SURFACE IRRIGATION AND LIVELIHOODS:
Results of User-Managed Irrigation Systems in Maharashtra, India

Nitin Bassi
Scientific Officer, International Water Management Institute
n.bassi@cgiar.org

The paper documents how efficient management of irrigation system by the end users (through Participatory Irrigation Management) has made a positive impact on their livelihoods. This was done on the basis of a study of successful Water Users Associations (WUAs). In the study, an attempt is made to rationally link the livelihood impacts to the successful management of conveyance system by the end users. The impacts on livelihoods were analyzed under the broad umbrella of DFID sustainable livelihoods framework. Major impacts included timely and adequate supply of irrigation water, increased crop productivity, improved standard of living, assured labor work, and better social networking. The main factor behind these encouraging results was the better operation and management of irrigation infrastructure or conveyance system by the members of the WUAs after the system was turned over to them. Interestingly in spite of the fact that irrigation system was selectively repaired by irrigation department (ID) before turning over to WUAs, results indicate that substantial work was done by the end users. Paper concludes that to have desired results actually achieved from farmer-managed irrigation systems, it is important to provide them with training on human resource management and efficient conveyance system management, and financial support for repair and rehabilitation of system before the irrigation systems transfer actually takes place.

Key words: Participatory Irrigation Management, Livelihoods, End User, Conveyance System, Sustainable Livelihood Framework.

1. INTRODUCTION

Agriculture is the main source of livelihoods for hundreds of millions of people around the world. In India approximately 60 per cent of the total population depends on agriculture as their livelihood source (Agriculture Summit, 2005). Considering importance of agriculture in sustaining rural livelihoods, Indian government has placed particular emphasis on irrigation development in recent past. The total irrigation potential (both surface and groundwater) in India is about 139.5 million hectare; out of which 97 million hectare has been created and 82.27 million hectare utilized by the end of year 2003-04. Comparative figures at the end of eight five year plan (1992-97) were 86.26 and 77.24 million hectares for potential created and utilized respectively (*Source*: Indiastat). Figures indicate that although irrigation development has taken place at greater pace, there is still big gap in the utilization of the potential created. In order to bridge this gap, various policy reforms were undertaken by the central government and various state governments. These reforms mainly included implementation of Command Area Development (CAD) program and enacting acts, guidelines, and policies for farmer participation in management of irrigation systems in the respective states. The state governments which were active in implementing these reforms were Andhra Pradesh, Gujarat, Madhya Pradesh, Karnataka and Maharashtra. The following study was carried out in the state of Maharashtra. The main purpose of the research was to bring forth the achievements of farmers managed irrigation systems (FAMIS). Often the focus of most of the studies is on how to improve the

FAMIS but this paper focus on the positive results achieved in the user managed irrigation systems in Maharashtra state.

1.1 Irrigation Development in Maharashtra

Agriculture was always in fore front of the development activities of Maharashtra state. Therefore development of irrigation is considered as key element in the state plans. The state has achieved a landmark in irrigation potential creation with construction of almost 2700 major, medium and minor irrigation projects, that accounts for around one half of the country's total dams population. The ultimate irrigation potential, from both surface water and ground water resources, was estimated at 12.6 million hectare (Sodal, 2004). But performance in potential utilization remains comparatively low. Out of the 6.3 million hectare of total irrigation potential created, only 4.8 million hectares has been utilized till 2003-04 (*Source*: Indiastat). To improve water use and overall performance, all-round measures have been initiated in the state, which includes policy reforms, technological reforms and managerial intervention. One of the main policy reforms is the adoption of Participatory Irrigation Management (PIM) in the state.

The first real intent by government of Maharashtra in moving towards PIM came in the form of Cooperative Water User's Association (WUA) Guidelines (1994) where irrigation department adopted a policy to create water user's association at minor canal level and transfer operation & maintenance responsibility for the minor and smaller channels to them (Naik and Kalro, 1998). Since then, there was continuous transformation in policies for involving farmers in the management of irrigation system. All these reforms ended with the state government coming out with Maharashtra Management of Irrigation Systems by Farmers Act (MMISF) in 2005. Currently, the state has 1127 WUAs (August, 2006) covering a cultivable command area (CCA) of 3,71,785 hectares, which are completely functional and around 2000 WUAs in various stages of formation. After Damani et al. (2006), salient features of the MMISF Act include: a) Irrigation water to be supplied to WUAs only, b) WUAs area of operation to be notified in official gazette with certified and updated map and list of members, c) All irrigators in the command area of WUA to be deemed member of WUA, d) Chairmanship of the WUA to be rotated amongst the directors from tail, middle and head reaches of the area of operation of WUA, e) Office bearers of the WUAs to be legally empowered, f) Multi-tier farmer organizations to be established in every irrigation project i.e. WUAs (minor level), Distributory Level Associations (DLA), Canal Level Associations (CLA) and Project Level Associations, g) Volumetric supply of irrigation water to WUAs, h)Clarity and accuracy regarding water use entitlements to WUAs, i) Freedom of crops to members of WUAs, j) Permission to conjunctive use of surface and groundwater, and k) WUAs to be given freedom in deciding, right of distribution of water to farmers, levying water charges and service taxes in their jurisdiction.

The act also provides for a management subsidy and maintenance & repair (M & R) grant to the WUAs. An amount of Rs.225 per hectare from central government & Rs.225 per hectare from state government were to be given as management subsidy to the WUAs formed under CAD projects. For the WUA formed under non-CAD projects, an amount of Rs.450 per hectare will be given, provided the associations should agree the condition of Rs.50 per hectare made available for management expenditure from their side. For the annual maintenance and repair, a grant of Rs. 60/hectare was given for the first five years of WUA operation by the state

government. This grant will reduce by Rs.10/hectare for each coming year and finally no grant will be given from 10th year onwards of WUA operation. Special emphasis was given on the capacity building of newly formed WUAs. In this regard, Water and Land Management Institute (WALMI), Aurangabad, was entrusted with the responsibility of imparting training to the office bearers of WUAs, canal operator (*patkaries*), beneficiaries of the WUA and officers from Irrigation, Agriculture and Co-operative department. The discussed provisions under the act give a sense of seriousness Government of Maharashtra is showing in the irrigation development and reforms.

1.2 Irrigation development and Livelihoods: The linkage

There is no doubt that irrigation has a central place as an engine for rural economic growth and as a means to ensure food security. Lankford (2003) on his study on irrigation development in Tanzania identified three stages in the perspective of livelihoods based irrigation development: proto-irrigation, irrigation momentum and river basin management. According to him in the proto-irrigation stage farmers are dependent on other livelihood activities than based on irrigated agriculture. But as the irrigation development gains momentum, farmers start moving to irrigated agriculture as main source of livelihood. In the final stage, there is wide scale increase in irrigation activities leading to water scarcity not only for agriculture but also for other sectors expressing growing water needs. This stage requires the need for sanctions, water management and conflict management. In response to the problems identified in the last stage role of end users in irrigation water management can be an important aspect.

Hasnip (2001) and Smith (2004) identified four inter-related mechanisms through which irrigated agriculture can reduce poverty or in other words improve livelihoods. Important in respect of this study are a) improvements in the productivity, incomes, employment for irrigators' households and farm labor; and b) the linkage & multiplier effects of agricultural intensification for the wider economy. Similar views in respect of importance of irrigation on poverty reduction are being shared by Lipton et al. (2003). Hussain (2007) in his study on exploring link between irrigation and poverty alleviation in six Asian countries found that poverty outside of irrigation systems (non-irrigated settings) is almost twice than that within irrigation systems. However badly designed and managed irrigation systems can have a significant impacts on the rural livelihoods. Some of these may include: a) unreliable supply of water to farmers leading to crop loss and diminishing returns (DFID 1997; Elakanda 2007), and b) inequitable distribution of water on account of sediment deposition and growth of weeds in the main channels which may force farmers especially at the tail end of the system to opt out of irrigated agriculture (DFID 1997). Considering these ill-effects better operated and maintained irrigation systems especially with emphasis on end user managed systems becomes important.

Inferences from the above discussion indicate that irrigation development plays an important role in the livelihoods of the rural community and effort is required for efficient use of irrigation water. Involvement of end users through the formation of WUAs can be considered as an option for improving the performance of an ailing irrigation system and thus thereby improving their livelihoods. With this as a background, following study was conducted in the state of Maharashtra to explore how much the introduction of end users managed canal irrigation in the state has an overall impact on farmers' livelihoods.

2. RESEARCH FOCUS and METHODOLOGY

The main objective of the study was to identify various primary stakeholders in irrigation (farmers- large & small at all the reaches, agriculture labor, women, etc.) and to understand how the formation of village institution (WUA) has an impact on their livelihoods. For the purpose, only successful WUA's having a minimum 5 years of working experience, and having demonstrated good management and financial discipline were selected. A set of criteria were used for deciding on good managerial and financial performance. For managerial performance, the criteria used were: a) maintenance of irrigation infrastructure, b) equity in water distribution, c) increase in irrigated area, d) regularity in holding meeting and e) existence of byelaws and compliance to rules and norms. And for financial performance indicators chosen were a) compliance to budgeting exercise, b) properly maintained accounts and c) availability of funds to cover annual recurring cost.

Based on the above listed criteria four WUAs representing different regions of Maharashtra were selected. These WUAs were from a) Village *Ozar*, Nashik (North Maharashtra); b) village *Borgaon*, Akola (Vidharba); c) village *Malegaon*, Nanded (Marathwada); and d) village *Brahmni*, Ahmednagar (Western Maharashtra). For the location of these sites, please refer figure 1. Selected WUAs were such that they represented the head and tail reaches of both major and medium irrigation projects (table 1). Respondents selected from WUAs represented the head, middle and tail end of the command area. From each end marginal, small, medium and large farmers were selected. Overall 10% or minimum 30 farmers (members and non-members) were selected. Other stakeholders like farm labors and shopkeepers (if possible) were purposively included in the sample. For obtaining information from the respondent's schedule, group discussions and informal interviews were done.

The performance of the selected WUAs was assessed based on the following indicators: a) Increase in Irrigated area, b) Financial sustainability of the WUAs and c) Recovery of water charges from the member farmers. For assessing impacts on livelihoods changes in Crop productivity, Profit, Livestock, Overall assets, Employment opportunities for farm labor and Social Outcomes were looked into.

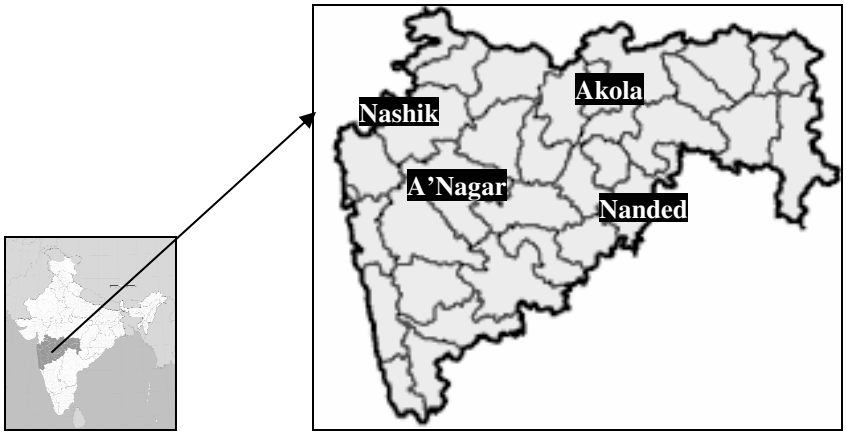

Fig.1: Map showing selected sites in the state of Maharashtra, India

Table 1: Matrix showing selected WUAs

	Head	Tail
Major project/NGO or Civil society promoted	Yogeshwar WUA, Mula Irrigation Project, village Brahmni, Ahmednagar.	
Major project/Irrigation department promoted	Kisan WUA, Katepurna Irrigation Project, village Borgaon, Akola.	Krishna Kalva WUA, Purna Irrigation Project, village Malegaon, Nanded.
Medium Project & NGO or Civil Society Promoted		Jai Yogeshwar WUA, Waghad Irrigation Project, village Ozar, Nashik.

3. INSIGHT

3.1 Profile of Selected WUAs

Profile of the selected WUAs along with membership details and other important features are given in table 2. In all the WUAs, water is supplied by the irrigation department on volumetric basis. These WUAs then have their own system of charging to its water users. In the case of WUA at OZAR, farmers pay irrigation charge according to the water taken for the field/hour. In other three WUAs crop area wise method was adopted in which members were charged according to the water used for crop grown/hectare of the area.

Table 2: Profile of selected WUAs

Name	**Jai Yogeshwar WUA**	**Kisan WUA**	**Krishna Kalva WUA**	**Yogeshwar WUA**
CCA	595	121	1036.1	292
ICA	390	101	658.32	200
Water Allotment **Kharif** **Rabi** **Summer**	 273 TCM 587 TCM -	 No data available	 999 TCM 3426 TCM 1526 TCM	 185.75 TCM 464.96 TCM 124.02 TCM
Total Beneficiaries	339	64	581	273
Total Members	292	64	295	172
Year of handing over of system to WUA	1991-92	2000-01	1991-92	1997-98
Number of Years of irrigation after WUA formation	15	4	14	8
Caste Composition	87% general	45% general	91% general	85% general
Mode of Irrigation	Conjunctive use	Canal	Conjunctive use	Conjunctive use
Sample Size	31	30	30	30

3.2 Performance of the Selected WUAs

For measuring performance of the WUAs indicators linked with the overall management of irrigation system and financial position of WUA were considered. These include change in the irrigated area, financial position and water charges recovery rate.

3.2.1 Irrigated Area

Increase in irrigation intensity (II) through canal water was seen for all the selected WUAs in their post formation stage (fig. 2). To further elaborate on figure 2, x-axis represents no change in II whereas any deviation from x-axis in the direction of y-axis represents change in II. There was increase in II for selected WUAs at village *Ozar, Brahmni* and *Malegaon* for both *rabi* (winter) and summer season in post WUA scenario. However for WUA at *Borgaon,* II has gone down for *summer* season. The main reason was nearly no release of water from the dam site in the summer season (2004-05) on account of less storage in the reservoir (2.34 million metre cube in 2004-05 as compared to 68.05 million metre cube in 2005-06). Reservoir storage levels at dam sites indicate that it was not only the more availability of water but well operated and managed irrigation system by WUAs which has led to increase in II.

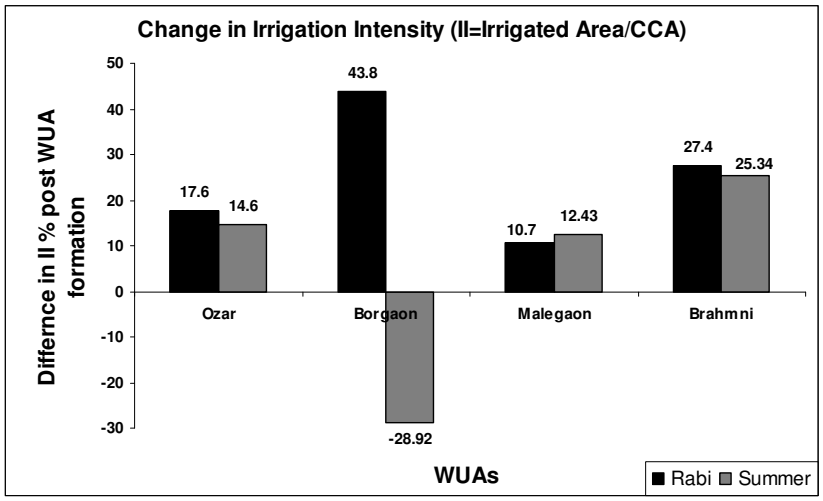

Fig. 2: Change in Irrigation Intensity post WUA Formation

3.2.2 Financial Position

Finances play an important role in sustainability of any institution. Figure 3 indicates that except for one i.e., WUA at *Malegaon*, all the WUAs were going in loss from the last two irrigation seasons i.e. 2004-05 and 05-06. WUA at *Malegaon* incurred loss only in the last working season (2005-06). This was mainly because water charges were not collected in 2004-05 season on account of no irrigation by canal water (no availability of water from dam reservoir). Figures available from water charge recovery (will be discussed in next section) made it clear that recovery rate was not a problem for the other three WUAs. Then what happened to these WUAs in last two seasons which were seem to perform well in seasons before? On searching for an explanation, an important fact came into the picture. All these conveyance system was transferred by irrigation department to WUAs without carrying out full repair and rehabilitation (R&R) work i.e. only selected repairing was done before transfer. The main reason quoted for this was the insufficient funds available with department to carry out full R&R work. One of the externality associated with this approach was the bad state of irrigation infrastructure i.e. minor supplying irrigation water to the command area of WUAs. After transfer, operation and maintenance of the minor became the responsibility of WUAs. Since the transferred system to the WUAs was in the terrible state, associated cost of O&M kept on increasing over the years. This was what exactly happened in the case of all the four selected WUAs. Therefore with due

course of time their expenditure on the O&M of the system increased, while the irrigation rate charged by these WUAs to their members remained more or less same. The increase in the cost of maintenance on minor was 79% for WUA at *Ozar*, 140% for WUA at *Borgaon* and 62% for WUA at *Brahmni* in the time period of two seasons i.e. from 2003-04 to 2005-06.

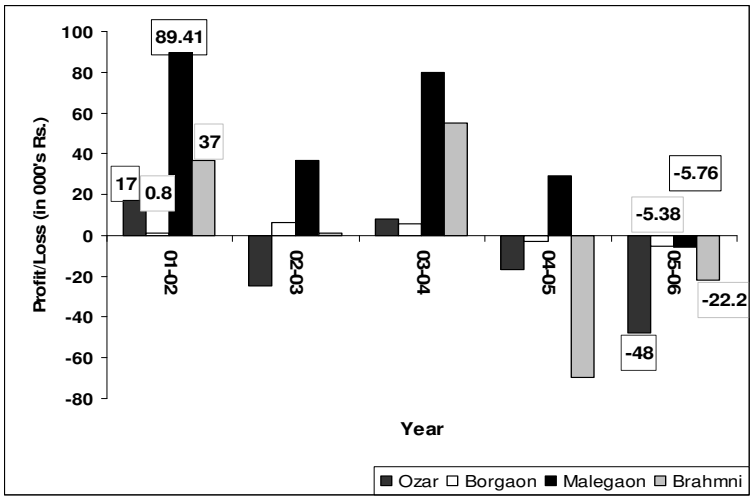

Fig. 3: Financial Position of selected WUAs

3.2.3 Recovery of Water Charges

Records confirm that except for WUA at *Brahmni,* all the other WUAs were having a water charge recovery rate of around 75%. Before the transfer of irrigation system to WUAs, irrigation department used to have complaints regarding the low water charges recovery rate. But with the assured and timely supply of irrigation water after the formation of WUA the recovery rate has gone up. This means that if farmers are certain of getting reliable supply of water for irrigation they don't hesitate to pay their share on time.

3.3 Impact on Livelihoods

Above section highlighted the performance of selected WUAs after the irrigation system was handed over to them. To summarize, selected WUAs were found to be performing fair enough on the indicators chosen to assess their performance. However of late there seems to be some problems in financial position of WUAs (refer figure 3) but that has to do more with the physical characteristic of transferred conveyance system. Now interesting will be to see the impact of WUAs performance on the livelihoods of the members and other stakeholders? To examine those, changes in the crop productivity, profit, assets, livestock, employment opportunities of farm owners & farm labors and social benefits were seen.

3.3.1 Crop Productivity

Change in crop productivity can be used as one of the indicators for assessing the impact on the livelihoods of the farmers. Table 3 highlights the changes in the crop productivity for the respondent farmers in selected WUAs. According to farmers reliable supply of irrigation water was the major factor behind these changes. Because of the irrigation water assurance they confidently invested more in agriculture inputs and were able to obtain increase crop yields. Also

increase in the number of wells (discussed in section 3.3.4) in the WUAs area of operation provided farmers with more opportunity for conjunctive use of water and hence better quality of irrigation. For WUA at *Ozar*, maximum increase in crop productivity was found for wheat followed by grapes (main cash crops in the region). There was decrease in the productivity of tomato. This was mainly because of high amount of rainfall from the past two years which has spoiled the standing tomato crop. At *Borgaon* WUA, maximum increase in crop productivity was for cotton which is also the traditional cash crop of the region. No specific reasons were found out for the decrease in the crop productivity of sunflower. At *Malegaon* WUA, maximum increase in crop productivity was for turmeric followed by sugarcane (main cash crop in the region). At *Brahmni* WUA, maximum increase in crop productivity was for cotton followed by wheat although sugarcane is the main cash crop in the region.

Table 3: Crop Productivity for Respondents of selected WUAs

Selected WUA	Main Crops grown by the Respondents	Average Productivity (in tonne/hectare)		Increase or Decrease in Productivity (in %)
		Pre WUA	**Post WUA**	
Jai Yogeshwar WUA, *Ozar*	Tomato	10.37	6.51	- 37.22
	Wheat	1.45	2.68	+ 84.83
	Gram	0.49	0.58	+ 18.37
	Onion	15.97	19.5	+ 22.10
	Groundnut	2.19	2.59	+ 18.26
	Grapes	20	34.79	+ 73.95
Kisan WUA, *Borgaon*	Cotton	0.91	1.07	+ 17.58
	Wheat	2.22	2.29	+ 3.15
	Gram	1	1	0
	Sunflower	1.65	0.95	- 42.42
Krishna Kalva WUA, *Malegaon*	Cotton	1.28	1.82	+ 42.19
	Wheat	2.22	2.82	+ 27.03
	Groundnut	1.16	1.5	+ 29.31
	Sugarcane	69.02	106.48	+ 54.27
	Turmeric	2.42	4	+ 65.29
Yogeshwar WUA, *Brahmni*	Cotton	1.62	2.87	+ 77.16
	Wheat	2.28	3.62	+ 58.77
	Onion	20	22.08	+ 10.4
	Groundnut	2.5	3.5	+ 40
	Sugarcane	99.46	121.46	+ 22.11

In congruence with changes in crop productivity, there was increased crop diversification after the formation of WUAs. Although PIM cannot be considered as "the" factor but it has played a major role in such diversification. Soyabean is the new crop introduced (4-5 years back) in the WUAs located at *Ozar, Malegaon and Brahmni.* In *Malegaon* WUA, citrus is also cultivated presently. To summarize these increased crop yields are direct function of mainly reliable supply of canal water and increased well irrigation and inputs for farm activities.

3.3.2 Profit

Crop diversification and increase yields on account of reliable supply of canal water and conjunctive use of water in WUA area of operation has made a significant impact on the profit/loss equation for farmers. Table 4 compare changes in profit in pre and post WUA scenario. Profit for different crops seems to be more or less in congruence with productivity.

For *Ozar* WUA, maximum profit was for wheat followed by grapes, for *Borgaon* WUA it was for cotton, for *Malegaon* WUA it was for sugarcane followed by turmeric and for *Brahmni* WUA maximum was for wheat followed by cotton. In all the selected WUAs increase in crop yield after the user managed irrigation systems have resulted in more profit for the corresponding crop (refer table 3 and 4).

Table 4: Profit for Respondents of selected WUAs

Selected WUA	Main Crops grown by the Respondents	Average Net Return (in Rupees/hectare)		Increase or Decrease in Profit (in %)
		Pre WUA	Post WUA	
Jai Yogeshwar WUA, *Ozar*	Tomato	355625	23348.21	- 93
	Wheat	7340	20848.21	+ 184
	Gram	11370.19	13294.12	+ 17
	Onion	27916.7	56111.11	+ 100
	Groundnut	10275	13262.5	+ 29
	Grapes	90000	250555.6	+ 178
Kisan WUA, *Borgaon*	Cotton	7314.65	10165.95	+ 39
	Wheat	8826.92	9250	+ 5
	Gram	8625	8625	0
	Sunflower	12875	7296.87	- 43
Krishna Kalva WUA, *Malegaon*	Cotton	13519.74	23065.79	+ 71
	Wheat	9135	14060.19	+ 54
	Groundnut	6937.5	11593.75	+ 67
	Sugarcane	35407.61	72361.11	+ 104
	Turmeric	35416.67	66041.67	+ 86
Yogeshwar WUA, *Brahmni*	Cotton	23750	48750	+ 105
	Wheat	7447.92	19730.77	+ 165
	Onion	35958.33	49020.83	+ 36
	Groundnut	13597.22	25737.5	+ 89
	Sugarcane	58994.57	83057.29	+ 41

3.3.3 Livestock

Table 5 represent livestock situation of the respondents. This has to be kept in mind that these figures are only related to the members of the WUAs and not for the entire village population. Decrease in milch animal population was seen for respondents in WUAs at *Ozar* and *Malegaon* whereas increase was seen for respondents in WUAs at *Borgaon* and *Brahmni* in the post WUA phase. Several reasons were quoted by respondents for decrease in milch animal population. Important ones were; a) Profit involved in dairying was much less than in agriculture, b) Keeping livestock require additional labor, c) they have more agriculture activities now, on account of secured supply of irrigation water and d) shift in cropping pattern from one which is cereal-based to one which is more based on cash crops. This makes it clear that with the formation of WUAs, agriculture activities in the command area of WUAs at *Ozar* and *Malegaon* increased and farmers moved away from dairying business to agriculture as their main source of livelihood. For WUAs at *Borgaon* and *Malegaon* presence of dairy cooperatives in the village has an impact on the increase of milch animal population. Farmers with these WUAs had access to ready markets for selling milk.

Non-milch animal population is on decline in all the selected WUAs except from that at *Borgaon*. No specific reasons were found for this particular phenomenon. But a few respondents were of the view that increasing use of machinery for the agriculture operations has resulted in lesser use of non-milch (draught) animals in the fields.

Table 5: Change in Livestock for Respondents of selected WUAs

Selected WUAs	Milch animal population of Respondents			Non- milch animal population of Respondents		
	Pre WUA	Post WUA	Increase or Decrease (in %)	Pre WUA	Post WUA	Increase or Decrease (in %)
Jai Yogeshwar WUA, *Ozar*	99	68	- 31.31	56	52	- 7.14
Kisan WUA, *Borgaon*	23	24	+ 4.35	30	30	0
Krishna Kalva WUA, *Malegaon*	140	86	- 38.57	73	57	- 21.92
Yogeshwar WUA, *Brahmni*	97	102	+ 5.15	38	29	- 23.68

3.3.4 Assets

Change in the assets pattern of the household, indicates about the life standard of that family. As shown in table 6, overall there was increase in assets of respondents in post WUAs setting. At *Ozar* WUA, interesting was to see the increase in number of wells (47% increase) and electric pumps (79% increase). Decrease in diesel pumps is because they are replaced by electric pumps now. In *Borgaon* WUA primary source of irrigation is canal water, so no major difference was seen in respect to wells, bore wells and pumps. In *Malegaon* WUA, as was the case with Ozar, increase was seen in respect to wells (25% increase) and electric pumps (100% increase). Increase in electric pumps was four times to that of wells, the reason as quoted by respondents was a measure against electricity cut. Since they have got limited supply of electricity for agriculture use, they often use two electric pumps with one well in order to have more irrigation in the same time. In *Brahmni* WUA, increase in bore wells (220% increase) and electric pumps (30% increase) was seen. Increase in number of wells and pumps in the selected WUAs reflect increasing use of groundwater for irrigation in the command area. This increase in groundwater usage again can be attributed to increase in groundwater level through percolation from canal water. This has proved to be major blessings for farmers going for perennial crops and especially for WUAs at *Ozar*, *Malegaon* and *Brahmni* where there is conjunctive use of water for irrigation. As a result farmers were able to get benefits in the form of increase crop yields and associated profits (refer table 3 and table 4). Currently none of the WUA was levying percolation charges, but for the years ahead, they are planning to have some kind of tax or charges on the use of return flows.

Other assets like televisions, phones and tractors have shown upward trends. Group discussions with farmers revealed that since agriculture activities have increased, borrowings has gone up, but savings has also increased. This increase in savings and profit post WUA formation may be leading farmers to invest more on material item then before. To summarize, changes in asset composition of WUAs members reveals that economic condition of farmers has improved in post WUA era.

Table 6: Change in Assets for Respondents of selected WUAs

Selected WUAs	Wells		Bore Wells		Tractors		Electric Pumps		Diesel Pumps		TV/Phone	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Jai Yogeshwar WUA, *Ozar*	38	56	0	0	0	13	29	52	8	4	2	44
Kisan WUA, *Borgaon*	1	1	0	1	1	0	2	2	0	0	13	30
Krishna Kalva WUA, *Malegaon*	20	25	0	5	4	2	14	28	2	0	5	36
Yogeshwar WUA, *Brahmni*	25	26	5	16	2	3	30	39	8	0	13	44

3.3.5 Employment for farm labor

Assured agriculture provided secured labor for local and migrant laborers. This is being the case for all the selected WUAs. At *Ozar,* migrant and local laborers have found more work because of increased cash crop based agricultural practices. These laborers mainly work in wineyards for at least 7-8 months in comparison to 4 months in pre WUA scenario. In Borgaon, laborers have assured work for 7-8 months particularly in cotton fields. In Malegaon and Brahmni where the major cash crop is sugarcane, the farm laborer mainly works in sugarcane fields. These labors were actually employed by sugarcane cooperatives on contract basis to harvest sugarcane. These people mainly have bulk work for about 8-9 months and then return back to their respective places. There they keep their living by cultivating rain fed crops in whatever small piece of land or leased land they have.

3.3.6 Social Outcomes

Benefits of the livelihood outcomes were distributed equitably among the entire castes and farmers group. Interesting was to notice that at Ozar WUA small farmers have also started with grapes as their major cash crop. It was seen that frequency of taking loans for the agriculture has reduced in all the WUAs in our sample. In education, an upward trend was seen as farmers in all the sampled WUAs were interested in at least schooling their children till matriculation. Since availability of water is not a major constraint now, there is better relationship and less conflicts among farmers in the WUAs area of operation. Although farm expenditure has gone up but it has been balanced by increased net returns to the farmers. On account of reliable and timely delivery of irrigation water there was a sense of trust among farmers regarding WUA functioning.

4. DISCUSSIONS

In the above section we highlighted the impact of better managed irrigation system below the tertiary level on the livelihoods of the farmers. These impacts were analyzed using the DFID sustainable livelihood framework (Carney 1998). The framework views how people operate in a context of vulnerability. This vulnerability context is the external environment in which people exist. These contexts can be trends (population trends, resource trends, technological trends etc.), shocks (human health shocks, natural shocks, economic shocks, conflict etc.) and seasonality (of prices, of production, of employment opportunities etc.) over which people have limited control. Within this situation the people have access to certain assets or poverty reducing factors. These assets are human, natural, financial, physical and social in

nature. These assets gain their meaning and value in the presence of social, institutional and organization environment together called as transforming structures and processes. This environment influences the livelihood strategy i.e. ways of combining and using assets that are open to people in pursuit of beneficial livelihood outcome to counter the vulnerability scenario. In context of the study and irrigation management by end users it can be discussed as follows.

To begin with there was a vulnerability scenario in the form of bad condition of conveyance system (irrigation infrastructure) and untimely supply of irrigation water to the farmers. Because of this sad state of affairs with irrigation infrastructure there was no reliable supply of irrigation water and farmers were having real problem in choosing or selecting what crop to grow and at what time to grow. In order to cope up with this scenario farmers in the command area got united and formed a WUA. In pursuit of their aim which is to improve the irrigation water delivery system, these WUAs had access to their collective assets or resources. These include a) their understanding of problems related with conveyance system and how it can be improved by their own action (human asset), b) availability of water (natural asset) which needed better management. The farmers felt that sometimes even with enough availability of water they were not able to irrigate their fields properly, c) conveyance system (physical asset) serving water to WUAs which needed urgent repair & maintenance, and d) trust and belief among each other (social asset). Only asset or resource lacking was the finance.

This was the perfect case in which a public system was kept in such a bad condition be it because of limited fund available with the government or apathy from the point of irrigation officials, that it was ultimately having effect on livelihoods of the farmers. With all this in background WUAs were having a serious concern of how to get going in persuasion of fulfillment of their objective. While the combined assets or resources were the first answer, the second was outside support or helping hand to provide them right direction. For WUA at *Ozar* this support was provided by the NGO called *Samaj Parivartan Kendra* (SPK), for *Borgaon* WUA it was leadership of an executive engineer from irrigation department, for *Malegoan* WUA it was the pilot project promoted by irrigation department and for *Brahmni* WUA it was again a civil society organization and an able leadership of one of the resident of the village. From the state government side there were guidelines and ultimately an Act called Maharashtra Management of Irrigation Systems by Farmers Act, 2005. The act supported the formation of WUAs and provided them with small amount of funds for maintenance.

Thus combination of farmers' investments, civil society interventions and government support resulted in design of institution of end users in order to counteract the ailing conveyance system. With the formation of WUAs there was a substantial improvement in the conveyance system and supply of irrigation water which ultimately lead to increase in irrigated area. The next step which the farmer's organization as collective took was the adoption of various livelihood strategies to make the benefits of reliable supply of irrigation water into tangible profit. The main strategy adopted was going for crop diversification and cash crops cultivation in addition to regular crops.

All these steps resulted in: a) some improvement in the conveyance system as the funds available for O&M were limited; b) better management of scarce water resources; c) increase in crop productivity as there was assured and timely supply of irrigation water making farmers

decide well in time what to grow and what not to grow; c) increase in profit mainly as a result of increased yield; d) more stable crop production on account of better operated and managed conveyance system; e) more secured work for farm labors mainly on account cash crop based agricultural activities, f) improvement in the life standard of farmers as depicted by increase in asset for farmers in the four selected WUAs and e) other social benefits. Major social benefits include- a) reduced period of stress or resource crunch- availability of water for irrigation in different seasons (*rabi* and *summer*), b) reduced migration- more secured farm labor work, c) smaller informal borrowings- with the increasing profit there was a downward trend in informal borrowings, and d) lower depletion of critical assets (house, land etc.) which are necessary for living. These were the overall outcomes seen with respect to all selected WUAs.

These outcomes further had irreversible impact on the collective assets or resources of the end users. Human capital got enriched through trainings provided by WALMI (a government organization) on how to effectively manage irrigation system, natural asset in the sense of better management of water- a scarce resource, financial asset by the way of more savings by farmers, physical asset by improvement in the condition of conveyance system and on social capital by the way of membership in the WUA.

4.1 Future Concerns

These outcomes present only one side of the story, there were other concerns too which require immediate attention. The major concern is the further improvements require for conveyance distribution system to make it much more efficient. As discussed earlier, the irrigation systems were transferred to the WUAs with only selective repairing. WUAs were in charge of O&M but for that to succeed first they got to have fully repaired and rehabilitated minors. Now there is a ray of hope with the sanction of World Bank assistance for PIM in the state of Maharashtra. This means that finance would not be constrain now for carrying out repair and rehabilitation work. Still it remains to be seen how much effectively government attend to this problem. For the interest, as per one of the estimates, cost of automation on a main canal can vary from Rs1 500 to Rs2 000 per ha and that on a secondary canal from Rs3 000 to Rs4 000 per ha.

Interestingly members in the WUAs were getting more involved for the sustainable use of water. Group discussions with them revealed that what they now want is to achieve more irrigation from the limited irrigation water available, and to have much more equity across the command area. If these two concerns are adequately attended to, there will be far greater benefits. It will also then make much more sense of distributing water to farmers on volumetric basis as currently done in Maharashtra.

5. CONCLUSION

The study indicates that PIM has definitely led to improvement in the livelihoods of the agriculturally dependent people in the villages. However it should not be generalized to newly formed WUAs as only successful and mature WUAs were selected for the study. What was heartening to see is the interest of farmers in the conveyance system management. The study throws a light on what PIM can achieve if it is implemented with precise strategy. It would not

be wrong to infer that systematic and sensible approach towards PIM can lead to number of benefits for farmers. But to achieve greater impact of PIM it is important to have efficient and well managed conveyance system in place, wherein government should provide funds and technical inputs. Role of government is also thought important in creating potential leaders from the villages itself by way of trainings and exposures in order to have well informed and performing WUAs. These individuals being from the same locality have an advantage of easily conveying the message about the benefits of farmers-managed conveyance system to the end users. Hence this approach becomes much more effective in making farmer-managed system a success. The paper ends with a broad understanding that to achieve desired result from farmer-managed irrigation system and to have positive impact on their livelihoods, there are some pre-conditions. They are: providing WUAs with the human trainings (capacity building), technical trainings (efficient conveyance system) and financial support (repair and rehabilitation of system) before transferring the irrigation system.

ACKNOWLEDGEMENT

The study was carried out with the financial support of Development Support Centre, an NGO working for PIM in the state of Gujarat under their national level study on the "Impact of PIM on the economic growth of rural communities". Author would like to give special thanks to Mr. Vivek Kher for his tireless support during the field work.

REFERENCES

Agriculture Summit. 2005. *Reforms for raising farm income*. Summary report. 09-10 April, 2005, New Delhi, India.

Carney, D. (ed.). 1998. Sustainable Rural Livelihoods: What contribution can we make? London: Department for International Development. In *Sustainable Livelihoods: A Case Study of the Evolution of DFID Policy*, W. Solesbury. Working Paper 217, June 2003, Overseas Development Institute.

Damani, R.L. et al. 2006. *Volumetric supply and pricing of irrigation water: Scenario in Maharastra.* Paper presented in National Conference on Volumetric Supply and pricing of Irrigation water. 17-19 December, 2006, Pune, India.

DFID. 1997. The Economics of Maintaining Irrigation Systems. DFID's Water KAR (Knowledge and Research) Projects. *R8027*. October 1996- September 1997.

DFID. 1999. *Sustainable Livelihoods Guidance Sheets*. Department for International Development, London.

Elakanda, S. 2007. *Key Water Related Issues identified in Sri Lanka*. Paper presented in 4th Thematic Workshop on Water Allocation and Water Rights. 23-26 January, 2007, Saitama, Japan.

Hasnip, N. et al. 2001. *Contribution of Irrigation to Sustaining Rural Livelihoods*. Literature Review. Report OD/TN 109, September 2001, HR Wallingford, UK.

Hussain, I. 2007. *Irrigation and poverty alleviation: pro-poor intervention strategies in irrigated agriculture in Asia*. Paper presented in 4th Asian Regional Conference & 10th International Seminar on Participatory Irrigation Management. 2-5 May, 2007, Tehran, Iran.

Lankford, B. 2003. Irrigation based livelihood trends in river basins: theory and policy implications for irrigation development. *Physics and Chemistry of the Earth* 28:817-825.

Lipton, M. et al. 2003. *Preliminary review of the impact of irrigation on poverty with special emphasis on Asia*. Food and Agricultural Organization, Rome.

Naik, G., and Kalro, A.H. 1998. *Two case studies on the Role of water users' associations in irrigation management in Maharashtra, India*. 17 February, 1998, World Bank.

Plusquellec, H. 2002. *How Design, Management and Policy Affect the Performance of Irrigation Projects - Emerging Modernization Procedures and Design Standards*. FAO, 2002, Bangkok, Thailand.

Smith, L.E.D. 2004. Assessment of the contribution of irrigation to poverty reduction and sustainable livelihoods. *International Journal of Water Resources Development* 20:243-257.

Sodal, S.V., 2004. *An initiative towards saving of water and sustainable Irrigation Management in Maharashtra State, India*. Paper presented in 3rd ICIS/WATSAVE International workshop on water savings: Challenges and Approaches. 7 December, 2004, Cairo, Egypt.