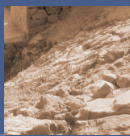


# ASSESSMENT OF OUTCOMES

## Drought Mitigation & Preparedness Program *Soon Valley Project*



PAKISTAN POVERTY ALLEVIATION FUND



## **Pakistan Poverty Alleviation Fund**

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## ACRONYMS

CBO	Community Based Organization
CO	Community Organization
CPI	Community Physical Infrastructure
DMPP	Drought Mitigation and Preparedness Program
ERD	Evaluation, Research and Development
MFIs	Microfinance Institutions
NRSP	National Rural Support Program
O&M	Operation and Maintenance
OCT	Orangi Charitable Trust
OPP	Orangi Pilot Project
PGR	Poverty Gap Ratio
PO	Partner Organization
PPAF	Pakistan Poverty Alleviation Fund
RCC	Roller Compacted Concrete
SVDP	Soon Valley Development Program
UC	Union Council
USDA	United States Department of Agriculture
WMC	Water Management Centre



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# FOREWORD

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The water and infrastructure interventions of PPAF are an integral part of its mandate for poverty reduction and improved 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.

During 2005-08, two large capital intensive DMPP projects in a rain dependent, dry agro-ecological zone in the province of Punjab (Soon Valley) were implemented, entailing 268 sub projects. This study specifically attempts to gauge outcomes and impact of pipe irrigation systems (the largest component in these projects).

Initiated inhouse by Evaluation, Research and Development unit the study was designed and conducted by Muhammad Masood Khalid and under subsequently supervision of by Tanvir Hussain. Households were enumerated by students of International Islamic University. The study was also externally reviewed by Rana Muhammad Sarwar and editorial assistance was provided by Anita Usama Bakhtiar (CSO Office). Soon Valley Development Program, a partner organization of PPAF, generously facilitated the exercise.

**Kamal Hyat**  
Chief Executive/Managing Director

# EXECUTIVE SUMMARY

The problem of water scarcity for irrigation purposes results in the obvious need to use available resources in an optimal manner. Among the range of available agricultural irrigation systems, pipe irrigation is an innovation that is efficient as it saves valuable time and cost effective, being free of conveyance costs. Incremental water is expected to bring more land under cultivation, change cropping patterns, increase production of food (especially vegetables), raise yields, create employment opportunities and ultimately result in higher earnings. Higher income in turn, leads to better living standards in the form of increased consumption of food, increase in the farm and household assets and higher spending on health and education.

PPAF's Water Management Center has organized a set of integrated water related interventions into a package called Drought Mitigation and Preparedness Program (DMPP). Interventions include pipe irrigation schemes, delay action and check dams, orchard plantation, water harvesting ponds and drinking water schemes. Soon Valley located in the Potohar Plateau of Punjab is largely dependent on rain fed agriculture. The PPAF implemented two DMPPs in the Valley to counter the falling water table and its adverse effects on local livelihoods. The first DMPP was implemented between June 2004 and June 2008 and the second DMPP was implemented between June 2005 and June 2008. The projects were implemented through Soon Valley Development Program (SVDP), a partner of PPAF. Out of the total cost of Rs 70.8 million for DMPP I and DMPP II in the area, Rs 50.9 million was contributed by PPAF.

To measure outcomes, PPAF conducted a baseline survey in six villages in the program area in 2006. A follow up panel survey of the same households was conducted in 2008 to measure changes at the household level in water availability, cultivated land, land use, productivity, income, expenditure, assets, and demographic characteristics. This report presents the findings and conclusions of the surveys in terms of effectiveness of these programs in generating the desired benefits and results.

The implementation of a pipe irrigation system took place alongside other PPAF interventions such as construction of check and delay action dams, contour walls, water harvesting ponds, drinking water supply scheme and plantation of orchards. Also, project areas received more than average rainfall during the study period. Thus in the interest of prudence, changes in the 'before' and 'after' status need to be interpreted with caution so as to not over ascribe or over attribute benefits that may or may not be on account of other externalities.

Major conclusions on benefits emerging from the study are summarized as follows:

- Significant increase in land under cultivation was noted due to incremental availability of water.
- Yield per acre of land also recorded a significant increase. Cropping intensity and diversity increased and cropping patterns changed in favour of crops requiring more water, especially vegetables.
- Dramatic increase in the value of agricultural land and lease rentals was

observed.

- Agricultural income increased as a result of the above factors and favourable market prices.
- Beneficiary households experienced a practical elimination of water conveyance losses, and substantially high time, labour, and cost savings.
- In terms of gender, the provision of pipe irrigation has eliminated the need for women to perform the menial task of water channel cleaning. Female literacy and health indicators in households have also indicated an improvement.
- Quality of life indicators such as infant mortality, health hygiene & sanitation status and household literacy have recorded substantial improvement.
- The decrease in the usage of petrol, oil and lubricants (which are fossil fuel based) in large quantities has resulted in decreased levels of carbon emissions and reduced dependence on firewood.
- Social mobility and community cooperation played an important role in the purchase of agriculture inputs and marketing of agriculture produce to international corporates at competitively negotiated rates/prices
- An increased demand for financial services (such as microcredit) was also observed.
- Quality of data on household expenditure was variable. Therefore, quantitative estimates of changes in poverty levels could not be estimated with reasonable robustness. However, expenditure on food seems to have decreased (from 70% to 50% of total monthly expenditure) after the implementation of the programs.
- Beneficiaries were of the view that the two Programs had helped them significantly with their livelihoods. It is expected that the increased availability of food (especially vegetables) and higher incomes have had a sizeable effect in reducing poverty in the area.
- Beneficiaries listed significant benefits of the programs to communities in terms of infrastructure development, access to technology, conflict resolution, and personal empowerment.

# INTRODUCTION

## 1.1 Background

Poverty in Pakistan has been a major challenge during the last three decades. Despite the fact that the agricultural sector demonstrated higher growth rates during the 1960s, poverty level remained higher (about 40 percent) in general. The poverty level gradually started declining after 1970 and the trend continued until 1987-1988 when once again it went into reversal. By the year 2001-2002, poverty level rose to 36 percent. The main reason behind the increase this time was reckoned to be the government's structural adjustment program. However, poverty level is reported to have decreased to 24 percent in more recent years.

With a view to enhance the access of the low-income communities to socio-economic services, the Government of Pakistan set up an independent and professionally managed unit called Pakistan Poverty Alleviation Fund (PPAF) in February 1997. PPAF's objective is to reach poor communities through a partnership with NGOs and Community Based Organizations (CBOs). The PPAF also focuses on institutional and capacity building measures to enhance the outreach of existing NGOs and social organizations.

The PPAF entered into a partnership with the Soon Valley Development Program (SVDP) to help the poor and disadvantaged rural communities. It was envisaged that the benefits of PPAF interventions will accrue directly to poor through: (a) income generation opportunities; (b) improved community physical infrastructure in the underserved areas; and (c) greater economic integration of women.

## 1.2 Baseline of Soon Valley

As part of its overall operations, the PPAF was required to develop a benchmark for its intervention areas, the outreach of Partner Organization and an impact assessment baseline for community infrastructure and capacity building activities. PPAF's Evaluation, Research and Development Unit (ERD) in collaboration with Social Mobilization Unit of SVDP conducted a baseline for the program in September 2006. This baseline was specially conducted to assess the social and economic impact of proposed pipe irrigation systems on the life of rural communities in the valley. ERD Unit also conducted an impact assessment survey of the same sample villages in six UCs of the valley in December 2008





to access the impact of pipe irrigation systems on the resident's quality of life. Details of the Project area and the programs are given below.

### 1.3 Program Partners

As part of the partnership, the SVDP executed two pilot programs named DMPP-1 and DMPP-II in six union councils in the Khushab district. The PPAF provided financial and technical assistance under the USDA funding while WWF-Pakistan under the poverty alleviation and environmental nexus provided technical assistance to SVDP for the protection of 3 Ramsar Wetlands in the valley. The Water Management Center (WMC) of PPAF was the overall financial and technical manager for the organization's interventions in the valley. The WMC strives to achieve its program goal 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, c) development and implementation of early warning systems, and d) natural resource conservation.

### 1.4 Project Area

The Soon Valley is situated at the Western end of the mountainous Salt Range where the average elevation is about 2,297 feet (ranging from the highest 5,197 feet at Mount Sakesar and lowest 1,283 feet at Jaba). The Soon Valley comprises of three sub-valleys named Saik, Jhallar and Kalhati gardens. The total area of the valley is about 737 square kilometres (182,173 acres), of which 75% is mountainous and 25% is plain. The lakes and water ponds cover over 880 acres of land. Of the total area only 22% is cultivated, 38% comprises of forests while the remaining 40% is uncultivated/rangeland.

The PPAF initiated different interventions (DMPP and CPI) in all 6 union councils of Soon Valley. The major and short term result oriented sub-projects under these interventions



are pipe irrigation systems. The current population of the area is around 110,000 and resides in 32 villages and 69 small settlements. Naushera is the political and business centre of the valley. The main villages and UC centres are connected through a 250 km black top road network. The drought spells of 1997-2002 adversely affected the economic and social fabric of the Valley, since its' economy is heavily dependent on agriculture.

Rainfall is the only source creating runoff and recharge of the ground aquifer. The water table depth ranges from 20 to 70 meters from the centre of the valley to the piedmont. The drought dried up the ground aquifer: the major source of irrigation is ground water being extracted through tube-wells. The effect of the drought disturbed the water balance in the entire valley and most tube-wells dried up.



## 1.5 Soon Valley Development Program

### 1.5.1 The Organization

The Soon Valley Development Program (SVDP) is a citizen's experience of involving people in planning and implementing indigenous knowledge. The objective is to fight poverty through taking local initiatives in community development, creating income-generating opportunities and develop community-level physical infrastructure programs. The SVDP has decided to combine development of physical infrastructure and micro-credit to alleviate poverty from the Valley. The SVDP campaigns for sustainable use of natural resources mostly focused on progressive farmers, activists and local opinion leaders. One major lesson that the organization learnt

from this experience is that collective, cohesive and collaborative action is imperative for any social change and this led the initiative to organize small farmers, developing a local model based on farmers cooperative.

For over twelve years, the organization has been involved in capacity building of small farmers groups through an awareness campaign targeted at depleting natural resources and conservation of groundwater resources (GEF/GSP 1997-98) to mobilize local



communities on the issues of environment and participatory management of groundwater resources as well as biodiversity and protection of forests (WWF 1998). The SVDP also organized CBOs, developed a network and facilitated their training in development planning & management (SPO-2000). This development activism at grassroots level has enabled SVDP to earn the Ashoka Global Fellowship in 2002 and a partnership with PPAF.

### 1.5.2 SVDP Programs

SVDP is presently focusing on four major programs i.e. micro-credit schemes for income generation, formation and patronization of farmers' cooperatives and the implementation of pipe irrigation schemes and sustainable underground water management.

*Micro-Credit Program:* SVDP initiated its credit program in 1996 with a credit line from Orangi Charitable Trust (OCT) of OPP. Later on, SVDP also signed a partnership for

micro-credit with PPAF in 2005. SVDP's credit policy under this agreement revolves around two basic principles i.e. the loan is meant solely for enhancement of existing small businesses and credit is provided without collateral. Secondly, saving is not compulsory.



Small business loans are paid back in monthly instalments while the agriculture loans are scheduled with the crops harvest.

The present micro-credit program is small but effective and streamlined. The average loan size for small business and agriculture loans is Rs.15400, while the total amount disbursed is around Rs.65 million for 4220 units. About 80 percent of the total loan has been provided to the existing small business entities, while the remaining is seasonal agricultural credit.

*Farmers' Cooperatives:* The proposed farmer's cooperative model is indigenous and developed through learning by doing. The principles, objectives and operational methodology emerged and were developed in the process of formation and consolidation of the first five cooperatives in late 2002. Within 18 months, the SVDP managed to establish 46 cooperatives under an elected body called the Cooperative Network. The

Farmers Cooperatives work for collective action on various projects like on-farm water management practices, soil and water testing for appropriate inputs, acquisition of quality inputs like seeds and fertilizers etc, marketing of agricultural produce and developing synergies for holistic impact on the local residents. The SVDP's partnership with the PPAF made it possible to organize Farmers Cooperatives through on-farm water management program.

*Pipe Irrigation Schemes (Sustainable Groundwater Management Program):* Soon Valley lies in the Salt Range Ecosystem: the land is semi-hilly where the average temperature remains moderate. The land holding is small and due to semi-hilly terrain the average size of farms is also small. Lower parts of the farms are irrigated by wells/tube wells while upper remain rain fed. Over the past one decade, the introduction of off-season cash crops and the need for more water introduced a new irrigation technology i.e. turbine system, with a capacity to pump out water at a higher level. Consequently, over 3000 wells have been replaced by private turbines.

*Turbines:* The use of traditional kacha watercourses, over exploitation of groundwater and prolonged drought has resulted in depletion of groundwater and drying up of irrigation wells.

To combat water shortage and facilitate an economic utilization of available groundwater resources, the farmers' cooperatives identified the introduction of pipe irrigation system as their first development priority. Therefore, SVDP introduced a pipe irrigation system in the Valley sponsored by PPAF with a grant of Rs. 9.86 million. The construction of pipe irrigation systems was carried out in mid – 2003 and by the end of 2008, SVDP had completed construction of 152 pipe irrigation schemes in 30 villages. The objectives of pipe irrigation project were to:

- a) Control huge water losses via conveying water to the farms
- b) Save energy cost for water harvesting through traditional water channels
- c) Increase area under cultivation by pumping water on higher levels
- d) Increase agriculture production by providing proper irrigation facilities
- e) Saving farmers' time spent on irrigation through traditional practices
- f) Ensure quality and quantity of water required for different crops, and
- g) Reduce carbon busting in the valley.

The PPAF model interventions in Soon Valley consisted of i) pipe irrigation schemes, ii) construction of water ponds iii) drinking water supply schemes iv) natural resource management, v) construction of delay action/check dams, vi) diffusion of technological innovations/ drip and sprinkler systems, vii) optimization of cropping patterns and development and viii) implementation of awareness and behaviour change campaigns. Table 1.1 below is a summary of sub-projects implemented during 2003-08.



**Table 1.2 Number of Sub-Projects Implemented in Soon Valley**

Interventions	Pre-DMPP	DMPP-1	DMPP-2	Total
Pipe Irrigation Schemes	34	56	62	152
Water Ponds	1	14	45	60
Drinking Water Schemes		10	0	10
Delay Action Dams		5	0	5
Check Dams	15	21	21	57
Natural Resource management		0	10	10
Contour Walls (in rft)			11,000	
Plantation/seeding-local species		15,000	6,000	21,000

Implementation of a majority of these interventions has been completed by the end of the year 2008 while the remaining will continue till mid-2009. The SVDP during 2003-08 completed 152 pipe irrigation schemes in 30 villages in the entire valley. This report is the impact assessment of the entire Drought Mitigation and Preparedness Program that also includes the construction of pipe irrigation schemes as a major component of livelihoods of rural population in Soon Valley.

## 1.6 Population and Demography

The settlement pattern is based on population concentration in big villages. The administrative village size ranges from 500 to over 1200 households; this includes small settlements within the village's revenue boundary. The household size, however, is normal at 7 persons.

*Living Environment:* The valley's total population is essentially rural and lives in an environment where 39 percent of the houses are Pacca (i.e. made of stone, bricks and cement) while 41 percent can be graded as semi-Pacca (half cemented) and the remaining 20 percent are Kacha (made of stone and mud plastered). A majority of residents own the houses in which they reside. Most of the villages are electrified and about 92 percent of them are connected. Safe drinking water has been a problem for a majority of households in the past. The water table's depth does not allow easy access to its source and therefore some households used to collect water from sources outside the village. About 28 percent of the households were connected with piped water supply schemes and 38 percent depended on hand pumps and tube wells. Over 65 percent of streets in the villages are still Kacha (un-paved) and also serve as natural drains for flood waters. The public sector development programs provided street pavement and wastewater disposal coverage to 35 percent of the population over the last 20 years.

*Communication:* Access and mobility to the outside village environment was better than

for the internal environment where all villages were linked through black top roads. Public transport for both local and inter-district travelling and movement of goods was available to 80 percent of the rural population.

*Literacy:* Availability of educational facilities over time made it possible to elevate the overall literacy level to 64 percent. Presently each village has about 4 primary schools for boys and girls. The access to public sector secondary school facilities for local residents are both affordable and within reach.

*Health:* The public health infrastructure is highly insufficient and provides a very low level of services and limited to Basic Health Units in 50 percent of villages. Only half of BHUs are functional, with a qualified doctor providing health care services for 4-5 hours a day. Additionally, dispensers and quack level services are available in the private sector. Over 50 percent of the villages are still without any Lady Health Workers.

*Land Distribution:* The Valley falls in rain-fed zone as the entire agriculture system depends on ground water mining. Land holdings are small and the maximum farm size is less than 12.5 acres. About 65 percent of farms are less than or equal to 2.5 acres of land, another 25 percent between 2.5-5 acres and the size of remaining 10 percent farms is 5-12.5 acres.

*Land Tenure System:* Majority farms are managed through sharecropping system, whereby the owners provide land and tube-wells while skilled labour manages the crops. Of the total farms, 18 percent are owner-operated, 6 percent tenant-operated and the remaining 76 percent are operated through sharecropping.

*Major Crops:* Over the last one decade the small landholding size, tube-well based irrigation and favourable ecosystem indebted the farming communities to cultivate high yield/high input cash crops. Current major crops in the valley are wheat, cauliflower, chillies, potatoes and other vegetables. The average per acre yield for these crops is 2200 kg for wheat, 5600 kg for Cauliflower, 3000 kg for chillies and 8000 kg for potatoes.

*Livestock:* Livestock rearing is only a medium level economic activity in the valley. An average household keeps about three (3) animals (buffalos, cows, sheep) for milk production and 50 percent of the households keep donkeys to support fodder collection for livestock. The village women are primarily responsible for livestock care.

*Income Levels:* The average daily wage rate for unskilled labour was Rs.150/- in 2006 and now increased to Rs.200-250. Average household monthly income in the valley in 2006 was around Rs.12,000/-, while the sample estimates calculated per capita income to be at Rs.1662/- per month. The active labour force constitutes about 60 percent of the population.

## 2. ETHODOLOGY

The present report is based on data collected at the baseline for pipe irrigation systems in September 2006 and impact assessment in October 2008. The following pages briefly highlight the data collection process at both baseline and impact assessment stages. Survey-related important issues include sample design, development of survey instruments, and training of enumerators pre-testing of questionnaires, data collection, and processing and data analysis.

### 2.1 Sample Design

The PPAF baseline survey was carried out in Soon Valley during September 2006. SVDP at that time initiated PPAF funded programs in 22 of 32 villages in the entire valley. For the purpose of baseline survey, ERD Unit randomly selected six villages and 30 households from each village with a total of 180 households. Finally, 175 households were included in the report and 5 questionnaires were excluded due to incomplete reporting. The sampling process initially started with marking of all the houses in these six villages.

	Village	UC	No of Households	
			Baseline 2006	Impact Survey 2008
1	Jaba	Khabeki	30	15
2	Khura	Uchhali	30	20
3	Kufri	Kufri	30	25
4	Kurradhi	Kurradhi	30	15
5	Sabhral	Sabhral	30	15
6	Uchhali	Uchhali	30	30
			<b>175</b>	<b>120</b>

This was a difficult task and was only possible with the help of both local people and the respective social mobilizers of the SVDP. Thirty households from each village were selected at random.

The Impact survey 2008 was conducted from the same villages, households and respondents. The impact survey's size reduced due to migration of marked families to other places, split of families and non-availability of baseline respondent during impact assessment survey.

### 2.2 Data Collection Instruments

Keeping in view the survey objectives, a common household questionnaire earlier designed and tested for all PPAF infrastructure projects was used as a standard baseline

instrument. Household asset distribution, income, consumption, employment, education and health structure and housing conditions are major parts of this instrument. Another research instrument to collect village level information was also used. The objective of using this instrument 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. Baseline survey and impact assessment surveys for Soon Valley were carried out randomly and included poor, middle income and well-to-do households.

### **2.3 Training, Pre-Testing and Data Collection**

The ERD Unit:

- a) Hired a team of required number of data collectors and supervisors and provided them with a two days training (first day in the class room and second to test the questionnaire as well as the capability of data collectors);
- b) The baseline team comprised of 10 enumerators and two supervisors;
- c) Supervisors were appointed for quality control, scheduling the data collection and conducting interviews of key informants and collecting primary data from different sources;
- d) The number of survey teams varied depending upon the sample size, location and logistical arrangements;
- e) Keeping in view the need for maintaining data quality, data collectors were hired to work for 15 days;
- f) The entire data collection, quality control and data feeding process were directly supervised by ERD professionals;
- g) The filled questionnaires are edited daily by respective supervisors during fieldwork.

### **2.4 Sample Size for Baseline and Impact Survey**

The sample size as well as respondents (120 households from 6 selected villages) was the same for both 2006 and 2008 surveys.

### **2.5 Data Feeding, Analysis and Reporting**

Data entry, cleaning and analysis and reporting were entirely done by ERD Unit at PPAF. The survey instruments used to conduct 2006 baseline and 2008 impact assessment



may not qualify as completely accurate scientific statistical tools for calculating poverty estimates. They may, however, serve as useful guide and as a benchmark for poverty monitoring. Secondly, the surveys represent socio-economic conditions and current ground realities impacted by the surge of food, fuel prices and agriculture performance of rural Khushab District.

The variables studied for income, consumption, asset building, agriculture production and demographics are almost identical in both surveys.

## 3. DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

### 3.1 Demographic Profile

This section reflects general information of sample households in Soon Valley regarding the dependency ratio, gender distribution, residential status, employment situation and level of education etc. The sample size comprises of 120 households from 6 villages with over a population of over 900. The average household is calculated at around 7.5 persons, which is higher than respective 1998 census figures 6.2 persons for the district and 6.6 for the province. The sample comprises around 52% males and 48% females and the sex ratio (female: male) turns out to be around 90/100. As shown in Table 3.1 population increased by 5.3% during the 2006-2008 which is near to the average annual growth rate of 2.05% for the district.

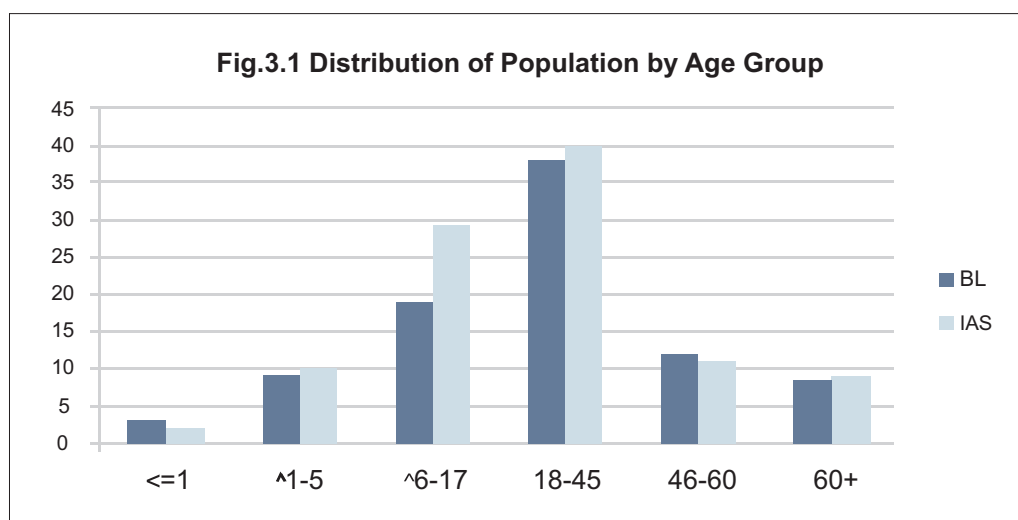
Table - 3.1 Demographic Composition					
		2006		2008	
		No	%	No	%
Households	Number	120	100	120	100
	Population	870	-	908	-
	Size	7.2	-	7.5	-
Population	Male	481	55.3	476	52.5
	Female	389	44.7	431	47.5
Literacy (10+ Years)	Overall	481	55	616	68
	Male	341	71	386	8
	Female	139	29	230	37
Dependency Ratio			49.80		48.50

Source: PPAF-ERD Data for Baseline 2006 and Impact Assessment 2008.

The current literates (10+ Years) comprising of 68% showing a positive trend towards education in recent years. Literacy ratio was 55% in 2006 showing a trend that a majority of the younger generation entered into the 10+ years bracket is literate. Literacy ratio (10+) for the district in 1998 was 40.5%.

### 3.2 Age Structure and Work Status

Infant and juvenile (<=17 years) population is about 32% of the total population, while the younger age group (18-45 years) is 40% of the total population. The middle age group (45-60 Years) shares 11% of the population: the two groups combined constitute the entire work force of the valley at 51%. This information provided in Figure 3.1 is for both the baseline and impact assessment survey. The table below shows a slight decrease in the age group <=1 and 45-60 years during last two years. The highest (16%) increase is visible in the age group of 6-17 years.



Secondly, the female population increased by 12% as compared to a 0.5% decrease in the male population. This may be attributed to better health facilities and particularly the country-wide program of immunity against six diseases, now available to the female population. Thirdly, over 50 percent of total females were in the reproduction age (18-50 years). Many Pakistani women get married at quite a young age (15-19 years) and start bearing children soon after. Maternal health is therefore a significant component of overall women's health in the reproduction age groups.

### 3.3 Literacy and Educational Attainment

In Pakistan, the literacy rate has continuously been very low, but this situation has changed considerably today. According to the 1998 census, 45 percent of our adult population (10 years and above) was literate. The literacy rate in Soon valley, however, is higher than the district average as well as the national average. The overall literacy is 67%: which is 69% for males and 34% for females.

Data on the level of educational attainment of population aged 5 years and above indicates two important aspects of education in the valley:

- a) More than one-fourth of the total literate sample passed only primary education (this also includes up to seven years schooling), while another 27% of the literates are under Matric (8-9 years of schooling). However, a substantial proportion of literates (40%) passed matriculation and intermediate level of education.
- b) The rate of primary level education was higher for females as compared to

males, while in higher education the share of females was lower than their male counterparts. Overall level of educational attainment of population living in the valley was higher than the corresponding level nationwide.

### 3.4 Dependency Ratio and Work/Employment Status

Population in the age groups below 17 years and above 65 years is 49% of the total population as per fig.3.2. This shows that half of the population is dependent on the remaining 50% working population: the dependency ratio slightly decreased by 1.3% during the last two years. Table 3.2 shows that overall dependency decreased from 49.8% to 48.5% in the entire valley with a wide variation in selected villages, i.e. lowest 44.7% in Jaba to highest 53.4% in Kuradi. In fact, the dependency ratio for Uchali increased from 45.3% at baseline to 48.6% at impact assessment stage.

Table 3.2 Dependency Ratio by Village and Project Intervention Period				
	2006		2008	
	Workforce	Dependency Ratio	Workforce	Dependency Ratio
Kuradi	45.6	54.4	46.6	53.4
Kufri	51.3	48.7	51.9	48.7
Sabhral	45.4	54.6	52.7	47.3
Jaba	52.5	47.5	55.3	44.7
Khura	46.9	53.1	50.4	49.6
Uchali	54.7	45.3	51.4	48.6
Overall	50.2	49.8	51.5	48.5

Communities that have a high dependency ratio have different economic considerations as compared to communities with a smaller proportion of non-working individuals. Dependents place a heavy demand on health and education that must be maintained and funded by the working age population. The dependency ratio for the Soon Valley is estimated at 49: out of the total population of 908 individuals, 441 are supposed to be dependants. The higher dependency ratio can largely be attributed to high fertility.

Out of the total population, the ratio of non-working persons decreased from 48% at the baseline to 43% at the impact survey which means that project activities generated at least 5% jobs for on farm and off farm activities. The ratio of working population increased from 52% at the baseline to 57% at impact survey. Almost all women reported involved contributing in household activities. As more women entered into the work age group, the ratio of household workers increased from 45% to 48% during the last two years.



**Table 3.3 Employment Status**

	Baseline	Impact Survey
Household Work	45%	48%
On-farm work	25%	24%
Farm Labour	1%	2%
Off Farm	2%	3%
Services/Jobs	17%	15%
Business	7%	7%
Others	2%	1%

### 3.5 Household Infrastructure

The surveys also collected data on household infrastructure. According to available information, 66 percent of houses were constructed with stone, bricks etc, with RCC roofs (steel and cement used). These houses were regarded as 'Pakka'. On the other hand, about 12 percent of constructions were 'Kacha' and were erected with stone, bricks and mud and sheltered with low quality wood frames used in roofs. The remaining 22 percent houses were of mixed quality 'Half Pakka'.

There are on average 3-4 rooms in a house. It should however be kept in view that such rooms in the rural areas are multipurpose; i.e. used simultaneously for boarding, dinning, drawing and even as animal shelter.

The availability of household facilities i.e., drinking water, latrine, wastewater disposal, fuel and electricity etc. are reported in Table 3.5 below. According to this information, a majority of the households (96%) are connected with electricity (92 percent). Around 83% households reported having an in-house latrine facility, whereas the remaining using open fields for defecation.

Around 79% of the population has access to in-house piped water systems through motor pumps, hand-pumps, tube wells and public sector water supply schemes. Another 9% of the households collect drinking water from different sources available within the village. There is still a sizable population (12%) collecting water from outside sources depending upon distance of the source.

Table 3.4 Household Infra-Structure (Facilities)		
Facility	Source	Percentage
Housing	Pucca	66%
	Pucca –Katcha	22%
	Kacha	12%
Drinking Water	Average No. of rooms /HH	3-4
	In-house Piped	79%
	Other	21%
Latrine	In-house-	83%
	Open Fields	17%
Electricity	Connected	96%
Sanitation	Drainage System	75%
Fuel	Fire Wood	85%
	Gas (cylinder)	5%
	Cow-dung etc	10%

Source: Soon Valley Impact Assessment Survey, 2008

### 3.6 Local Perceptions on Development Issues

Members of the local community organization were asked to respond to a set of 9 different issues that local communities currently face both at the baseline and impact survey levels. The responses were assessed in terms of no benefit, slight benefit, significant benefit and very significant benefits. To analyze the responses, they were placed into two further categories a) no/slight benefits as no change, b) significant and very significant as change in perception. CO members' perceptions at the baseline and impact stages are shown in the table below.

PPAF interventions with local community infrastructure development at the doorstep, lost community interaction with other public sector institutions and their credit requirements remained the same with a slight or medium level improvement in social cohesion, access to technology, skills and personal development and access to markets. The only major visible change as perceived by CO members is in the area of infrastructure development.

Table 3.5: Perceptions of CO Members on Development Issues				
Sr.	Issues	Baseline	Impact	Remarks
1	Credit Benefits	37%	37%	No Change , high demand for credit facility
2	Infrastructure Development	32%	72%	Major visible change
3	Social Cohesion	45%	55%	Low level change
4	Access to Technology	18%	33%	Medium role in provision access to technology to the COs
5	Conflict Resolution	28%	50%	CO played significant role in conflict resolution

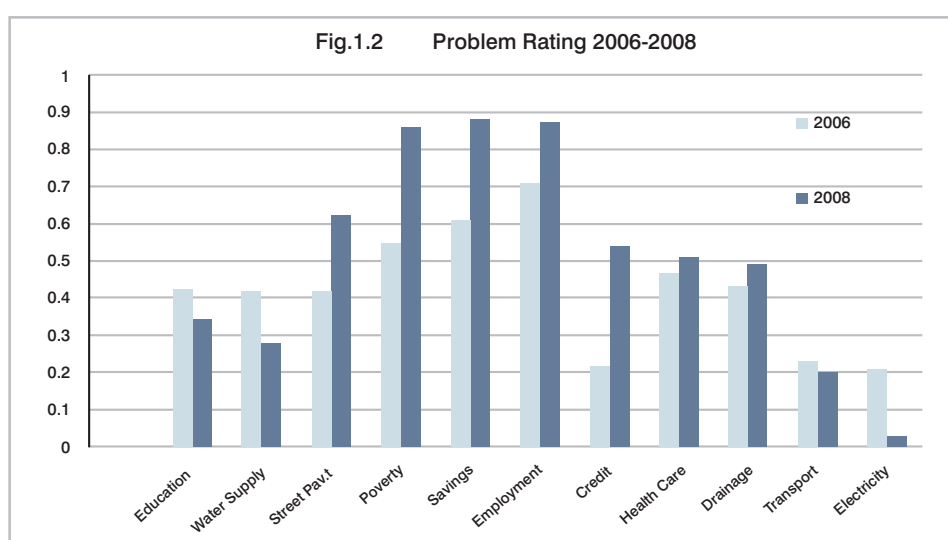
6	Skills	31%	48%	Moderate role in skill development
7	Personal empowerment	24%	51%	Moderate role in personal de+
8	Access to public Services	28%	22%	Negative impact because higher level interventions by the NGO-
9	Access to market	12%	25%	Low /Medium level change +

### 3.6 Major Socio-economic Aspects

Besides household level surveys an attempt has been made to identify major issues or needs for a set of 10 indicators and assess whether the extent of these problems decreased or increased during the PPAF intervention period. These indicators and their responses are ranked in terms of the severity of these problems during the last two years.

It is evident from Fig. 3.2 below that problem ranking during the last two years has changed significantly.

- The three highest priority needs identified at the baseline were- Employment (1) Proper Savings mechanism (2) and poverty (3) in the year 2006 remaining the highest priority in 2008 and interchanged priority within the group;
- Project interventions significantly improved local level employment opportunities, while the impact on demand for more employment opportunities shifted employment from rank -1 to rank -2 in 2008;
- Figure 3.2 shows that access to education, quantity and quality of drinking water supplies, transport and availability of electricity improved;
- There seems to be some deterioration in availability and coverage of infrastructure facilities –drainage and street pavement. That demands to fill the 25% coverage gap;



## 4. DIRECT OUTCOMES

Impact of PPAF facilitation for the construction of pipe irrigation systems is the beginning of an agrarian revolution, at least in the Soon valley. A single intervention changed the whole agriculture scenario- increase in area under cultivation, land reclamation, enhanced per acre yield and income, substantial reduction in irrigation time, significant change in cropping pattern and value of land.

### 4.1 Impact on Agriculture

*Land Reclamation:* The average household in 2006 was cultivating around 3.5 acres of land through conventional methods of irrigation. The introduction of pipe irrigation system utilizing the same water sources increased the system efficiency and allowed farmers to reclaim and irrigate more land. Table 4.1 shows that around 38% additional land was reclaimed and used for cultivation during 2006-2008. A total 3,000 acres of arid land was brought under irrigation in the program area. On average, each village reclaimed 21-35 acres of un-irrigated land.

Village	2006 (Acres)	2008 (Acres)	% Increase in Land under cultivation
Jaba	3.7	5.5	49%
Khura	3.7	4.7	27%
Kufri	3.8	5.0	31%
Kuradhi	4.3	5.7	34%
Sabhral	3.6	5.5	54%
Uchali	3.0	4.2	39%
Average	3.6	5.0	39%

The reclaimed land generated an additional income of Rs. 369.1 million to total income and around Rs.189.7 million net income to farming communities in Soon Valley. The total income generated by reclaiming 3,000 acres of arid land under pipe irrigation system is estimated at Rs. 166 million.

*Increase in Per Acre Yield:* Water conveyance efficiency and sufficient availability of water for irrigation increased per acre yield by 130% (870 kg to 1450 kg). Increases in yield vary from lowest 110% to 150% depending upon the crop, as well as inputs used and fertility of land (Table 4.1.2).

*Increase in Value of Agriculture Products:* Increased yield of agriculture products is associated with the increase in prices of food products during 2006-08, bringing about multiple effects in crop value. The impact assessment survey calculated that the farm level value of the agriculture products brought about 175% increases over the 2006 value of farm products (Table 4.1.2).

**Table 4.2 increasing yield and Value of agriculture Products**

Village	Total Yield (Kg)		%	Value (Rs)		%
	2006	2008		2006	2008	
Jaba	24800	57040	130%	257000	904800	250%
Khura	73560	157360	114%	735600	1785200	145%
Kufri	100470	255480	154%	1000100	3284800	228%
Kurradhi	51320	112180	119%	513200	1346200	160%
Sabhral	36200	84820	134%	373000	1052000	180%
Uchali	92480	205540	122%	859800	2146900	150%
	378830	872420	130%	3738700	10262900	175%

*Changes in Cropping Pattern:* Ensured availability of water for irrigation of different high yield cash crops generated a trend of changed cropping pattern. Around 85% of the farmers reported a change in cropping pattern from traditional high delta crops (cauliflower) chillies, potatoes, peas etc. Prior to DMPP interventions potato was not grown in Soon valley. Through the farmers' Cooperative Network, potato cultivation was introduced. Now, two crops of potatoes are grown.

In the year 2008, potato was grown on 9,500 acres (2,500 acres in summer and 7,000 acres in winter). Total potato production was 55 million kilograms. The average per acre production reached 5,800 kg with a cost of Rs.42,600. With a per acre revenue of Rs. 84,200 the net per acre income reached Rs. 41,600.

*Reduction in Irrigation Time:* Water conveyance efficiency and human time savings in managing irrigation reduced the per acre irrigation time by 33% i.e. from 4.8 hours to 3.3 hours. The per acre irrigation time before pipe irrigation system was 6 hours and has now been reduced to 4 hours for major crops.

**Table 4.3: Reduction in Irrigation Time**

Village	Per Acre Irrigation Time	
	2006	2008
Jaba	3.5	2.5
Khura	5	3.6
Kufri	5.9	4.1
Kurradhi	3.7	2.5
Sabhral	5	3.1
Uchali	4.8	3.4
Average	4.7	3.2

*Enhanced Value of Agriculture Land:* Installation of a dependable, all season, personal, productive and efficient irrigation system instantly increased the value of agriculture land. The immediate impact is reported with a 64% increase in annual lease rate from Rs. 5,500 per acre in 2006 to Rs.9,000 per acre in 2008.

Table 4.4: Increase in Annual Lease Rate			
Village	Annual Per Acre Lease Rate (Rs.)		
	2006	2008	% increase
Jaba	4500	7500	67%
Khura	5750	8700	51%
Kufri	6000	11000	83%
Kurradhi	5000	8500	70%
Sabhral	5700	9500	66%
Uchali	5500	8500	55%
Average	5500	9000	64%

*Energy Cost Saving:* Pipe irrigation system on average reduced irrigation hours by 33 percent for all crops. Reduction in irrigation hours in turn reduced energy consumption and labour saving. An average per hour diesel consumption is 2 litres per hour, while total estimated saving of 862,000 irrigation hours resulted in a saving of Rs. 103 million for diesel oil, Rs. 6.9 million for mobile oil and Rs.27 million in labour.

*Reduction in Carbon Emissions:* The reduction in running hours of diesel engines also helped in the reduction of carbon emissions that harm the environment.

## 4.2 Construction of Delay Action and Check Dams

PPAF constructed a total of 5 delay action and 57 check dams and around 7000ft of contour walls in the hilly areas of Soon Valley. This infrastructure helped in delaying rush of water from the hills, allowing it to seep into the aquifer and taking up groundwater level in the wells.

A case study of delay Action Dam Kela shows that:

- The Dam's height is at 5 meters, its length is 3 meters and it has a catchment area of 0.35 million acres;
- The dam normally retains flood water for 56 hours after the rain;
- Water level of the tube wells in the downstream areas increased by 30 feet;



- The water table in the dug area came up from 50 feet to 15-20 feet from the ground level;
- Due to shallow water table farmers started water mining through small diesel pumps instead of using turbines;
- Contour walls, check dams and the delay action dam eliminated the flood threat to downstream settlements;
- Rain water floods that usually took 5-6 hours now completes its cycle within 42-56 hours, allowing silt to settle in the check dams, contour walls and delay action dam and reducing the speed of water flow and damage to property and degradation of land;
- It also increased vegetation coverage in the catchment and downstream areas;
- The shallow aquifer helped farming communities in saving energy costs of water mining, irrigation time and the availability of sufficient water encouraged them to reclaim 3000 acres of land under cultivation.
- The Watershed and Rangeland management initiatives under DMPP especially focused on combating deforestation: around 21000 new plant and 400 canals of seeding for local species of plants will significantly help in combating deforestation in the entire valley.

### 4.3 Rainwater Harvesting

Rainwater harvesting seems to be a small intervention but in this case it is based on a felt need and proper selection of site, bringing about a sustainable and effective impact. SVDP implemented 60 such water ponds in the entire valley and all of these ponds are constructed in community grazing areas. On average, each water pond meets the entire annual water needs for 2500 livestock. As the grazing areas are community hamlets, every household has grazing rights. Around 150 thousand livestock or 40 thousand families are the current beneficiaries of these rainwater harvesting ponds.

## 5. HOUSEHOLD INCOME AND EXPENDITURE

A previous chapter examined the employment situation, focusing on five labour market indicators: labour force participation, employment status, sectoral distribution of employed labour force, occupational status and unemployment. This section will focus on household income, sources of income and household expenditures.

### 5.1 Household Income and Sources of Income

Welfare of a society largely depends on the augmentation of its income levels. Any economic impact of infrastructure development can also be measured in monetary terms- relative income from specific improvement or development. People living in the project area earn their livelihoods from multiple sources. Table 5.1 below, presents the share of different sources of income in the total monthly income of rural economy in Soon Valley.

Income Sources	Baseline		Impact	
	Income	% Share	Income	% Share
Agriculture	4,820	48.5	7,970	50.0
Livestock	1050	10.5	925	6.0
Business	850	8.5	1,630	10.0
Services	1,850	18.5	3,275	20.5
Labour	345	3.5	920	6.0
Pensions	750	7.5	715	4.5
Rents	100	1.0	0	0.0
Remittances	195	2.0	140	1.0
Others	0	0	300	2.0
Average Monthly Income	9960	100	15,875	100.0
Per Capita Monthly Income	1328		2117	

Source: Soon Valley Baseline (2006) and Impact Assessment Survey (2008).

#### Sectoral Share in Monthly Income:

- Overall the average monthly household incomes in Soon Valley increased by 53 percent (Rs. 9,960 to Rs. 15,875) during 2006-08;
- Agriculture and livestock sectors are the major sources of livelihood (56%) in Soon Valley, where income from agriculture products contribution 50 percent while livestock contribute only 6 percent in household income. Extensive involvement in agriculture during the intervention period, reduced the share of livestock from 10.5 percent in

2006 to 6 percent in 2008;

- The share of services in total household income also increased from 18.5 percent to 20.5 percent during the same period;
- Business/self-employment also demonstrated an increase from 8.5 percent to 10 percent;
- The share of skilled and unskilled labour increased from 3.5 percent to 6 percent;
- Contribution of the services sector also increased from 18.5 percent to 20.5 percent.

*PPAF Interventions:* PPAF interventions mainly concentrated in the field of improvement in irrigation namely the installation of pipe irrigation systems, construction of small dams/check dams, introduction of low-delta crops and use of water conservation technologies. Small land holding size coupled with the introduction of new technologies, changes in cropping patterns and market linkages increased income from agriculture by 65% to Rs. 7,970. Indeed, while we must factor in inflationary trends during the period under study, we can still note that even after accounting for inflation the percentage increase in income from agriculture is likely to be positive. The use of soft interventions focusing on creating awareness about agricultural patterns and the efficient use of market linkages can also be associated with an increase in business incomes in the valley as more market oriented selling/buying practices were introduced at the impact stage.

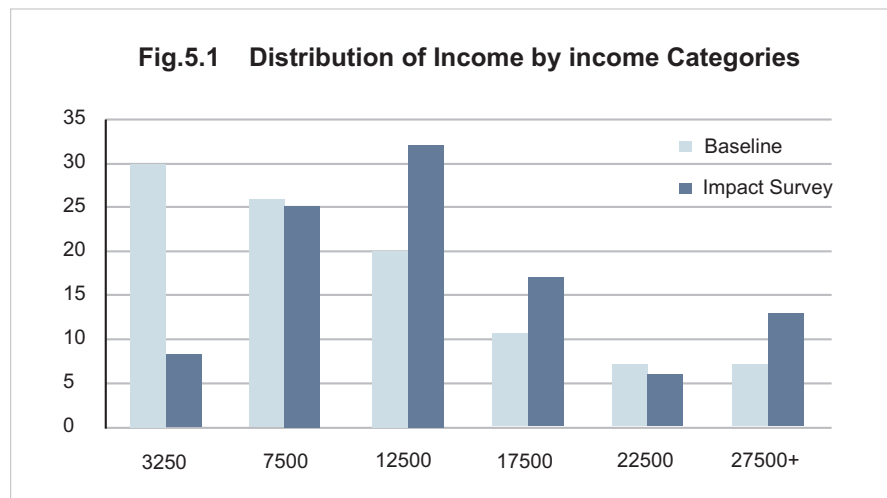
*Change in Income Groups:* Table 5.1.2 presents the percentage distribution of households by income groups. All the sample households were arranged into six groups in the ascending household income order. Lowest (first) income group shows the poorest, while the highest (sixth) income group shows the richest one.

Table 5.2 Households by Income Group Range		
(Rs. Per Month)	Percentage of Households	
	Baseline %	Impact Survey %
Less than 5,000	31	8
Between 5,001– 10,000	26	25
Between 10,001– 15,000	20	31
Between 15,001– 20,000	11	17
Between 20,001– 25,000	7	6
Greater than 25,000	5	13
Total	100	100

At the time of initiation of PPAF interventions in early 2006, about one third (31 percent) of the sample population was in the category of poorest of poor while another 26 percent were also among the poor (2nd income group). This implies that around 57% percent of sample population was in the lower income group. The average monthly income of households in these two groups was at Rs.3,250 and Rs.7,500 respectively.

PPAF interventions changed this scenario completely by 2008, reducing the overall ratio from 57% to 33% and leaving only 8% population in lowest two income groups (Rs.433 per capita per month) and pushed 23% up in the next higher income group (Rs.1000 per capita per month).

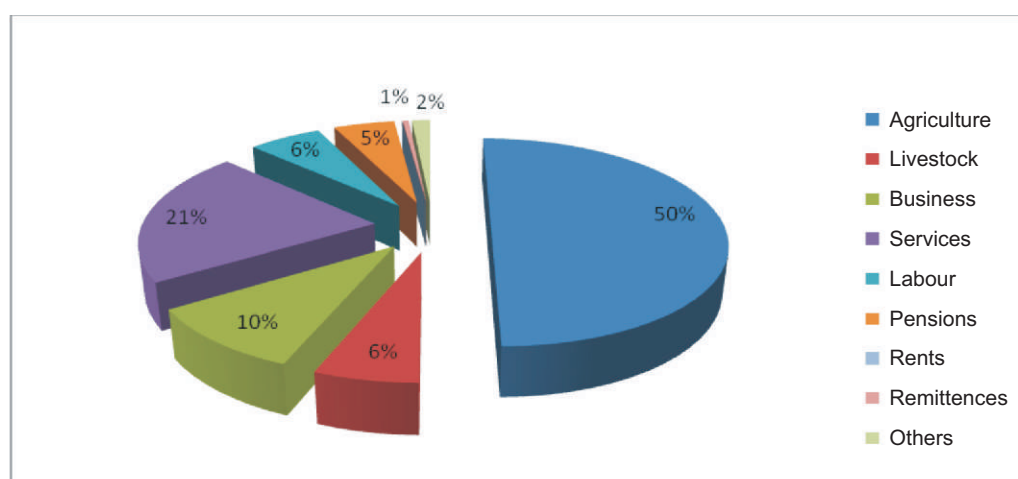
The sample population in middle income group (3rd and 4th income range) enjoyed an average of Rs.12500 and Rs.17500 per month respectively. Population in the middle income group increased from 31% to 49% during the same period. Per capita income of the middle income group calculated between Rs.1675-2350 per month.



**Source: Soon valley Baseline**

The remaining 12 percent is in higher income population (in 5th and 6th income groups) with an average monthly income of Rs.22500 and Rs.27500+ respectively. The ratio of population increased from 12% in 2006 to 19% in 2008. Besides a small decline in the fifth income group the growth in the 6th income group is substantial (5% to 13%).

**Figure 5.2 Average Household income by Share**



## 5.2 Household Expenditure Patterns

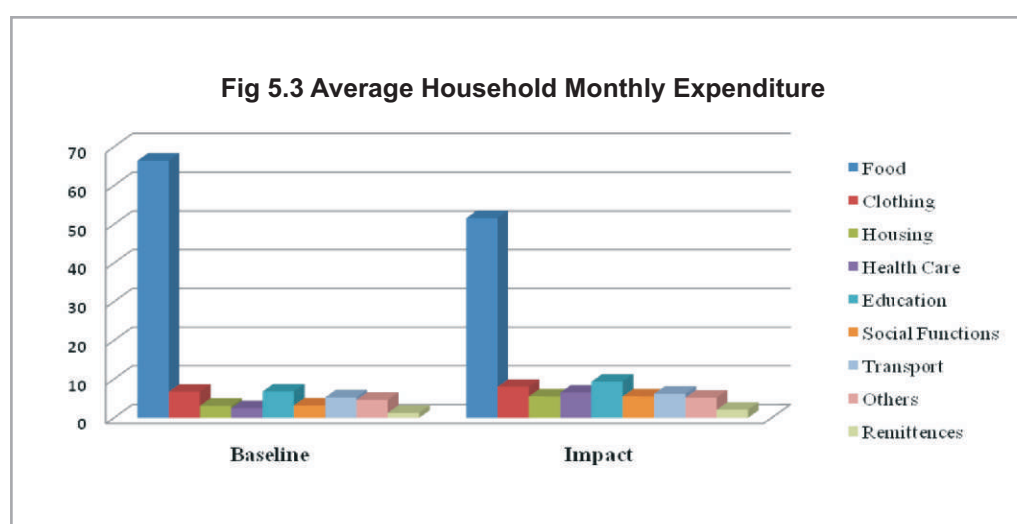
Other than income levels, household expenditure levels truly reflect residents' living standards (see Table 5.2.1). Average household expenditure decreased by almost 5% from Rs. 9,400 in 2006 to Rs. 8,950 in 2008, whereas the expenditure on food decreased by 26%. This is mainly due to improved food availability from own agriculture production in the intervention area.

Household monthly consumption expenditure on food and non-food items is presented in Table 5.2.1 and Figure 5.2.1. The major source of expenditure before and after project interventions has been on food items. Improvement in irrigation systems increased on-farm food production, resulting in a visible decrease in household level consumption expenditure on vegetables, beef /mutton, poultry, milk, sugar, fats and oils.

Expenditure on food shares constitute around half of total household monthly expenditure (66% at baseline and 51% at impact survey). The higher expense on housing (5.5%) is understood to have occurred because of increased electricity tariffs and increasing use of electric appliances (TV, refrigerators, electric iron and fans). Household expenditure on health (6.5%) and education (9.5%) increased over the

years due to the introduction of private sector health and education facilities in the area. Allocation on social functions and mobility remained almost the same. Clothing is another expensive item in household expenses, which is understandable where the household size is 7.5 with at least 3 school going children in each household.

Table 5.3 Average Household Monthly Expenditure				
Expenditure Items	Baseline	% Share	Impact	% Share
Food	6,253	66.5	4,620	51.5
Clothing	625	6.7	712	8.0
Housing ( repairs & utilities)	287	3.1	484	5.5
Health Care	231	2.5	586	6.5
Education	643	6.8	840	9.5
Social Functions	301	3.2	496	5.5
Transport	503	5.3	558	6.0
Others	434	4.6	468	5.0
Remittances	123	1.3	186	2.5
Average Monthly Expenditure	9,400		8,950	
Per Capita Expenditure	1,255		1,195	





## 6. Household Assets and Indebtedness

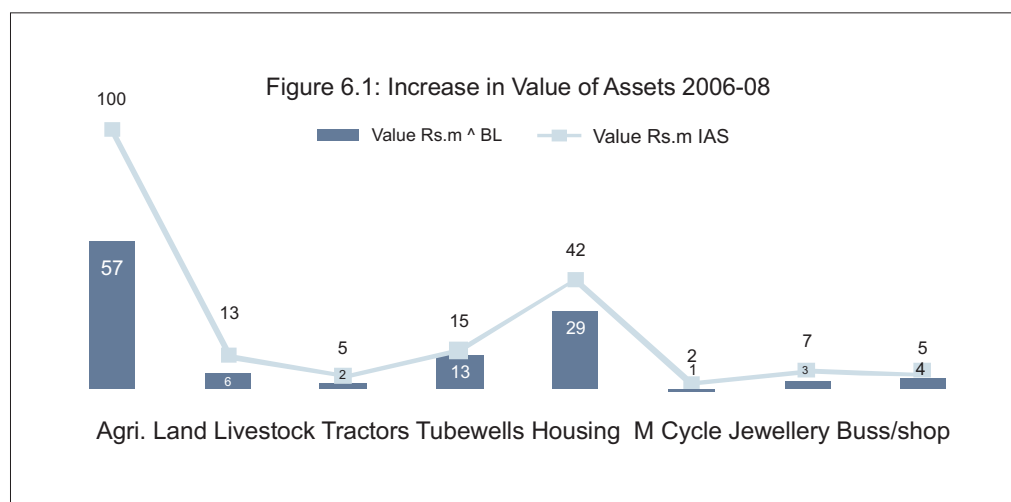
### 6.1 Ownership of Durables and Productive Assets

PPAF's interventions for irrigation and other infrastructure development had both direct and indirect impacts. Direct impacts include increases in agriculture production (food and cash crops) and household income. Indirect impacts are in fact, more sustainable and value added. The installation of pipe irrigation systems brought more land under cultivation, increased the demand for agriculture machinery (tube-wells, tractors and threshers), the possibility of growing enough fodder increased the willingness to buy and to keep more livestock (Table 6.1). Increase in income levels generated a capacity to improve living conditions by investing in housing, building household assets and savings businesses.

Table 6.1: Increase in Assets			
Assets	Number		% Increase
	2006	2008	
Agricultural Land (Acres)	291	549	88.7
Livestock	229	339	48.0
Tractors	12	17	41.7
Tube wells	74	84	13.5
Housing	116	127	9.5
Motor Cycles	28	32	14.3
Bicycles	52	55	5.8
Total	802	1203	50.0

The table above shows that during the project period, the value and number of durable and productive assets increased by 65% and 50%, respectively:

- The highest increase (78%) was reported in total value of agriculture land (Table 6.1.2). On average, each household brought 2.2 acres of uncultivated land under cultivation, helping the farmers in more agriculture production and bringing about an additional benefit of Rs. 0.4 million in value of land. The total value of land for the sample households increased from Rs.57 million to over Rs.100 million;
- Around 48% increases in the number of livestock bring about 105% increase in the total value of milk animals;
- The need to develop more uncultivated land created a demand for more tractors, causing an increase in the value of tractors by 112%;
- The number and value of household assets such as housing (45%), motor cycles (20%) jewellery (152%) and loans (133%) also increased significantly.



Assets	Value (Rs. million)		% Increase
	2006	2008	
Agri.Land	56.60	100.50	77.6
Livestock	6.20	12.80	10.6.5
Tractors	2.40	5.10	112.5
Tube wells	13.20	15.10	14.4
Housing	28.70	41.70	45.3
Motor Cycles	1.50	1.80	20.0
Jewellery	2.70	6.80	151.9
Business/shop	3.50	4.90	40.0
Total	116	191	64.7

## 6.2 Access to loan and Sources of Lending

*Sources of Lending:* Both informal and formal loan sources are available in the district. The formal sources include bank loans for agriculture, house building, consumption and purchase of agriculture machinery and small enterprises. Besides banks, micro-finance institutions such as NRSP and SVDP are also operating. The Cooperative Bank is another source of credit in the district.

Formal sources of loans 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 CO members. The interest rate of formal sources ranges

from 15% to 30% for different types and categories of repayment schedules. The informal sources of lending include private money lenders, landlords, “Arthi”s, friends and relatives. All informal sources have their own repayment modalities and may vary from each category of loan and providers.

The money lender normally gives a loan with some personal guarantee and a written agreement on stamp paper. Money lender loans are mostly termed as hard loans and the debtor exercises this option as a last resort, when any possibility of getting soft loan from formal and other informal sources fail. The “Arthi” loan seems to be a soft loan and only tied with the sale of product at his shop. The “Arthi” provide agriculture inputs at the peak/higher market rates and purchase product at routine/normal market rates. The “Arthi” 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.

Loans from friends and relatives are normally free of any interest but with a verbally agreed payment schedule. In some cases it may be tied with some personal favour, future interest or the purchase of an asset. The repayment schedule varies from 1-month to 1-year or longer, depending upon the debtor's repayment capacity.

*Access to Loans:* The household survey explores possibilities of access to loans for the target communities. Only 7.5% of the respondents reported their household to have taken a loan. Four broad types of loans were identified by the respondents i.e. agriculture, house building, social responsibility/ consumption and other.

*Amount of Loan:* The overall loan portfolio in Soon Valley is very small. Although the overall volume of loan increased by 200% from 2006 to 2008, reported average amount of loan has remained in four digits. It was only Rs. 2750 in the year 2006 and increased to Rs. 5700 in 2008.

*Payment Schedule and Conditions:* The different payment schedules reported for different categories of loans- monthly (35%) quarterly (8%) bi-annual 27% and annual 30%. There are only two conditions reported for the loans- personal guarantee (35%) and pledging of assets (65%).

## 7. Key Findings

Access to financial resources coupled with physical infrastructure and capacity building are integral to the sustainability of the community-led alternative development model. Donor attention and close supervision along with quality and intensity of interaction between the donor, PO and COs are important factors in achieving higher intensity targets and developing innovative initiatives. Effective beneficiary participation at inception, design and implementation stages is a pre-condition for need based, cost effective and sustainable project implementation. The success of pipe irrigation schemes is evidence of effective beneficiary participation at all stages of the project implementation cycle. The development orientation, motivation, and capacity building of change agents (the PO, the Task Force and village organizations) and an effective needs assessment appears to play a key role in terms of outcomes and outputs.

On average a typical pipe irrigation scheme (sub-project) for a specific CO benefit a small group (15-20) of individual farmers operating the farm through tube wells. Indeed, PPAF's experience in Soon Valley indicates that stand alone interventions for the improvement of irrigation systems (pipe irrigation) increased land use, yield per acre and changed cropping pattern. The net outcome of these interventions is an increase in employment opportunities, reduction in dependency ratio, and increase in income levels. The hybrid irrigation model (pipe irrigation) resulted in higher value addition through reduction in conveyance losses and exhibited a greater degree of positive impact, in terms of improving production and livelihoods, compared to other community based and public sector conventional models such as water course lining and *Karez* rehabilitation.

The DMPP is an innovative concept using integrated water management where each major or minor component has a role to play in maintaining the water balance in the intervention community sustaining the groundwater aquifer. A case study of one delay action dam shows around 10 meters improvement in the water level of dug wells, which has resulted in controlling flooding and land erosion while enhancing vegetation coverage.

Beneficiary participation in capital cost, implementation and operation as well as project maintenance contributed in the long term financial and operational sustainability of these sub-projects. A case study comparing 25 drinking water supply schemes constructed by the public sector and 10 drinking water supply schemes constructed through community-led demand driven approach shows that the working efficiency of these systems is 30% and 100% respectively demonstrating the greater sustainability of community-led demand driven approach.

The key findings of the impact assessment of PPAF's DMPP intervention in Soon Valley are as below:

- Average area under cultivation from the same source increased by 38 percent (3.5 acres to 5 acres) within two years. A total 3000 acres of arid land is brought under irrigation in the SVDP operation areas.
- 33% increase water conveyance efficiency and human time saving. The per acre irrigation time was reduced from 6 hours to 4 hours for major crops.
- 64% increase in the annual lease rate of irrigated land was estimated.
- The pipe irrigation system on average reduced irrigation hours by 33 percent for all crops. The reduction in irrigation hours in turn reduced energy consumption and labour use.
- PPAF constructed a total of 5 delay action and 57 check dams and around 7000ft of contour walls. The infrastructure helped in delaying the rush of water from the hills, allowing water to seep into the aquifer and taking up the groundwater level in the wells. The construction of Delay Action Dams recharged the wells between 20-50 feet at different levels in the valley.
- The Watershed and Rangeland management initiatives under the DMPP specially focused on combating deforestation. Around 21000 new plant and 400 canals of seeding for local species of plants will significantly help combating deforestation in the entire valley.
- The Delay Action and Check Dams helped in retaining flood water for 56 hours after the rain, allowing settlement of silt, water seepage in the ground and eliminating the threat of floods to the downstream settlements and degradation of land.
- The water level of the wells has increased by 30 feet, resulting in significant decrease in the energy cost for water mining in agriculture. It is also helped to bring about an increase in the vegetation coverage in the catchment area as well as in the downstream areas.
- Rainwater harvesting seems to be a small intervention but it brings about sustainable and effective impact. SVDP implemented 60 rainwater harvesting



ponds in the community grazing areas. On average each water pond meets the entire annual water needs for 2500 livestock. Around 150 thousand livestock or 40 thousand families are the current beneficiaries of these rainwater harvesting ponds.

- **Drinking Water Supply Schemes:** A total of 10 water supply schemes under the program were constructed for small sized rural settlements. The systems are based on diesel engine based pumping and community tanks. On average each scheme is designed to meet the entire water needs of 40-50 families including the livestock. The beneficiary communities are responsible to meet the entire operation and maintenance (O&M) cost of these schemes.
- **Household Income:** The average household monthly income increased by 53% from Rs.9960 in 2006 to Rs.15875 in 2008. Agriculture and livestock being the primary source of income share 56 percent, while services (20.5%), small businesses (10%) and labour (6%) are the major secondary sources.
- **Household Expenditures:** The average household expenditure increased by 44% during the assessment period (Rs. 6059 in 2006 to Rs. 8744 in 2008). The major (52%) source of household expenditure reported for food. Interestingly the expenditure on food in decreased by from 66.5% in 2006 to 52% in 2008. This is mainly due to improved food availability from own agriculture production. The improvement in irrigation systems helped increase in on-farm food production and a visible decrease in household level consumption expenditure on wheat, vegetables, poultry and milk.
- **The impact of only one PPAF intervention - pipe irrigation system-** is the beginning of an agrarian revolution in Soon valley. A single intervention changed the whole agriculture scenario- increase in the area under cultivation (38%), land reclamation, enhanced per acre yield (100%) and income, reduction in irrigation time (31%), change in cropping pattern and enhanced value of land (63%).