DMPP intervention also aims to indirectly impact food security, agriculture development and poverty reduction. Innovation is the key word for using any combination of sub-project under the DMPP umbrella to enhance system efficiency and agriculture productivity in different agro-ecological zones. This includes using strategies such as water course lining, water reservoirs development, construction of delay action and check dams, land leveling, sprinklers, solar pumping, pipe irrigation and drip irrigation systems.

During 2002-09, 25 DMPPs were implemented in all four provinces, as well as in the Northern Areas, and a number of different combinations for plains, hilly areas and desert terrains were ventured into. DMPP-Khipro is one of such combination, specific to tail-end canal irrigated and desert areas. The Rs. 47.3 million integrated DMPP water efficiency plan for Khipro contained a number of sub-projects: lining of existing water courses, land leveling, construction of water reservoirs, drip irrigation, installation of tube wells and wind mills. As a part of implementation strategy PPAF remained non-prescriptive, model neutral and solely focused on quality assurance, provision of financial resources and technical supervision.

This report specifically analyzes the impact of DMPP on life and economy of people living in the project area. ERD unit in mid-2007 conducted a baseline of this DMPP by randomly selecting 8 control and 8 treatment villages from 4 UCs. ERD unit revisited the same 224 households to gauge the performance of its interventions against a set of indicators in terms of their efficacy, efficiency, financial viability, social acceptability and sustainability in delivering services to the respective community organizations/ beneficiaries. However, in the interest of prudence PPAF does not ascribe the entire impact of DMPP interventions in the treatment villages.

Major findings of the impact assessment report are as follows.

:

Land Under Cultivation

Land under cultivation in both the control group and treatment group demonstrated no statistically significant increase between the baseline and impact years .

Yield per Acre

Yield per acre, for cotton, wheat and chili, increased significantly for the treatment group at impact stage when compared to the control group. This increase in yield per acre can be associated directly with the DMPP intervention. However, increase in yield per acre witnessed in the treatment group was higher for cotton and chili while increase in yield per acre for wheat was only marginally higher from the control group.

Water Consumption

The average time required for irrigating land decreased significantly in the project area for two major crops namely; cotton and wheat. However, frequency of irrigation required for each crop did not show any significant decrease in the treatment group.

Produce Marketing Practices

The practice of selling produce shifted in both the project and non-project areas from local market and self selling towards main wholesale *Taluka* market. However, the project area did not demonstrate a greater increase in market linkages and therefore we can assume that the DMPP intervention did not result in any extra market linkage for households in our project area.

Cropping Pattern

The impact assessment showed no major change in the cropping pattern in our project area when compared to the non-project area. However, a number respondent households did report changes in their cropping pattern at impact stage with majority of them growing a third crop during intervention period.

Household Income

Household income demonstrated a greater and significant increase amongst our project households when compared to non-project households. However, this increase in total average household income was due to a significant increase in agricultural income amongst the project households. Other sources of income, like business, labour, and livestock demonstrated no significant difference between project households and non-project households.

Household Expenditure

Household expenditure showed a greater and significant increase in the project area when compared to the non-project area. This greater difference in increase in

average household expenditure reflected the increase in household income mentioned earlier. Food expenses demonstrated the greatest and most significant increase in project households while other sources of expenditure like clothing, house, transportation and health demonstrated no significant difference between project households and non-project households.

Employment Trend

Labour employment under the agricultural sector (on farm employment) demonstrated an increase in the project area while employment in agricultural sector in non-project area decreased moderately. This increase in agricultural labor employment in project area can be directly associated with increase in yield per acre in the project area whereby increased production resulted in greater employment on project area farms.

In conclusion, the DMPP-Khipro intervention of PPAF resulted in positive change in key indicators like yield per acre, irrigation time, agricultural income, food expenditure and on farm employment amongst our project households. However, other indicators like cropping patterns, water frequency, land under cultivation and market linkages demonstrated no significant difference between the project and non-project households.

A key learning from Khipro impact assessment has been the need to implement second generation awareness interventions alongside physical infrastructure projects. These interventions have the potential to expand knowledge and information frontiers of local community stakeholders and change agents leading to innovation and improved value practices adding in agriculture and livelihoods.

1.1 Background

Through the 1990s, Government of Pakistan adopted a poverty alleviation approach that included equitable income distribution and human resource development as its prime objectives. The strategies employed to achieve this included launching of special programs and short-term measures that focused on enhancing the earning potential of the poor, as well as the provision of social safety nets for the poorest stratum of society. One such major initiative was the establishment of Pakistan Poverty Alleviation Fund (PPAF), which commenced operations in April 2000, with the aim of targeting poor urban and rural communities with aid of NGO's and Community Organizations (CO's). PPAF was formed to complement government efforts towards poverty alleviation using (a) income generation opportunities, (b) improved community physical infrastructure in underserved areas and (c) greater economic integration and mainstreaming of women.

The PPAF's focus includes institutional and capacity building measures meant to enhance the outreach, scale and impact of NGOs that the organization selects as its partners using standard transparent criteria. SAFWCO is one such partner organization. SAFWCO and the PPAF have worked together to alleviate poverty, reduce vulnerability and improve food security through sustainable agricultural development by focusing on efficient management of water and water related disasters as well as empowerment of local community organizations to initiate and implement infrastructure development projects. SAFWCO has been operating since 1993 and is registered under the Societies Registration Act 1860. PPAF-SAFWCO entered into a partnership agreement in April 2002 and have subsequently implemented a number of community projects for improving the socio-economic conditions in the area.

Under the agreement with SAFWCO, PPAF provided financial and technical assistance under USDA (United States Department of Agriculture) funding, while Water Management Center (WMC) of PPAF provided overall financial and technical support . WMC strives to achieve its programme goals through; a) Integrated water efficient irrigation systems and agriculture enhancement mechanisms, b) Effective management of successive drought cycles and water related disasters through integrated water resource management, and c) disaster preparedness and natural resource conservation.

Pakistan suffered from an acute drought during 1997-2002, which affected about 58 districts including Sanghar, an existing dry zone area receiving scanty rainfall, in Sindh. The cumulative effect of the drought and Sanghar's geography was so intense that it disturbed the region's water balance. The long term average rainfall in the area is already very low (around 71 mm) however actual annual rainfall during the dry spell (from 1995 to 2002) was even lower, indicating the extent of water shortage and disturbed water balance in the area:

Table 1.2.1 District Sanghar Actual Annual Rainfall 1995 – 2002

Year	Rainfall (mm)	Year	Rainfall (mm)
1995	1.78	1999	0.76
1996	12.70	2000	0.41
1997	0.23	2001	0.86
1998	2.54	2002	0.08

The result of this water crisis was that agriculture was negatively affected, and farmers were compelled to carry out excessive pumping of fresh groundwater, which led to a decline in the groundwater levels, aggravated by the reduced flow of the Nara and Khipro canals.

Keeping in view the above problems and water scarcity experienced by the area - PPAF selected Khipro as a drought affected area and prepared a Disaster Management and Preparedness Plan. Sub-projects under DMPP were implemented by SAFWCO with the help of COs in four selected union councils of Taluka Khipro in District Sanghar. MWC provided technical support to SAFWCO in project implementation. DMPP implementation plan envisaged the use of a strong local task force where the PO collaborated closely with the respective village level Co's for project implementation.

1.2 The Project

Disaster readiness can be defined as a community's ability to meet its needs during a state of emergency or crisis. A preparedness plan puts in place the means to enable the community to respond to a disaster, and also to start the process of restoring normalcy afterwards. DMPP, therefore, aims at (a) strengthening the resilience capacity of communities in case of a disaster and (b) demonstrating effectiveness of interventions in reducing negative impacts (if any) and (c) minimizing damage associated with natural disasters. DMPP has been implemented as an overall project, complete with guidelines for its nationwide implementation.

DMPP for Khipro in particular has been jointly prepared by WMC and SAFWCO. DMPP Khipro involved 97 sub-projects with an estimated cost of Rs 47.3 million and a completion period of two years from July 2005 to June 2007. Due to difficult field conditions the project completion period was extended to June 30, 2008 through a supplementary agreement signed on October 31, 2007. The entire grant was utilized through COs. The PO, however, failed to fully mobilize the Task Force resulting in implementation of 89 of the planned 97 sub-projects, the cost and nature of which is given below.

Table 1.2.1 Cost Structure of Sub-Projects Implemented under DMPP

PROJECT TYPE	No	PPAF SHARE	(Cost in Rs. Millions)	
			CO SHARE	TOTAL COST
Drip Irrigation	21	9.342	2.341	11.68
Land Leveling	11	0.885	0.222	1.106
Water Course Lining	28	14.79	3.70	18.49
Sprinkler Irrigation	1	0.34	.09	0.43
Tube Well	10	3.36	0.84	4.20
Water Reservoir	16	8.46	2.12	10.58
Wind Mill	2	0.65	0.16	0.81
Grand Total	89	37.83	9.47	47.31

Following is a summary of each project sub-category including its expected impact in Khipro, Sanghar

Water Reservoirs

Canal water supply for irrigation in Khipro is unreliable and results in water unavailability when it is needed urgently for crop production. In order to provide a continuous supply of water, water reservoirs are constructed for storage purposes (both from canals and tube wells, as available and needed). The storage water is then pumped out to provide a regular and continuous supply of water for drip or furrow irrigation and to provide drinking water for humans and livestock.

The project includes excavation of water reservoirs of varying dimensions: about 1.2 to 1.7 m deep within retaining walls and a concrete lined bed to arrest seepage losses. A



typical reservoir (40.5 x 18.7 m and 1.7 m deep) will irrigate about 7.3 ha. The reservoirs are located near villages, and a boundary wall is constructed around them for protection. Stored water from reservoirs is conveyed through valves and PVC/GI pipes, which ultimately give water to the farms. 16 water reservoirs with a total cost of Rs 10.580 million were included in the DMMP. PPAF contributed towards 80% of the reservoir's cost whereas the community shared the remaining 20%. The respective local community organizations were responsible for maintenance and operation of the pump.

Water Course Lining

Existing water courses were lined with bricks and cement to allow gravitational flow of canal/stored water from reservoirs and tube-wells. The average size of a water course is one feet wide and 1.5 feet deep, while the length of average lined water course depends on the command area and number of shareholders. A total of 28 water courses with a cost of Rs.18.5 million were lined under DMPP Khipro.



Drip Irrigation

Drip irrigation is one form of pressurized irrigation system which is essentially connected with water reservoirs and motorized pumping systems. Drips are used to enhance irrigation water efficiency and water conservation. A total of 21 drip irrigation systems with a cost of Rs. 11.7 million were installed in the whole project area.

Sprinkler Irrigation

Irrigation sprinklers are another form of pressurized irrigation systems. Many irrigation sprinklers are buried in the ground along with their supporting plumbing, but above ground and moving sprinklers are also common. Most irrigation sprinklers are functioned through electric and hydraulic technology. Only one sprinkler irrigation system costing Rs. 0.43 million was installed under the DMPP intervention.

Land Leveling

Land leveling is the process of smoothing and shaping the surface of the agricultural field in order to provide a slope which fits existing water supply routes and results in optimal water conveyance for existing field conditions. 11 projects of land leveling were undertaken by the WMC unit in Khipro for a total cost of Rs. 1.106 million.

1.3 The Project Area

Location and Extent of Project Area

Sanghar District derives its name from its main town and was carved out from Tharparkar and Nawabshah districts on 1st July, 1953. The district lies between 25° 30' to 26°-29' north latitudes and 68°-25' to 70°-13' east longitudes. It is bound on the north by Khairpur District, on the northwest by Nawabshah District, on the east by Jaisalmer and Jodhpur (India), on the south by Mirpurkhas and Umerkot districts and on the West and Southwest by Hyderabad District. Total area of the district is 10,728 sq km. The location of four Union Councils in Project area is shown in Fig. 1.3.1.

Figure 1.3.1 Union Councils' Location in Pakistan

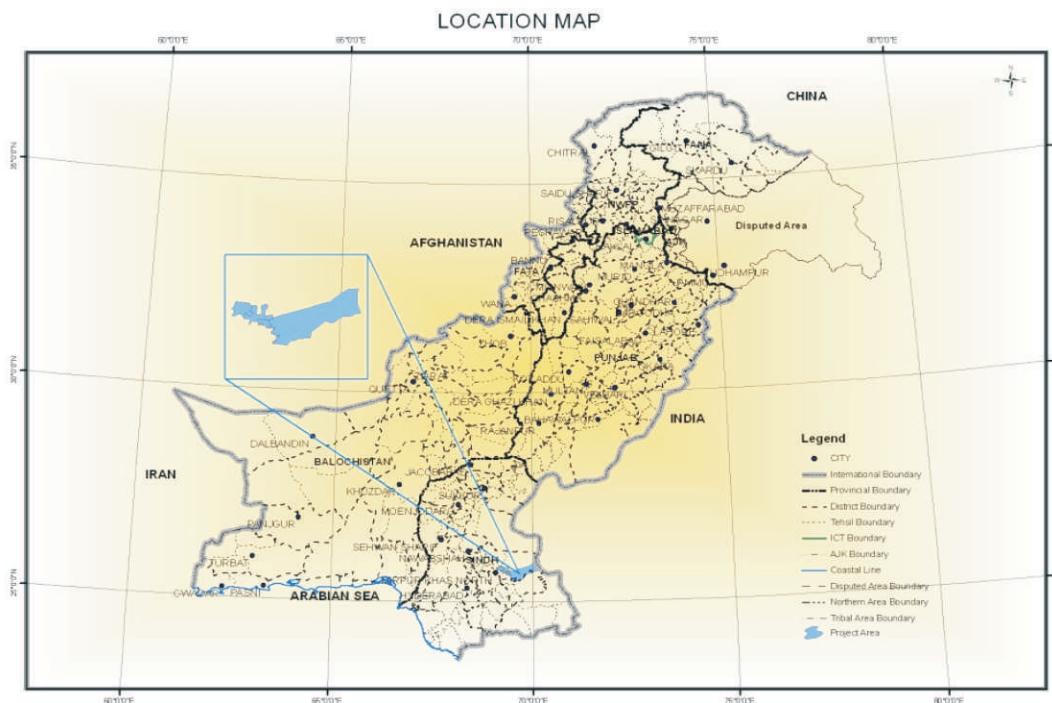
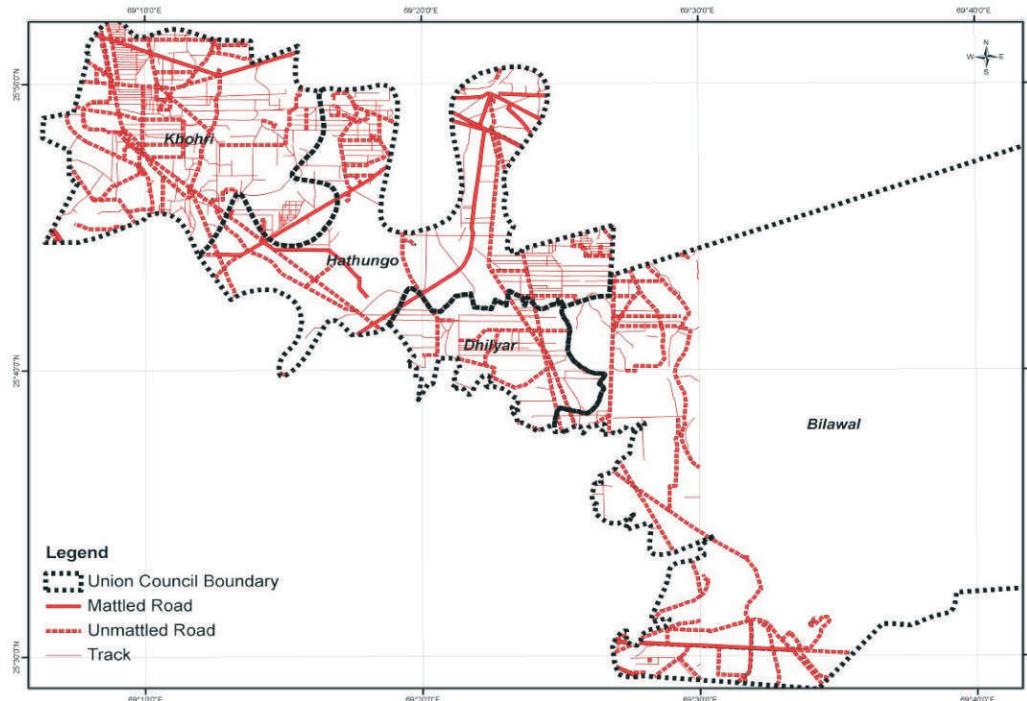


Figure 1.3.2 Union Council Boundaries



Total area of the four selected union councils is given in table 1.3.1 below. The Bilawal Hanjoro union council is the largest UC where 90 per cent of the area is desert. The project included only 10 per cent of the total area which is inhabited and canal irrigated area.

Table 1.3.1 Areas and Number of Villages in Project Union Councils

Union Council	Area (ha)	Number of Villages/settlements
Khori	14,903	62
Dilhyar	12,724	78
Bilawal Hanjoro	16,488	78/8
Hathango	11,474	67
Total	203,979	285/214

Topography

Villages

The total number of villages and settlements in the Project area is 285 (51 villages and 69 small settlements). Maximum number of villages / settlements are in the union councils: Bilawal Hanjoro and Dhilyar (78 each) and minimum numbers of villages/settlements are in union council Khor (62). Only 8 villages out of 78 of Bilawal Hanjoro UC were included in the Project Area. The total number of villages/settlements in the Project area was 214.

1.4 Population and Demography

Baseline and Impact Assessment Survey: As part of its overall operations, PPAF was required to develop a benchmark for its intervention areas, partner organization outreach and impact assessment baseline for community infrastructure and capacity building activities. ERD unit of PPAF, in collaboration with Social Mobilization unit of SAFWCO conducted a baseline study for the program in August 2007. Baseline was conducted in 8 villages, selected as treatment from amongst 18 project villages, and 8 control villages in which the DMPP project was not implemented. ERD unit also conducted an impact assessment survey of the same sample villages in the 4 UCs of the area in May 2009. Salient features of the baseline study conducted in August 2007 are presented below:

Demography:

Settlement pattern is based on population concentration in villages and small settlements. The administrative village size ranges from 45 to over 100 households that include small settlements within the revenue boundary of the village. The household size however is 6.8 persons.

Living Environment:

The total population of the area is essentially rural and lives in an environment where 65 per cent of the houses are Katcha (mud houses) and another 14 per cent can be graded as semi-Pucca (half cemented) and the remaining 21 per cent are Pucca (made of bricks and cement plastered). A majority of the residents own the houses in which they reside, most of the villages were electrified and about 74 per cent of the houses are connected. Safe drinking water has been a major problem for majority of households as the water table's depth does not allow easy access to the source, so that some households collect their supply from somewhere outside the village.

The access and mobility to the outside village environment was better than the internal

environment where all villages are not linked through proper roads. Public transport for both local and inter-district travelling and movement of goods is highly insufficient.

Health: Public health infrastructure was highly insufficient, providing a very low level of services and was limited to Basic Health Units in 25 per cent of the villages. Only one fifth of the BHUs are functional, with a qualified doctor and provide health care services for 4-5 hours a day. Dispensers and quacks level services are also available, although only in the private sector. Over 75 per cent of the villages were without any Lady Health Workers.

1.5 The Rural Economy

Agriculture

Almost 68 per cent of the village economy's earnings at Khipro are agriculture based. The drought and its resulting effects have lasted for a decade now, and have caused a considerable degeneration in agriculture activities, forcing many people to migrate to other areas. About 2 per cent of the households are engaged in services, a majority serving provincial government departments. A significant fraction of the population is also involved in livestock rearing as well as in small and medium sized business activities. The sources of income generation for women were limited. They were generally involved in catering the households and serving the family members. However, their role is important particularly in livestock care and helping the male members in agricultural activities. The scope for their involvement in handicrafts and self-employment is limited.

Land Distribution

The area falls in the canal irrigated and rain-fed zone with a limited scope for ground water mining. A majority of farming land belongs to affluent landlords and is cultivated on share cropping basis. A large percentage of these landlords are absent from their lands, and cultivation is carried out by others on their behalf.

Land Tenure System

A majority of farms are managed through a sharecropping system, whereby the owners provide land and tube-wells and skilled labor manages the crops. Of the total farms, 7 percent are owner-operated, 28 per cent tenant-operated and remaining 76 per cent operated through sharecropping.

Livestock

Livestock rearing is only a medium economic activity in the area. An average household keeps about three (3) animals (buffalos, cows, and sheep) for milk production and 50 per

cent of the households keep donkeys to support fodder collection for the livestock. Women are primarily responsible for livestock care.

1.6 The Report Format

The report in hand is designed to measure social and economic impact of DMPP interventions combined with availability of micro-credit and other health and education related infrastructure facilities for overall quality of life of residents of the area. Chapter 2 provides a brief on survey methodology. Chapter 3 outlines, in brief, the demographic characteristics at the baseline and impact years amongst our sample households. Chapter 4 contains a detailed discussion on socio-economic characteristics of the area during the intervention period. This is followed by Chapter 5 which analyzes direct outcomes of the DMPP project on agricultural economy. Chapter 6 is dedicated to an assessment of the impact of DMPP intervention on households' income and expenditure patterns and impact of access to credit on household economy. Chapter 7 provides a short conclusion to our study highlighting key results and emphasizing key learning's.

2.1 Survey Methodology

The present report is based on data collected at the baseline for the integrated DMPP project in August 2007 and subsequent impact assessment in May 2009. The following pages briefly highlight the data collection process at both baseline and impact assessment stages highlighting survey-related issues including sample design, development of survey instruments, training of enumerators, pre-testing of questionnaires, data collection, processing and data analysis.

2.2 Sample Design

SAFWCO in 2006 initiated the PPAF funded DMPP program in 18 villages in the entire Khipro Taluka. PPAF baseline survey was carried out in 8 treatment and 8 control villages in 4 UC's of the project area. For the purpose of baseline survey, ERD unit of PPAF randomly selected 8 of the 18 (45%) treatment villages and 177 households proportionate to the number of households in these villages (table 2.2.1). With the objective to assessing the impact of DMPP intervention an equal number (8) of control villages with 50 per cent of household sample were also selected for control and treatment analysis at the impact stage (table 2.2.2).

This was a formidable task and was only possible with the help of both local COs and respective social mobilizers of SAFWCO. The impact survey of May 2009 was conducted on the same villages, households and respondents as before but size of the impact survey was reduced to 88 per cent for treatment households and 90 per cent for control households. The reason behind this was the migration of some of the 2007 respondent families.

Table 2.2 .1 Treatment Villages

Village Name	Union Council	No of Households	
			Impact
Rano Samejo	Hathungo	26	24
Allah Bakhsh Mangrio	Bilawal Hingorjo	13	11
Balo Lal Mangwar	Dhilyar	21	15
Gul Muhammad Rajar	Dhilyar	30	29
Suleman Gaju	Dhilyar	17	12
M Khan Rawal	Khori	20	19
Haji Hassan Kaim Khani	Khori	30	27
Rano Lal Syal	Khori	20	18
Total		177	155

Table 2.2.2 Control Villages

Village Name	Union Council	No of Households	
		Baseline	Impact
Khady	Hathungo	10	10
Haji Alam Ali	Dhilyar	7	6
Gul Hasan Mangrio	Dhilyar	8	8
Jadam Rajar	Dhilyar	10	10
Allah Rakhyo Bozdar	Dhilyar	10	9
M Ali Mangrio	Khori	10	8
Haji Liaqat Ali	Khori	10	9
Waro Wasan	Khori	10	9
Total		75	69

2.3 Data Collection Instruments

Keeping in view objectives of the survey, a common household questionnaire earlier designed and tested for similar PPAF infrastructure projects was used as a standard baseline instrument. Household asset distribution, income, consumption, employment, education and health, housing structure and conditions are major parts of this instrument. Another research instrument (questionnaire) to collect village level information was also used as an addendum, the objective of which was to gather community-related information; including access to educational and health facilities, community organizations, prices of different items at village level, and general problems faced by the people. The baseline survey and impact assessment surveys for all PPAF interventions are carried out randomly, including poor, middle income and well-to-do households.

2.4 Training, Pre-testing and Data Collection

ERD, as a standard practice for baseline surveys, hires a team of data collectors and supervisors as per requirement and provides them with a two day training session. The first day of training is spent in-house acquainting the survey team with questionnaire fields and requirements. The second day is scheduled for pilot testing of questionnaires in the field by data collectors who are regularly monitored and tested for data collection and filled out questionnaire quality.

Baseline teams generally comprise of 3 data collectors and one supervisor. Supervisors are appointed for quality control, scheduling the data collection and to conduct interviews of key informants and collect primary data from different sources. The number of survey teams varies depending upon the sample size, location and logistical arrangements. Keeping in view the need to maintain data quality, data collectors are hired to work for 7-10 days. The entire data collection, quality control and data feeding process is directly supervised by ERD

professionals. The filled questionnaires are edited daily by the respective supervisors during the course of their fieldwork.

2.5 Sample Size

The sample size/respondents for this impact assessment report for this DMPP intervention was 155 households in treatment and 69 households in control villages.

2.6 Data Entry and Analysis

Data entry, cleaning, analysis and reporting are entirely done at ERD-PPAF. The survey instruments used to conduct baseline and impact assessment are not necessarily advanced scientific tools, but they serve as a useful guide and benchmark for poverty monitoring. The information on income, consumption, asset building, agriculture production and demographics provides key insight on primary variables affecting the quality of life in Khipro, Sanghar.

3.1 Demographic Profile

This section reflects a demographic snapshot of sample households in Taluka Khipro, specifically the dependency ratio, gender distribution, residential status, employment situation and level of education. Total population, comprising 900 households of the 16 treatment and control villages, is 5447 persons. The average village population is calculated as 350 persons and average household size is calculated at around 6.93 persons.

Table 3.1.1 Households and Population of the Treatment and Control Villages

Treatment and Control Villages 2007					
Village	No of Villages	Households	Population		
			Total	Male	Female
Treatment Villages	8	506	3028	1534	1452
Control Villages	8	394	2411	1249	1170
Total	16	900	5439	2783	2622

Source: Village level Data Collected at Baseline

Table 3.1.2 Demographic composition in Sample Households

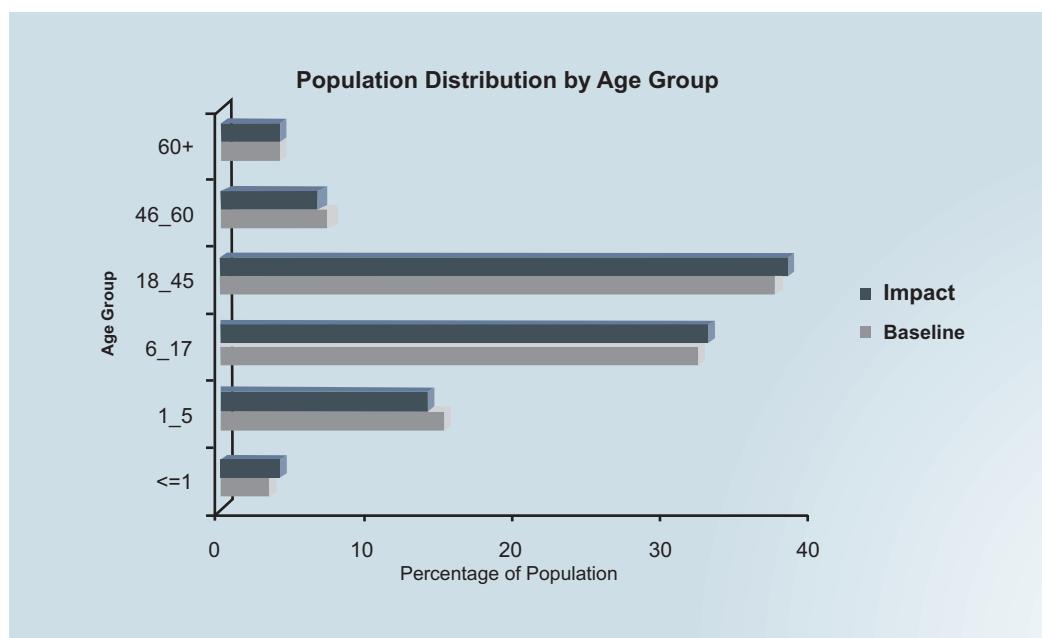
	Treatment & Control Villages				
	2007		2009		Variation
	No	%	No	%	
Household Size	1524	-	1553	-	+29
	6.8	-	6.93	-	+0.13
Population- Male	830	54.5 %	842	54.2%	+1.44%
	694	45.5 %	712	45.8%	+2.59%
Labour Force	679	44.5%	694	44.6%	+0.01%
Literate (Age 10+ years)	422	31.44%	351	32.77%	+2.6%
Male Literacy (Age 10+ years)	259	45.20%	301	50.25%	+5.05%
Female Literacy (Age 10+ years)	40	8.65%	49	10.49%	+1.84%
Dependency ratio		87.2%		88.4%	+1.2%

Source: PPAF –ERD data for Baseline 2007 and Impact Assessment 2009.

3.2 Age Structure

The infant and juvenile (<=17 years) population is about 51 per cent of the total population. The younger age group (18-45 years) is 37.5 per cent of the total population. The middle age group (45-60 Years) is about 7 per cent of the population. The above two groups combined constitute the entire work force of the area which is 44.5 per cent. This information is provided in fig.3.2 for both the baseline and impact assessment years. The table below shows a slight decrease in the age group of 45-60 years during the last two years. There is also a slight (0.4%) increase in the age group of 6-17 years.

Secondly, the female population increased by 2 per cent as against 1.8 per cent increase in male population. Thirdly, almost 42 per cent of the total females were in their reproductive age (18-50 years). Many Pakistani women get married quite young (15-19 years) and start bearing children soon after. Maternal health is therefore a significant component of the overall health of women in the reproductive age groups.



3.3 Literacy and Educational Attainment

In Pakistan, literacy rate (as defined by a person's ability to read and write) has been very low historically. This situation has changed considerably over the years. According to the 1998 census, 45 per cent of our adult population (10 years and above) was literate. The literacy rate for Sanghar district was 42.88 per cent for men and 17.45 per cent for women. In Khipro however, the literacy rate in 1998 was much lower at 20.5 per cent.

Literacy levels increased significantly during the last 10 years. The overall literacy increased by around 11 per cent in Khipro. More than 70 per cent of the total literate simply passed only primary (this includes up to seven years schooling) education, another 9 per cent of the literates are under Matric (8-9 years of schooling). However, a substantial proportion of literates (20%) passed matriculation and intermediate level of education.

Male literacy increased significantly to more than 50 per cent while female literacy crossed the 10 per cent mark. However, the gender gap between male and female literacy rates did not demonstrate a decreasing trend thus reinforcing the need to streamline gender in education interventions in the area.

4.1 Household Infrastructure

The survey also collected data on the household infrastructure. The following table highlights the salient household features of Khipro as demonstrated by the sample impact survey conducted in 2009. According to the available information, 21 per cent of the sample houses were constructed with stone, bricks etc, with RCC roofs (steel and cement used). These houses were regarded as 'Pucca'. On the other hand, about 65 per cent of the constructions were 'Katcha' which were erected with bricks and mud and sheltered with low quality wood frames used in roofs. The remaining 14 per cent houses were of mixed quality and classified as 'Semi-Pucca'.

Table 4.1.1 Household Infrastructure Facilities

Facility	Source	Percentage
Housing	<i>Pucca</i>	21.00%
	<i>Semi-Pucca</i>	14.00%
	<i>Katcha</i>	65.00%
	Avg No. of rooms per HH	2
Drinking Water	In-house Piped	73.00%
	Other	27.00%
Latrine	In-house	27.00%
	Open Fields	73.00%
Electricity	Connected	74.55%
Sanitation	Drainage System	5.00%
Fuel	Fire Wood	98.21%
	Gas (cylinder)	0.45%
	Cow-dung etc	1.34%

Source: Khipro Impact Assessment Survey, 2009

On average, there were 2 rooms in a house. However, these rooms were multipurpose and were used simultaneously for boarding, dinning, receiving guests and occasionally even as animal shelter. The availability of household facilities i.e., drinking water, latrine, wastewater disposal, fuel and electricity etc. are reported in Table 3.4.1 above. According to this information, a majority of the households (74.33%) were connected with electricity and around 27 per cent households reported having an in-house latrine facility whereas the remaining reported using open fields for defecation.

Drinking water supply in the four sampled Union Councils of Khipro was provided through

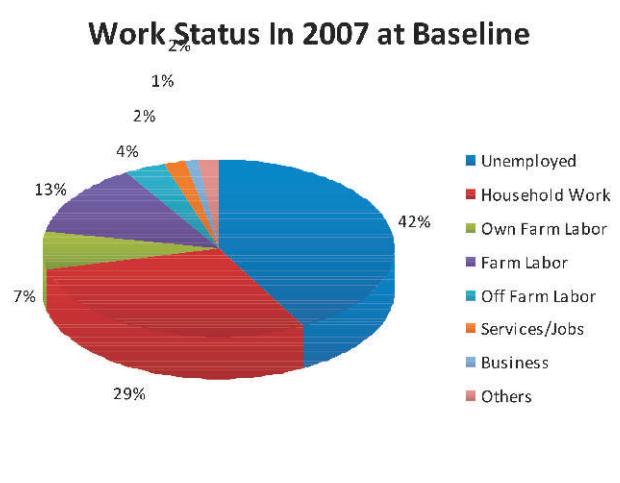
in-house piped water supply systems (this included public sector piped water schemes and hand pumps) to 73 per cent of the surveyed households. Households, not having access to in-house piped water supply systems, used community/village based water supply systems which were located at a reasonable distance. These included village water canals, open wells, and ponds. The most glaring deficit in social service provision in the area was in drainage systems. Only 5 per cent of the sampled control and treatment households reported having any sanitation drainage system. Indeed, any further interventions in this area should be acutely sensitized towards provision of sanitation systems in the region.

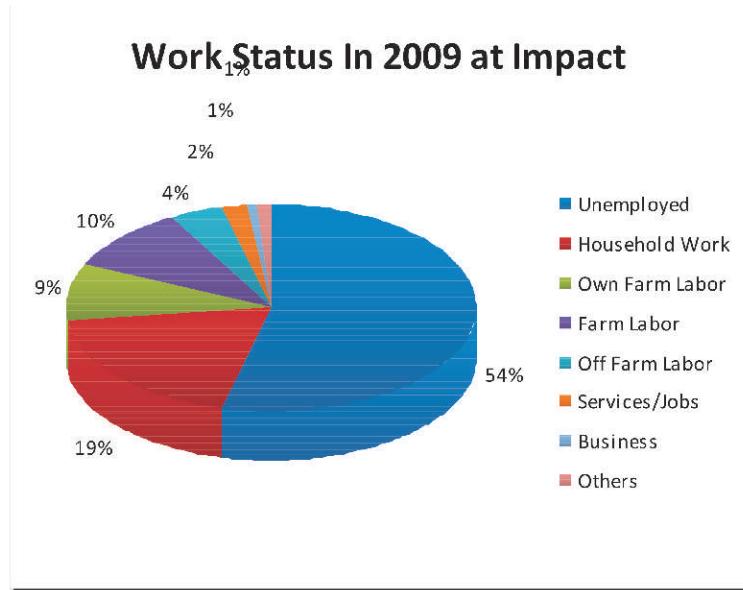
4.2 Dependency Ratio and Work/Employment Status

The dependency ratio, measuring the reliance of the 0 to 14 and 65 and above age groups on the working population between the ages of 15 and 65, for Khipro taluka during 2007 was 87.2 per cent, however this dependency ratio increased by 1.2 per cent in the year of the impact survey. This increase captured the overall increase in average sample household size during the intervening years. Similarly, in 2007 almost 95 per cent of the dependents were categorized as child dependents with ages equal to or below 14 years. The high number of child dependents is a direct consequence of low average life expectancy due to lack of health facilities and high fertility rates due to lack of family planning programme outreach among rural communities in Sanghar.

Table 4.2.1 Work Status for Economically Active Population

Status	Baseline 2007		Total	Impact 2009		Total
	Control	Treatment		Control	Treatment	
Unemployed	42.1%	42.6%	42.0%	57.1%	51.7%	54%
Household Work	29.3%	28.3%	29.0%	19.5%	19.4%	19%
Own Farm Labor	7.0%	7.4%	7.0%	9.0%	9.7%	9%
Farm Labor	14.1%	12.2%	13.0%	7.9%	11.4%	10%
Off Farm Labor	3.8%	3.8%	4.0%	2.4%	4.3%	4%
Services/Jobs	1.4%	2.4%	2.0%	2.5%	1.5%	2%
Business	1.0%	1.0%	1.0%	0.7%	0.9%	1%
Others	1.3%	2.3%	2.0%	0.9%	1.1%	1%
Total	100	100	100	100	100	100





Analyzing the working patterns of the economically active respondents from our samples we can see that compared to 2007 unemployment increased in Khipro during the intervention phase. However, this overall increase in unemployment does not imply the lack of job creation as a result of the DMPP intervention. A closer look at the data reveals that while own farm employment increased for both the control group and the treatment group during the intervention years, the increase for the treatment group was 0.7 per cent higher. Similarly, as an effect of drought conditions throughout Khipro, farm based labor decreased considerably during the intervening years as expected. This was a result of labor moving out of agriculture and seeking employment in non-farm sectors. However, the positive impact of the DMPP project is most visible in the decrease in farm labor.

As demonstrated above, employment in the agriculture sector shrunk by half to 7.9 per cent in 2009 from 14.1 per cent in 2007 amongst the control group. Nevertheless, during the same intervening period, employment in the agriculture sector among treatment villages decreased by only 0.8 per cent to 11.4 per cent in 2009. Indeed, the drastic decrease in agricultural sector labor employment meant that farm labor either assimilated into off farm labor employment or was left unemployed. Data on unemployment during 2007 and 2009 clearly demonstrates the nearly 6 per cent higher unemployment in the control group when compared to the treatment group. Interestingly, this 6 per cent corresponds roughly with the greater decrease, of almost 6 per cent, in farm based labor for the control group. This clearly demonstrates that SAFWCO and PPAF's intervention in drought mitigation, focusing on the lining of water canals, provision of tube wells, creation of water reservoirs and land leveling had a considerable, significant and positive impact in helping to maintain earlier rural employment patterns amongst the treatment group whilst the control group saw a major shift in employment patterns.

4.3 Local Perceptions on Development.

The members of the local community organization were asked to respond on a set of 9 different issues that the local communities currently facing both at baseline and impact

survey. The responses were assessed in terms of no benefit, slight benefit, significant benefit and very significant benefits. To analyze the responses the responses were further placed in two categories a) no/ slight benefits as no change, b) significant and very significant as change in perception.

The CO members' perceptions at the baseline and impact stages are shown in table below. Community organizations lost community interaction with the other public sector institutions, their credit requirements remained the same, slight or medium level improvement in social cohesion, access to technology, skills and personal development and access to market. The only major visible change the CO members perceived is in infrastructure development. They now perceive the need for other infrastructure

Table 4.3.1 Perception on Local Development Issues

Issues	Baseline	Impact	Remarks
Credit Benefits	37%	37%	No Change , high demand for credit facility
Infrastructure Development	32%	72%	Major visible positive change
Social Cohesion	45%	55%	Low level change
Access to Technology	18%	33%	Moder ate increase in provision access to technology to the Cos.
Conflict Resolution	28%	50%	CO played significant role in conflict resolution
Skills	31%	48%	Moderate role in skill development
Personal empowerment	24%	51%	Moderate role in personal development
Access to public Services	28%	22%	Negative impact because higher level interventions by the NGO -
Access to market	12%	25%	Low /Medium level change

Apart from the community organization level data on perception regarding important development issues data was also collected on the respondent level regarding major constraints/problems faced by them. Responses were categorized as follows; 0 for no problem, 1 for slight problem and 3 for serious problem. The table 4.3.2 below lists the total percentage of men and women who thought the issue was a serious problem.

Drainage remained one of the most important problems for both men and women with 50 per cent of both reporting it as a serious problem. Healthcare remained the highest priority problem for women as 66 per cent reported it as a serious problem while only 29 per cent of men thought healthcare was a serious problem. This major difference in priorities can be associated with the more frequent interaction of women with healthcare issues especially concerning their children. Interestingly enough while 43 per cent of

women reported poverty as a serious problem only 22 per cent men considered it a serious problem. These numbers help highlight the importance of targeted gender specific poverty reduction aimed at decreasing poverty amongst women in Khipro.

Table 4.3.2 Percentage of Respondents who categorized the issue as a serious constraint/problem

Development Issues	Impact Survey 2009			
	Women		Men	
	Priority Ranking	% of Women	Priority Ranking	% of Men
Educational attainment	6	26%	10	7%
Water supply	7	24%	7	21%
Street pavements	4	32%	4	28%
Fuel supply	4	32%	11	6%
Poverty	3	43%	6	22%
Savings	4	32%	2	30%
Social cohesion	10	17%	10	7%
Health care	1	66%	3	29%
Drainage	2	50%	1	49%
Transportation	4	43%	12	4%
Electricity	9	18%	8	19%
Employment	4	43%	3	29%
Access to Credit	5	27%	5	23%
Community Mobilization	8	19%	9	8%

The objectives of PPAF's DMPP intervention in Khipro aimed at alleviating and mitigating the effects of the drought that had affected the area between 1997 and 2002. As such the lining of water courses, building of water reservoirs, installation of tube wells and wind mills as well as drip and sprinkler irrigation was expected to result in quantifiable outcomes in yield per acre, land reclamation, increased agriculture productivity and change in cropping patterns. The following sections seek to examine these very direct outcomes of PPAF's DMPP project.

It must be noted that due to constraints in the baseline survey conducted in 2007 the subsequent impact survey of 2009 included an addendum to the main questionnaire asking respondents to report before and after intervention details on land usage, irrigation costs, method of selling produce, method of purchasing agriculture inputs, cropping pattern, yield per acre, and average work hours in the field.

5.1 Land Cultivation

The DMPP intervention of in Khipro was primarily located in rural areas where the primary mode of livelihood generation was agricultural production. Table 5.1.1 shows the average land under cultivation in the treatment and control villages both before, i.e. 2007, and after, i.e. 2009. On average we can note that the land under cultivation in our treatment group was greater than the land under cultivation in our control group. While the average land under cultivation increased amongst the treatment group from 9.72 acres per household to 10.42 acres per household, the control group saw an increase in average land under cultivation from 5.49 acres to 5.88 acres per household. However, the percentage increase demonstrated through our sample remained the same between both groups at 7 per cent.

Group	Average Land Under Cultivation		
	Baseline 2007	Impact 2007	% Change
Treatment	9.72 acres	10.42 acres	7%
Control	5.49 acres	5.88 acres	7%

In order to test for the statistical significance of average land under cultivation we also conducted a hypothesis test for our treatment and control groups. The hypothesis tested were as follows; 1) The average land under cultivation per household increased after PPAF's intervention amongst the treatment group, and 2) The average land under cultivation per household increased after PPAF's intervention amongst the control group. The results demonstrated that the increase in land under cultivation was not statistically significant for either the treatment group or the control group. Therefore, we can conclude that the DMPP intervention did not result in a statistically significant increase in average land under cultivation per household in Khipro, Sanghar.

One of the reasons for the results above could be that DMPP's water management projects in drip

irrigation, water course lining and water reservoirs are more likely to positively affect yield per acre, irrigation time and water consumption rather than average land under cultivation. Another reason for the lack of a significant increase in land under cultivation in our intervention area could be the lack of available extra land or non-cultivated land towards which available water resources could be diverted.

5.2 Agricultural Yield:

The yield of cultivated land is a primary factor in increasing profitability, sustainability and income generation from scarce land resources. Therefore, availability of sufficient water and the use of efficient water management techniques like drip irrigation help in increasing the yield per acre in the intervention area. Similarly, the DMPP intervention has had a dramatic effect on the yield per acre amongst our treatment households. The following table highlights the “before” and “after” yields for both the treatment and control groups for the three main crops in Khipro namely; cotton, wheat and chilies. It also contains results for hypothesis tests, at the 95% confidence level, for both the treatment and control groups.

Table 5.2.1 Yield per Acre of Major Crops

Group	Crop	Yield Per Acre		
		2007	2009	% Change
Treatment	Cotton	946.91*	1142.97	21%
	Wheat	960.00*	1122.69	17%
	Chilies	370.4*	651.2	76%
Control	Cotton	1155.22	1323.2	15%
	Wheat	1079.21*	1254.51	16%
	Chilies	455.00	590.00	30%

*Significant at 95% confidence level.

In the table above the tested hypothesis are; 1) Is the yield per acre for cotton in 2009 greater than the yield per acre for cotton in 2007, 2) Is the yield per acre for wheat in 2009 greater than the yield per acre for wheat in 2007, and finally, 3) Is the yield per acre for chilies in 2009 greater than the yield per acre for chilies in 2007. The results are listed above. Clearly, while the treatment group in Khipro demonstrated a statistically significant increase in yield per acre for all three major crops, the control group only saw a statistically significant increase in the yield per acre for wheat. This demonstrates that even though, on average, the yield per acre before the DMPP intervention was higher for all three crops amongst the control group, the percentage increase in average yield after the intervention period was higher and more significant amongst the treatment group.

Indeed, provisioning of sprinkler and drip irrigation systems along with water course lining and water reservoirs has increased the efficient usage of water for irrigation amongst the existing cultivated land in Khipro. The DMPP sub-projects have allowed the treatment group to counter the effects of drought conditions relatively more when compared to the control group. However, we must also note that the increase in average yield per acre for wheat has only been marginally greater amongst the treatment group and the differential impact is definitely less than what was expected as a result of the DMPP intervention. The most drastic difference in impact is in the yield per acre of chilies. The primary reason for this greater increase in yield per acre for chilies can be attributed to the fact that 20 per cent of all

respondent households in our treatment sample, who were cultivating chili in 2009, started growing the crop during the DMPP intervention period. This increased production and cultivation of chilies was partly a result of the DMPP project as farmers were able to access the extra water conserved towards producing an extra crops during their regular cropping cycles

5.3 Water Consumption for Irrigation:

Water resource management is essential for maintaining and enhancing an irrigation system in drought effected regions. PPAF's infrastructure intervention in Khipro sought to improve local capacities in mitigating drought conditions and reviving the efficient use of scarce water resources. Therefore, this section examines the impact of the DMPP intervention on average time required in irrigating land, as well as, the frequency of giving water to each crop in one production cycle. Table 5.3.1 below shows the average hours required for irrigating one acre of land for the treatment and control groups. We can see that on average the control group households require more time in irrigating one acre of land when compared to our treatment group households. This difference holds for both the major crops produced in the region namely; cotton and wheat. We have not included chilies in our water consumption analysis due to small sample size. We can also note that on average the percentage decrease in time required for irrigation was higher in the treatment group than in the control group.

Table 5.3.1 Time in Required for Irrigation

Group	Crop	Hours Required to Irrigate One Acre		
		2007	2009	%age Decrease
Treatment	Cotton	2.98*	1.95	35%
	Wheat	2.97*	1.90	36%
Control	Cotton	3.69*	2.48	33%
	Wheat	3.82*	2.61	32%

*Significant at 95% confidence level.

In order to test for the statistical significance of the differences in the control and treatment groups we tested the following hypothesis; 1) did the average time required for irrigating one acre of land producing cotton decrease in 2009 when compared to 2007, and 2) did the average time required for irrigating one acre of land producing wheat decrease in 2009 when compared to 2007. The results above demonstrate that there was a statistically significant decrease in both cotton and wheat in the treatment and control groups. However, we can also note that the decrease in average time required for irrigating one acre of land was greater in our treatment group when compared to the control group. The overall decrease in time can be associated with improved rainfall or climate conditions during the intervention period nevertheless the greater decrease of 2 per cent in cotton and 4 per cent in wheat in the treatment group can be associated with better water flows due to water course lining and drip and sprinkler irrigation systems.

Table 5.3.2 Frequency of Irrigation

Group	Crop	Number of Times Land is Irrigated		
		2007	2009	% Change
Treatment	Cotton	5.2	5.12	(2%)
	Wheat	4.18	4.24	1%
Control	Cotton	5.59	5.67	2%
	Wheat	4.304	4.304	0%

The table 5.3.2 above gives the number of times land is irrigated for each crop. In order to test the statistical significance of the changes in crop watering frequency during the DMPP intervention period we ran the following hypothesis tests for both the treatment and control groups; 1) did the average number of times land is irrigated for each cotton crop decrease/increase in 2009 compared to 2007, 2) did the average number of times land is irrigated for each wheat crop increase in 2009 compared to 2007. The results of our hypothesis tests show that no statistically significant change was witnessed in either the control group or the treatment group. Therefore, we can conclude that our DMPP intervention had no effect on the frequency of irrigating land for each crop during one production cycle.

5.4 Produce Marketing Practices

Another key aspect of DMPP interventions is to change the method of selling agricultural produce in intervention areas. Increased water management and conservation would have a direct outcome in increased yield per acre. Coupled with increased production, we would expect respondent households to access main markets for selling their produce as the size of each household's crop increases. The following table highlights the main methods adopted by households in Khipro to sell their produce.

Table 5.4.1 Method of Selling Produce

	Treatment		Control	
	before	after	before	after
Village market	29	13	14	0
Wholesale Mandi ¹	33	58	23	44
Self Selling ²	34	25	18	11

Respondents selling agricultural produce in the wholesale “*Mandi*” increased substantially in both the treatment and control groups whereas households selling produce in the village market or through “self selling” decreased in both the control and treatment groups. Even though an increase was witnessed in market linkages we cannot associate this increase with our DMPP intervention alone as both the control and treatment group's witnessed the increase in *mandi* selling. A more plausible reason for the households to approach *Taluka* wholesale markets for selling agricultural produce may be the increase in commodity prices during the years under study. Higher prices, easy availability of buyers and better crop yields may have driven respondent households to seek larger markets and thus better prices, for their agricultural produce.

5.5 Cropping Patterns

One of the expected outcomes of the DMPP interventions planned and executed by PPAF has been a change in existing cropping patterns prevalent in the intervention area. Indeed, PPAF's earlier DMPP experience in Soon Valley, Punjab has demonstrated a considerable change in cropping patterns at the time of impact assessment. However, in Khipro the percentage of respondents reporting a change in cropping patterns after the intervention is only 6 per cent; whereas 76 per cent respondents have reported no change in cropping patterns (18% of our sample households recorded “no response” for this question).

Table 5.5.1 Percentage of Respondents Reporting Change in Cropping Pattern

Treatment Group	Percentage of Respondents	
	No Change	Change
Cropping Pattern	76%	6%

The majority of respondents give “old pattern suitable” as a reason for not changing the existing cropping pattern whereas some respondents reporting no change in cropping pattern also give “not aware of what changes can be brought about” as another reason for maintaining the existing cropping pattern. A close examination of both responses demonstrates that households in our project area “perceive” existing cropping patterns as the most suitable cropping patterns that they can apply in their region. Therefore, DMPP interventions coupled with second generation soft interventions, aimed at increasing awareness and changing perceptions, are more likely to improve cropping patterns in project areas when compared to stand alone DMPP interventions like Khipro.

Overall the outcomes of PPAF's DMPP intervention in the agricultural economy are most pronounced in increasing the yield per acre of crops in the treatment group and decreasing the average hours required for irrigating one acre of land. This is primarily due to better water availability, increased water flows and efficient water usage through drip irrigation. However, the DMPP intervention has not changed the land under cultivation significantly demonstrating that water management projects are less likely to affect land reclamation whereas projects aimed at increasing sources of water like tube wells and new water channels are more likely to have a direct impact on land reclamation. Similarly, while some shift has been witnessed in cropping pattern, as 6 per cent households have started growing a third crop the majority of respondent households (approximately 76%) reported no change in cropping patterns. The vast majority of respondent households who reported no change in cropping pattern said that the old cropping pattern was most suitable of the land and that they thought that cotton and wheat, as cash crops, were the best suited for production in the existing climate conditions of Khipro.

The previous chapter focused on the direct impact of the DMPP project on Agriculture patterns in Khipro, Sanghar. This chapter seeks to examine the indirect benefits of PPAF's DMPP project at the income and expenditure levels.

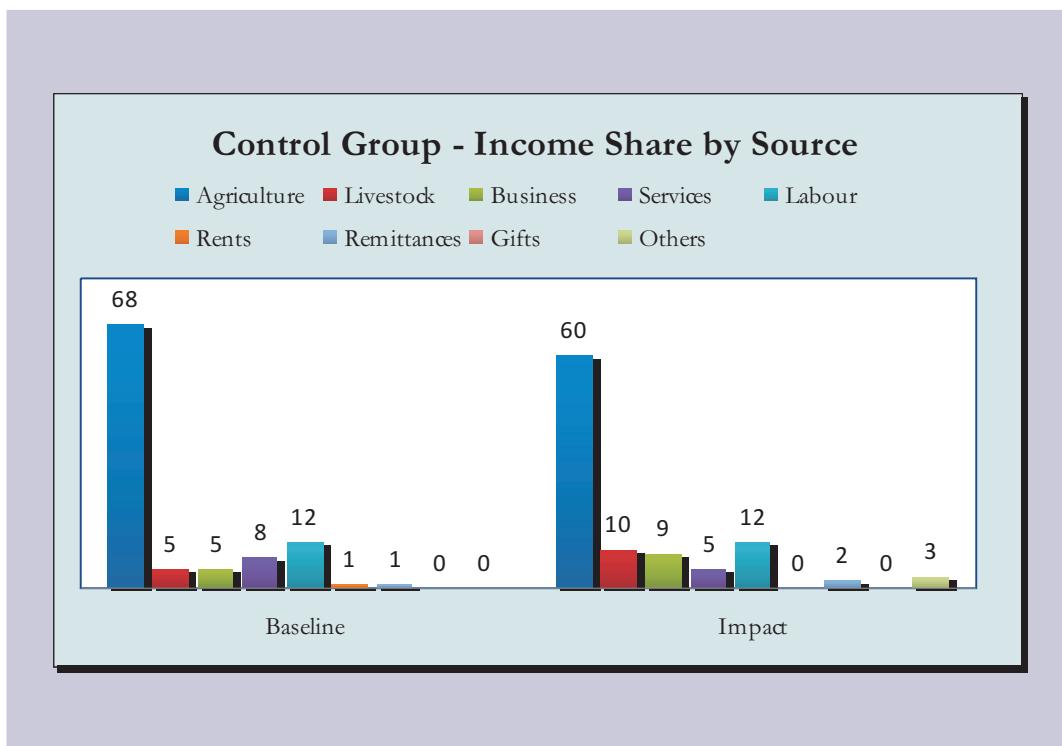
6.1 Household Income and Sources of Income

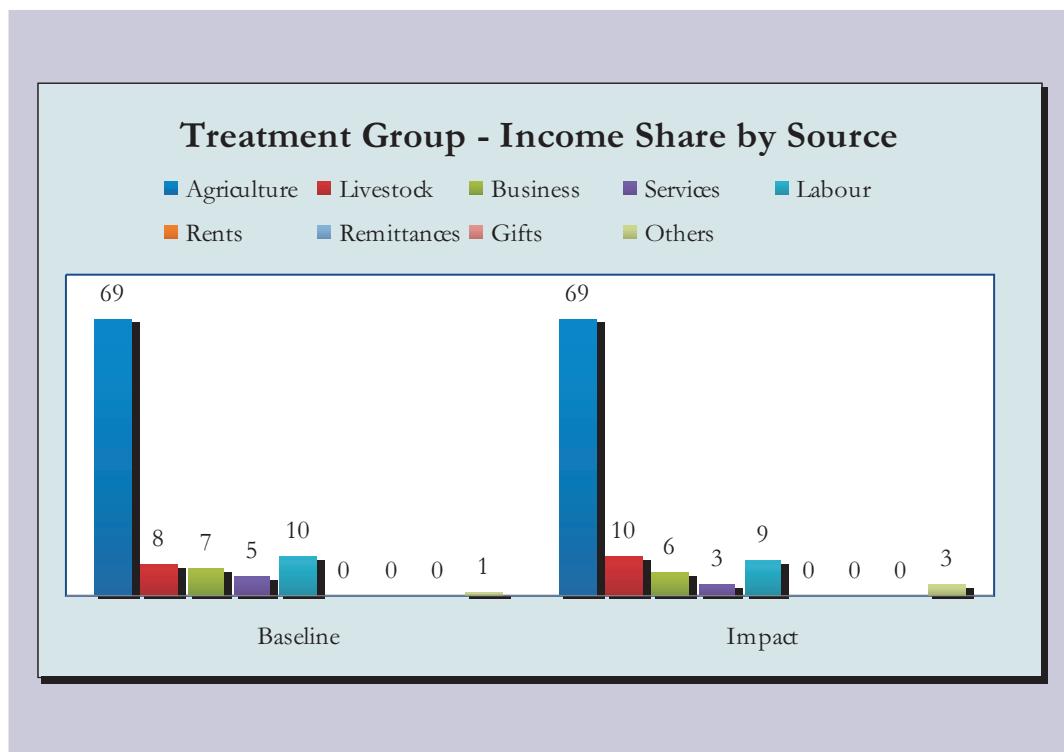
The welfare of a society largely depends on the way its income levels are augmented allowing greater flexibility to individuals to exercise choice when making consumption decisions. One of the planned indirect benefits of the DMPP project in Khipro, Sanghar has been to improve the household income levels in the area through improved access and management of water resources. Agricultural income, which forms the backbone of earning livelihood in Khipro had been drastically affected as a result of the drought in the region between 1997 and 2002. As table 6.1.1 demonstrates, agricultural income formed almost 68-69 per cent of total income for households (treatment as well as control villages) in Khipro during the baseline year of 2007 while labor income formed the second most important source of income by providing 12 per cent of total income in the area.

Indeed, average monthly incomes have generally increased from all sources of income over the study period with the exception of rent and service income for the control group. A cursory look at the data in table 6.1.1 demonstrates that agricultural income increased significantly more for the treatment group when compared to the average monthly income increase amongst the control group. Later on we highlight whether this difference in the increase of average monthly incomes between the control and treatment groups is statistically significant or not.

However, the most important impact on the composition of the sources of earning livelihoods between the treatment and control groups is in the percentage share of agriculture income in total household income. As a result of drought conditions we would expect agricultural production, and therefore agricultural incomes, to decrease in the wake of water shortages in the area. This is amply borne out by data on the control group which saw a decrease in the share of agricultural income from 68 per cent in 2007 to 60 per cent in 2009. Amongst our treatment group the share of agricultural income has remained the same at 69 per cent of total income. Indeed, providing better water management and conservation through the DMPP intervention has allowed the treatment group to sustain their earlier distribution of sources of income while the control group, which had not been affected by the intervention, saw a drastic change in its composition of earning livelihoods. This change might be a result of respondents in the control group moving out of the agriculture sector and seeking employment and living in other sources.

Source	Control Group				Treatment Group			
	Baseline		Impact		Baseline		Impact	
(Monthly Income in Rs.)	Actual	Share by Source	Actual	Share by Source	Actual	Share by Source	Actual	Share by Source
Agriculture	5,458	68%	7,121	60%	5,049	69%	9,674	69%
Livestock	437	5%	1,169	10%	575	8%	1,334	10%
Business	389	5%	1,060	9%	512	7%	828	6%
Services	602	8%	596	5%	353	5%	471	3%
Labour	973	12%	1,386	12%	757	10%	1,274	9%
Rents	60	1%	0	0%	0	0%	0	0%
Remittances	98	1%	198	2%	0	0%	0	0%
Gifts Received	1	0%	0	0%	34	0%	0	0%
Other Income	0	0%	317	3%	45	1%	415	3%
Average Household Income	8,020		11,848		7,310		13,996	
Per Capita Income	1,384		1,716		1,206		2,359	





Before going into a further analysis of increase in household income in Khipro, the report examines whether these increases in average monthly household incomes are statistically significant or a result of sampling distributions. In order to test the difference in means of change in average monthly income between the control group and the treatment group the following hypothesis are outlined:

1. The increase in the average monthly income from agriculture between 2007 and 2009 was higher for the treatment group than for the control group.
2. The increase in the average monthly income from livestock between 2007 and 2009 was higher for the treatment group than for the control group.
3. The increase in the average monthly income from business between 2007 and 2009 was higher for the treatment group than for the control group.
4. The decrease in the average monthly income from services between 2007 and 2009 was higher for the treatment group than for the control group.
5. The increase in the average monthly income from labor between 2007 and 2009 was higher for the treatment group than for the control group.
6. The increase in the total average monthly income between 2007 and 2009 was higher for the treatment group than for the control group.

The results of these hypothesis tests are reported below along with the average monthly increase in income for the treatment and control groups.

Table 6.1.2 Difference in Average Increase in Monthly Income from Major Sources of Income between Baseline Year 2007 and the Impact Year 2009

Source of Income	Average Increase Between Baseline and Impact	
	Treatment	Control
Agriculture	4,625 *	1,663
Livestock	758	731
Business	316	671
Services	(6)	118
Labor	514	413
Total Average Monthly Income	6,684**	3,828

*Statistically significant at 95% confidence level.

**Statistically significant at 90% confidence level.

As the results in table 6.1.2 highlight, the increase in average monthly income from agriculture was almost PKR 3,000 more amongst the treatment group than amongst the control group. In fact, the treatment group saw a 91 per cent increase in household income through agriculture while the control group only demonstrated a 30 per cent increase. While we cannot determine for certain the exact increase in disposable income from agriculture after accounting for inflation in Khipro, we can safely assume that even after correcting for inflation a 91 per cent statistically significant increase in agricultural incomes over 2007-2009 would have resulted in an actual increase in disposable income for our treatment group. This is further borne out by the last result in table 6.1.2 which shows that the overall difference in the greater increase in total average monthly incomes amongst our treatment group compared to the control group was statistically significant at 90 per cent confidence level. Therefore, we can conclude that after the completion of the DMPP intervention in Khipro, Sanghar, the average monthly household incomes increased more than the average household incomes of the control group. The primary reason for this result was the significant increase in agricultural incomes, which makes up 60 – 70 per cent of total income, amongst the treatment group when compared to the control group.

The increase in agriculture income was also a result of the 2007-2008 commodities price crisis. As the world saw a shortage in food commodities the prices of food items in Pakistan also increased drastically which positively affected farmers. This phenomenon was also witnessed in Khipro. Farmers supplemented their incomes with the increased output prices while they transferred consumption by using more self produced food items. However, a corresponding increase in the price of non-substitutable and non-self produced food items also increased household expenditures which had a negative impact on livelihood levels. The implementation of the DMPP intervention, just before the 2007-2008 commodities crisis, had an incremental benefit amongst the treatment group. With individual projects aimed at increasing water storage, using water efficient technologies and decreasing water wastage by lining of canals PPAF helped farmers in Khipro reap greater benefits during the commodities price by decreasing the drought's effects and helping maintain the agriculture production levels amongst the treatment group.

Since the increase in incomes from other major sources, apart from agriculture, namely; livestock, services, business and labor are statistically insignificant we cannot make any definite conclusions as to their impact on increasing livelihoods in Khipro. PPAF's DMPP intervention, which directly affects the

agricultural economy in the region and was aimed at mitigating drought affected conditions in Khipro, has demonstrably resulted in an increase in agricultural incomes for the treatment group. However, we must note that while PPAF was funding the DMPP project in Khipro it was also running parallel programmes in micro-credit and that some of the increase in incomes may reflect the indirect impact of PPAF's micro-credit and micro-enterprise programmes. Nevertheless, the fact that agricultural incomes have significantly increased while other sources of income especially services, livestock and business income have not significantly increased demonstrates that if the increase in agricultural income does capture some residuals of the micro-credit programme it is likely to be relatively small because other major sources of income which are traditionally effected more by micro-credit and micro-enterprise programs namely; services and business, have not shown a statistically significant increase.

6.2 Income and Poverty Estimates

In this section we examine the number of households falling in income brackets between Rs. 5,000 to Rs. 30,000. The aim of the following analysis is to estimate whether households in Khipro have transitioned out of extreme poverty (given that they witnessed a statistically significant increase in their agricultural incomes between the baseline year and the impact year). In order to examine average monthly incomes at the household level and compare them with poverty standards per adult individual we need to construct an adult equivalent household size. For this paper we will use the "OECD approach" towards constructing adult equivalent households. This approach, though not standard, provides a reasonable estimate of the size of each household and has been used by the OECD since late 1980's in calculating adult equivalence scales for poverty, income and expenditure cross country analysis.

The "OECD equivalence approach" gives the following scales to each member of the household; 1 for the head of the household, 0.7 for each subsequent adult member of the household and 0.5 for each child in the household below the age of 15. We have assigned these scales to each member of the household in our treatment and control sample. The average adult equivalent household at the baseline was 4.42 while the average adult equivalent household at the impact year was 4.53.

In order to examine income and poverty in Khipro based on our sample data we collected national poverty estimates from the Economic Survey of 2007-2008 of the Government of Pakistan. An attempt was made to collect more recent figures through the PSLM and PRSP-II data but unfortunately no updated data was available.

Table 6.2.1 Pakistan's Poverty Categories per Month

Category/Band	Income per individual	Income per adult equivalent household
Extremely Poor	Less than Rs. 472.23	Less than Rs. 2,125.03
Ultra Poor	Rs. 708.35	Rs. 3,187.58
Poor	Rs. 944.47	Rs. 4,250.12
Vulnerable	Rs. 1,180.59	Rs. 5,312.66
Quasi-non Poor	Rs. 1,888.94	Rs. 8,500.23
Non Poor	Over Rs. 1,888.94	Over Rs. 8,500.23

Source: Economic Survey 2007-2008, Ministry of Finance, Government of Pakistan

We calculated the average income per adult equivalent household by multiplying the Government of Pakistan poverty bands with the calculated average adult equivalent household of 4.5 members. The results are also listed in the table above. We can thus use Rs. 5,000 as the baseline for vulnerable and poor respondents for our following analysis.

Figure 6.1.1 below, which contains a graphical representation of the number of households in each income bracket for the treatment group, shows that at the time the baseline survey was conducted in 2007 44 per cent of households had an average monthly income of below Rs. 5,000 which classified them as within the poverty bracket. This number decreased subsequently at the time of the impact to only 22 households. While the change in the Rs. 5,000 to Rs. 10,000 income bracket was nominal, most of the households shifted into the Rs. 10,000 to Rs. 20,000 income brackets.

Figure 6.1.1 Households by Income Bracket – Treatment Group

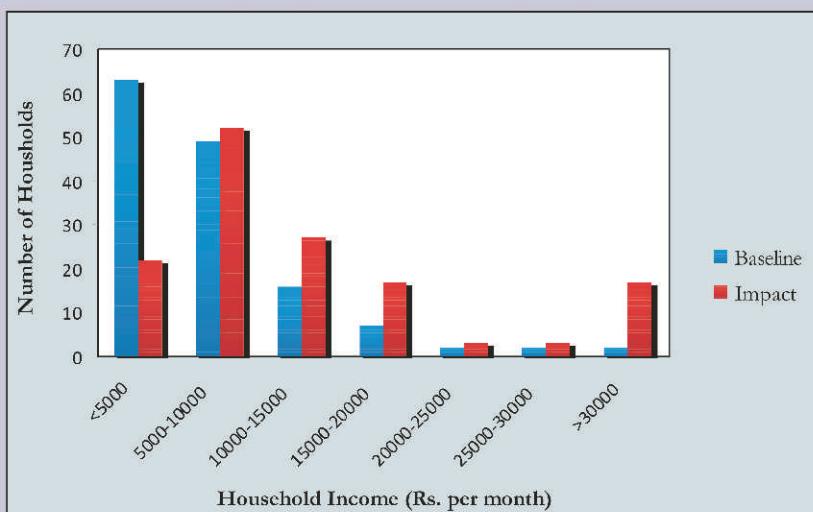
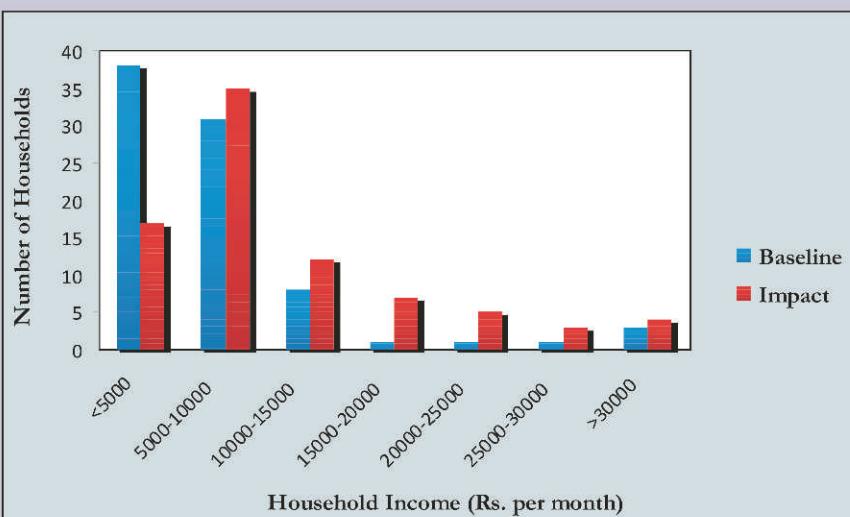


Figure 6.1.2 Households by Income Bracket – Control Group



The highest increase in an income bracket was in the Rs. 30,000 and greater in which number of households increased from just 2 at the baseline to 17 at the time of the impact study. This increase corresponds to the 2007-2008 food crises as large producers of food with hoarding capacity sold their extra stock at high prices thus increasing their overall monthly incomes. This trend can also be demonstrated in Khipro where the most increase was witnessed in the highest income bracket amongst the treatment group. Like the decrease in the number of households in lowest income bracket was seen in the treatment group a similar shift was also witnessed in the control group (see figure 6.1.2). However, the decrease in the number of households in the below Rs. 5,000 bracket in the control group was 55 per cent, which was lower than the 65 per cent decrease seen in Treatment group.

Therefore, on average 10 per cent more households managed to move out of the poverty and vulnerability bracket in the DMPP intervention treatment group than in the control group. However we must also qualify that this tentative figure only shows that on average more households managed to transition out of poverty in the treatment group than in the control group. Indeed, exact estimations would ideally depend on latest 2008-2009 poverty bracket figures for district Sanghar coupled with accounting for inflationary trends at baseline and impact years. Indeed, an even more exact estimation of poverty would require creating an index of all indicators of poverty including expenditures, housing facilities, access to water, and access to electricity etc.

Household Expenditure

In order to estimate the impact of a project on household vulnerability we need to analyze the pattern of household expenditures in conjunction with household income. This section seeks to examine average monthly household expenditures in Khipro by source. Table 6.3.1 highlights the average monthly expenditures along with the share of each item in total expenditure. On average we can note that after the impact survey of 2009 the share of food in total household expenses has equalized in both the control group and the treatment group to about 48 - 49 per cent whereas at the time of the baseline survey food expenditures accounted for 45 per cent of total expenditure amongst the treatment group and 50 per cent amongst the baseline group. Another significant change in composition can be noted in health care expenditures where its share in total expenditures declined more in the treatment group than in the control group.

Table 6.3.1 Average Monthly Household Expenditure

Source	Control Group				Treatment Group			
	Baseline		Impact		Baseline		Impact	
	Expense in PKR	Share	Expense in PKR	Share	Expense in PKR	Share	Expense in PKR	Share
Food	3,790	50%	3,689	49%	2,772	45%	3,723	48%
Clothing	522	7%	614	8%	513	8%	563	7%
Housing	546	7%	209	3%	282	5%	193	3%
Health Care	897	12%	581	8%	849	14%	478	6%
Education	295	4%	147	2%	236	4%	187	2%
Social Functions	708	9%	831	11%	613	10%	583	8%
Transportation	545	7%	348	5%	501	8%	449	6%
Remittances	4	0%	0	0%	11	0%	113	1%
Other Expenses	285	4%	1,079	14%	338	6%	1397	18%
Average Household Expenditure	7,593		7,498		6,116		7,688	

We also conducted the following hypothesis tests to test the statistical significance of the difference in change of average household expenditure for each source. The hypotheses tested are as follows:

- 1) The change in average food expenditure, between the baseline and impact years, was greater for the treatment group than for the control group.
 - 2) The change in average clothing expenditure, between the baseline and impact years, was greater for the treatment group than for the control group.
 - 3) The change in average housing expenditure, between the baseline and impact years, was greater for the treatment group than for the control group.
 - 4) The change in average health care expenditure, between the baseline and impact years, was greater for the treatment group than for the control group.
 - 5) The change in average education expenditure, between the baseline and impact years, was greater for the treatment group than for the control group.
 - 6) The change in average social function expenditure, between the baseline and impact years, was greater for the treatment group than for the control group.
 - 7) The change in average transport expenditure, between the baseline and impact years, was greater for the treatment group than for the control group.
 - 8) The change in average remittance expenditure, between the baseline and impact years, was greater for the treatment group than for the control group.
 - 9) The change in average other expenditure, between the baseline and impact years, was greater for the treatment group than for the control group.
 - 10) The change in total average monthly household expenditure, between the baseline and impact years, was greater for the treatment group than for the control group.
- The results for the hypothesis tests mentioned above are reported below in table 6.3.2 along with the average change in monthly household expenditures.

Table 6.3.2Change in Average Monthly Household

Source of Expenditure	Average Change Between Baseline and Impact Years	
	Control	Treatment
Food	-101*	951
Clothing	92	50
Housing	-337	-89
Health Care	-316	-371
Education	-148	-49
Social Functions	123	-30
Transportation	-197	-52
Remittances	-4	102
	794	1059
Average Household Expenditure	-94**	1571

*Significant at 95% confidence level.

**Significant at 90% confidence level.

Food was the only source of expenditure amongst surveyed households that demonstrated a positive and significant (at 95% confidence level) difference between the treatment group and the control group. As food is a normal good and is likely to increase if income increases we can assume that this result in household expenditures reflects the significant increase in agricultural incomes demonstrated in the earlier section. Indeed, we would expect an increase in disposable income to shift consumer expenditure patterns in food as consumers look to buy better quality, high nutrition and more expensive food items like meat, poultry and vegetables as a substitute to low quality food items like pulses. We must also note that since this significant increase in food expenditure is analyzed using mean difference in change between impact and baseline years, any effects of aggregate food price hike, which was prevalent in 2007-2008, is controlled for in both the treatment and control groups. Finally, almost 95 per cent of the production in Khipro, Sanghar is in cash crops namely cotton and wheat. Therefore, the increase in food prices, which was witnessed in 2007-2008, could not result in a shift of food consumption to self produced goods, which would be expected in regions where a diverse range of crops are produced, and instead the increase in household incomes was diverted towards increased food expenditures.

Due to the significant increase in food expenditures which make up almost 45 per cent of total expenditures a statistically significant difference (at the 90% confidence level) in overall average expenditures was witnessed between the treatment and control groups during the intervening period. This difference, like food expenditures, can be directly associated with the increased average household income (significant at 90% confidence level) shown earlier in the income section. All other sources of household expenditure demonstrated statistically insignificant changes between the baseline year and the impact year.

6.4 Financial Access and Sources of Lending

The sources of loans (i.e. lenders, suppliers, middlemen and wholesalers, or Arthis) that are available in the district can be categorized into formal and informal. The formal sources include bank loans for agriculture, house building, consumption and purchase of agriculture machinery and small enterprises. Besides the banks, other micro-finance providers such as SAFWCO and NRSP are also operating in the district along with The Cooperative Bank.

The formal sources of loan involve the pledging of assets- land, house, gold or other immovable property. The MFIs mostly provide small loans against personal savings and/or personal guarantee by the CO members. The interest rate of formal sources ranges from 15 to 30 per cent for different types and categories of repayment schedules. The informal sources of lending include financial intermediaries, landlords, Arthis and friends and relatives. All informal sources have their own repayment modalities and may vary from each category of loan and providers.

Such lending normally includes personal reputation, relationship and peer solidarity based guarantee or in some instances a written legally executable agreement containing a promissory note or collateral. Financial intermediary loans are mostly termed hard loans and the debtor exercises this option as a last resort, when possibilities of acquiring a soft loan through formal and other informal sources is impossible.

The Arthi's loan can be termed a soft loan and only tied with the sale of product at his shop. The Arthi provide agricultural inputs at the peak/higher market rates and purchase products at routine/normal market rates. The Arthis interest is that he purchases the product and does not pay the whole amount instantly. He immediately deducts his loan money and gives the debtor a receipt for his balance payment: the Arthi pay

the balance amount.

Loans from friends and relatives are normally free of any interest but with a verbally agreed payment schedule. In some cases repayment may be tied to a personal favour, future interest and/or the purchase of an asset. The repayment schedule may vary from one month to one year or longer, the period depending upon the repayment capacity of the debtor.

The household survey explores the possibilities of access to loans for the target communities. Only 7.5 per cent of the respondents reported the household having availed a loan facility. Four broad types of loan identified by the respondents are agriculture loans, house building, social responsibility/consumption loans and other (general). The overall loan portfolio in Khipro is very small. Although the overall volume of loan increased by 200 per cent in 2009, the reported average amount of loan has remained in four digits. It was only Rs. 2750 in the year 2007 and increased to Rs. 8000 in the year 2009. The different payment schedule reported for different categories of loans- monthly (35%) quarterly (8%) bi-annual 27 per cent and annual 30 per cent. There are only two conditions reported for the loans- personal guarantee (35%) and pledging of assets (65%).

Conclusion

The impact assessment of PPAF's DMPP intervention, implemented through SAFWCO, resulted in the following major findings. The outcomes of the DMPP intervention on the existing agricultural economy were pronounced in yield per acre and irrigation time. As a result of increased water flows, water conservation, and application of modern pressurized irrigation techniques the yield per acre for all the three major crops namely; cotton, wheat and chili demonstrated a significant increase in the treatment households compared to the control group households. While this increased was most pronounced in cotton and chili yields, the difference in wheat yield per acre was marginal therefore we can conclude that the main effect of our DMPP intervention was in increasing the yield of a major cash crop i.e. cotton in our intervention area. We also noted that while the overall time required for irrigating land once decreased in both the control and treatment groups, primarily due to change in weather patterns and decrease in drought conditions, the fall in irrigation time amongst the treatment group was greater due to our DMPP intervention in the treatment group.

However, the impact assessment also highlighted key deficiencies in outcome indicators at the impact stage. Land under cultivation, which was expected to increase, did not show any significant change. Similarly, cropping patterns and access to market linkages also did not show a demonstrable change in the treatment group when compared to the control group. However, here we must also mention that 8 (almost 5%) households did report changing their cropping patterns by either growing a third crop namely; chili or sugar cane (5 and 2 households respectively), or exchanging one crop for another more profitable one namely; sun flower for cotton (1 household). Finally, frequency of water irrigation required for each crop also showed little or no change in the project area. The fact that these important indicators did not show any or little improvements as a result of the DMPP intervention highlight the fact that stand alone infrastructure projects, without accompanying soft interventions, are less likely to benefit communities. We will highlight this further in the recommendations section.

As a result of the significant increase in yield per acre we also noted a significant increase in household income from agriculture amongst respondents in the treatment group compared to the control group. This increase in household income from agriculture can be directly associated with the DMPP sub projects and is a positive impact of PPAF's intervention in the area. Indeed, the subsequent increase in overall average household incomes in the treatment group also reflected this significant difference between control and treatment groups in incomes from agriculture as other sources of income did not show any statistically significant differences amongst the treatment and control groups. Another key result of this difference in the increase in agriculture based incomes was that on average 10 per cent more households were able to transition out of poverty and vulnerability in the DMPP intervention area than in the non intervention area.

In keeping with the trend of effects on agricultural indicators in both outcome analysis and household income impact analysis, household expenditure also demonstrated a significant impact only in food expenditure. This again can be linked with the earlier increase in household incomes and existing cropping patterns. As almost all respondents grew cash crops only the increase in household incomes would result in increasing expenditures on food in the absence of any substitution from self produced food items.

Key Learnings

Unlike PPAF's other DMPP interventions, like Soon Valley, Punjab, where impact assessment has demonstrated a positive change in almost all outcome variables including cropping pattern our impact assessment of the Khipro DMPP does not demonstrate the same robust positive outcome indicators. One of the key learning's from the Khipro DMPP has been the importance of implementing soft second generation interventions along with infrastructure interventions in project areas. Second generation interventions planned by PPAF are aimed at increasing awareness among farmers in the following fields such as; watershed management, rangeland management, behavior change management, early warning systems for floods and droughts, water balance monitoring, demonstration farms for latest farming techniques and market linkages.

A closer look at the impact results of Khipro demonstrates weaknesses in exactly those indicators which require change and innovation namely; cropping pattern, market linkage, land under cultivation and water frequency. Indeed, most of the respondents reporting no change in cropping pattern gave "don't know about cropping pattern change" or "think only current pattern is suitable" as their responses. The simultaneous application of a second generation awareness intervention in Khipro would have definitely attempted to change existing perception on agricultural production and would have resulted in a more pronounced impact on the agricultural economy.