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Study of Participatory Irrigation Management (PIM) system and its impact on Sustainable development of Tribal Community (A case of Ver Medium Irrigation Project in Mandvi Taluka of Surat District in South Gujarat)

Participatory Irrigation Management: In Brief

Water management is a major concern of agriculture in the world. Its importance derived from water's effect on livelihoods, food security, and the sustainability of environmental systems. The huge population growth and the frequent drought shocks are making water resources under severe threat and calling for global efforts for new concepts of water planning and management.

Irrigation sector is facing problem of wastage of water, low utilization of available water, disputes between farmers leads to tail ender deprivation and resulted poor irrigation, lack of planning and coordination between farmers create demand at one time and create havoc in water distribution leads poor irrigation and wastage of water. These all leads to insufficient water and no time management which ultimately leads to less agriculture production and poor water rate recovery.

Since 1980s many countries commenced adopting new approaches for managing their irrigation sector. These strategies mainly based upon decentralization of this sector. The concept of Irrigation Management Transfer (IMT) was used as a strategy for this transition. The World Bank defined PIM as "the involvement of irrigation users in all aspects of irrigation management, and at all levels". This means water users participate in planning, design, construction, operation and maintenance. Also these aspects include their participation in financing, deciding on rules and norms, monitoring and evaluating of irrigation system. The processes of PIM build two structures of capital namely; social capital (new institutions, skills, community action and leadership) and productive capital (better maintained irrigation infrastructure). Regarding governance concept, PIM represents a partnership between government, NGOs and water users.

Objectives of the Participatory Irrigation Management:

- To promote and secure equitable distribution of water among its users, adequate maintenance of irrigation system, efficient and economical utilization of water to optimize agricultural production.
- To protect the environment and to ensure ecological balance inculcating sense of ownership of the irrigation system in accordance with the water budget and the operational plan.
- To Bridge the gap between potential created and potential utilized.
- For Prompt attention to problems and resolutions of disputes.
- For Collective involvement in better application & management of agricultural extension services.

Selection of the Research Problem

Water is one of the basic elements required for the existence and survival of mankind. Besides quenching the thirst of living being, it plays lead role in agriculture sector as a critical input in the form of irrigation.

Participatory irrigation management influence livelihood through changes in agriculture and economy directly. Livelihood change is the one of the most important in any development activity.

We have selected the research problem “Study of Participatory Irrigation Management systems and its impact on sustainable development of tribal community “in Ver irrigation project. This project situated in Mandvi block of Surat district in southern region of Gujarat and project having 3500 hectare of command area. The reason behind that is the project is managing in participatory way by participation of users from last seven years by local people; it is also partnership of government department, farmers and non-government organization. Some more reason for selecting this project is following:

- It helps for preparing managerial improvement plan for overall system
- It helps to understand the partnership of government, non-government organization and farmers in irrigation management.
- It also helps to understand contribution of participatory irrigation management in rural development and contribution for changing livelihood of local people towards sustainability.
- It helps in understand socio economic impacts in village and contribution of work for betterment in lifestyle of tribal community.
- This can help to take the corrective measures to other PIM projects and can replicate to other areas.
- It helps to correction the policy and future plan.
- It helps to increase community participation at all level in this project and also in other part of state.
- The experience of last three decades shows that if farmers actively participate in irrigation management there is a marked improvement in water utilization in irrigation.
- There is big potential for involving farmers in irrigation management in Gujarat state because Gujarat having 67.60 lakhs hectare potential for irrigation and out of that state created 58.07 lakhs hectare for irrigation. Government report shows that 44.96 lakhs hectare maximum area utilized under irrigation up to June 2014 and also there is an act for participation of farmers in irrigation management from year 2007.

Objectives of the study

The main objective of this study is to know the impact of PIM on tribal sustainable living. It is a search for suitable managerial system that assures betterment in tribal living. The detail of the objective is-

- To know and assess institutional arrangements of the Water Users Associations (WUAs) created by NGO and government under PIM.
- To know the dimensions of managerial decision making process done with farmers and Water User Association to set up and run the system. And assess it on the scale of cause and effect relationship.
- To know the Role of NGO, Government and people/ farmers (people wisdom) for set up and run the system. Identify the factors that play significant role to manage this project sustainably as well as to bring desired efficiency and effectiveness in their performance.
- To know the change in crop productivity and change in cropping pattern in tribal area after such intervention of Participatory Irrigation Management

- To assess the impact of PIM on sustainable development of tribal community after such intervention.

Hypothesis of the study -

- PIM policy is favorable in the interest of those farmers who are having land in command area and are the members of water user association.
- Water user association manages the Irrigation management as per PIM act 2007
- Participatory irrigation management provides timely irrigation to farm thus helps to increase crop productivity, change in cropping pattern and increase area under irrigation.
- In this Participatory irrigation management the water user association receives rebate on time from irrigation department so repair of the canal network are in place.
- The Government and NGO support to Water User Association and ensure Participatory Irrigation Management at the field level.
- Water user association is financially sustainable and addressing the need of farmers for their development.
- Due to PIM system in this area people become more powerful to bring sustainability in the development effort
- In Comparison of other system in Gujarat, the Proposed Research project is working more effectively.

Significance of the study:

- The experience of last three decades shows that if farmers actively participate in irrigation management there is a marked improvement in water utilization in irrigation.
- Gujarat having 67.60 lakhs hectare potential for irrigation and out of that state created 58.07 lakhs hectare for irrigation. Government report shows that 44.96 lakhs hectare maximum area utilized under irrigation up to June 2014.
- There is an act for participation in irrigation management in Gujarat state.
- These study area farmers are managing project from year 2007. So the study will help to understand the features of the project that why and how farmers are managing this project from 2007
- It helps in understand irrigation facility and management of participatory irrigation management.
- It helps in understand socio economic impacts at village level and study will disclose about the real impact on the scale of the sustainability.
- It helps to plan for actual training needs of project farmers and also helpful in clarification of training content and way of training.
- It helps to target focus group of different types of stakeholders for training and other activities of water user association, so it helps move towards empowerment.
- This can help to take the corrective measures to other PIM projects and can replicate to other areas and also impact of act.
- It helps to correction the policy and future plan.
- It helps to increase community participation at all level in this project and also other part of state.

- This study will help to draw a suitable model for sustainable participatory irrigation management work.
- This study will disclose about Ver irrigation project and sustainability of livelihood of local people.

Research Methodology

Research area: Participatory Irrigation Management

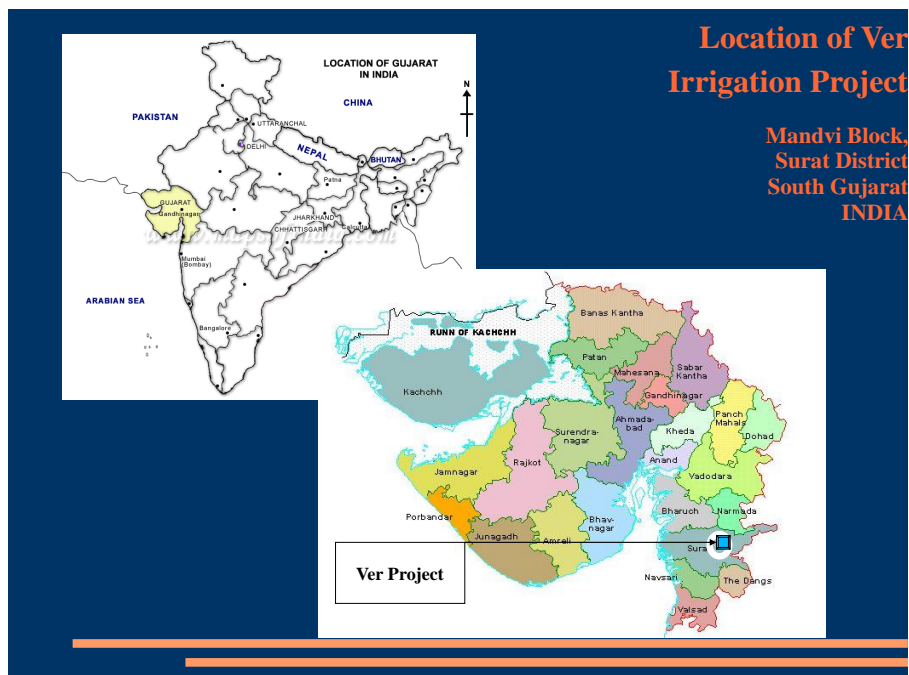
The concept of Participatory Irrigation Management (PIM) has been recognized all over the world as a tool for improving irrigation management along with sustainability of the system. Irrigation systems need to be restructured to make water management efficient. However increasing demand of water in all sectors including irrigation made it imperative that the efficiency of the Irrigation Water Management must be increased. National Water Policy and State Water Policy, lay emphasis on participatory irrigation management to be adopted as an essential strategy for improving the performance of all the irrigation projects and therefore farmers should be involved progressively from the grass root level particularly in water distribution & canal maintenance. Thus the Government has planned to involve farmers-users in a more systematic way, at least, at the tertiary level of the canal systems for alleviation of the management problems

Research Project

The Research project name is Ver Medium Irrigation project and it is situated in Mandvi block of Surat district in Southern region of Gujarat. In South Gujarat approximate 200,000 hectare area covered under participatory irrigation management and 262 water user association formed by government and NGO for irrigation management.

The covered project under this research Ver medium irrigation project located in Mandvi taluka of Surat district. Participatory Irrigation Management work is implemented from year 2007 in this project. There are 28 villages, 3500 hectare area and 3057 farmers come under project. There are 11 water user association in this 3500 hectare command area, 3057 members associated with this irrigation cooperative society(WUAs).The Participatory Irrigation Management work done by Irrigation Department,NGO name Aga Khan Rural Support Programme(India) and by beneficiaries.So Researched took village farmeres,NGO representatives and Irrigation Department staff as respondents.

Location (area) of Research Project: Ver Medium Irrigation Project located in Mandvi block of Surat district.



Selection of Respondents

Introduction of Universe, Selection methods and Sample Size

The researcher has to decide the sample size for study in advance, which means he has to decide in advance, the units, as a part of the universe which he wishes to study. Sample selection is very important in conducting research. The samples or the units which a researcher selects for his research should adequately represent it as a whole. If there is an error in the selection of samples, the whole study will prove to be meaningless. Therefore the researcher should carefully select the samples. Mostly random sampling is considered to be more convenient in research. Each unit gets an equal chance of selection in this method.

For the selection of samples in this study, a list of the members was available with the irrigation committee formed for the management of irrigation plan. 11 irrigation committees are formed with a total of 3057 members. 28 villages are included in it so that 10% of the members from that are selected as samples, which represent the entire members of the scheme, which are 305 farmers. In addition to that 2 farmers from the village of each irrigation committee are selected, who are not directly associated with this scheme, but who conduct farming in the village by themselves to earn living. 2 farmers per village are selected that means total 22 farmers are selected who represents non-beneficiary farmers. In addition to this, 4 officials from government irrigation department, associated with this scheme are also selected as samples, which represent the irrigation department. Apart from these 7 representatives of non-government organization are also selected as samples. Leaders from various committees like irrigation committee, milk committee and members of gram panchayat/ Sarpanch etc. are also selected as samples. A total of 409 samples are selected as respondents from various sectors, so that each village, farmer (unit and individual) gets an equal chance of selection through these samples. The details of each respondent are presented in the table below:

There are other people those who are associated with this project direct or indirect. Under Participatory Irrigation Management there are three types of stakeholder in this project. 1. Beneficiaries of project, 2. NGO

staff, and 3.Irrigation Department staff. So Researcher has taken these three types respondents. Apart from that for fulfilment of objectives it's needed to take sample of other farmers those who are living in same village but not a direct beneficiaries of this research project. There are others respondents like milk co-operative leaders and Gram Panchayat leaders, based on above different type of respondent the following types of respondents took for research work.

Type of Respondents

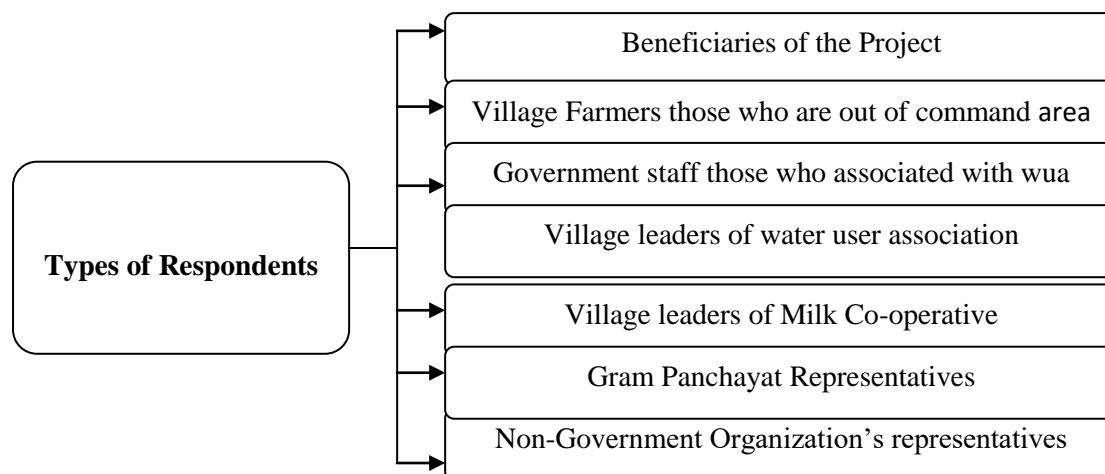
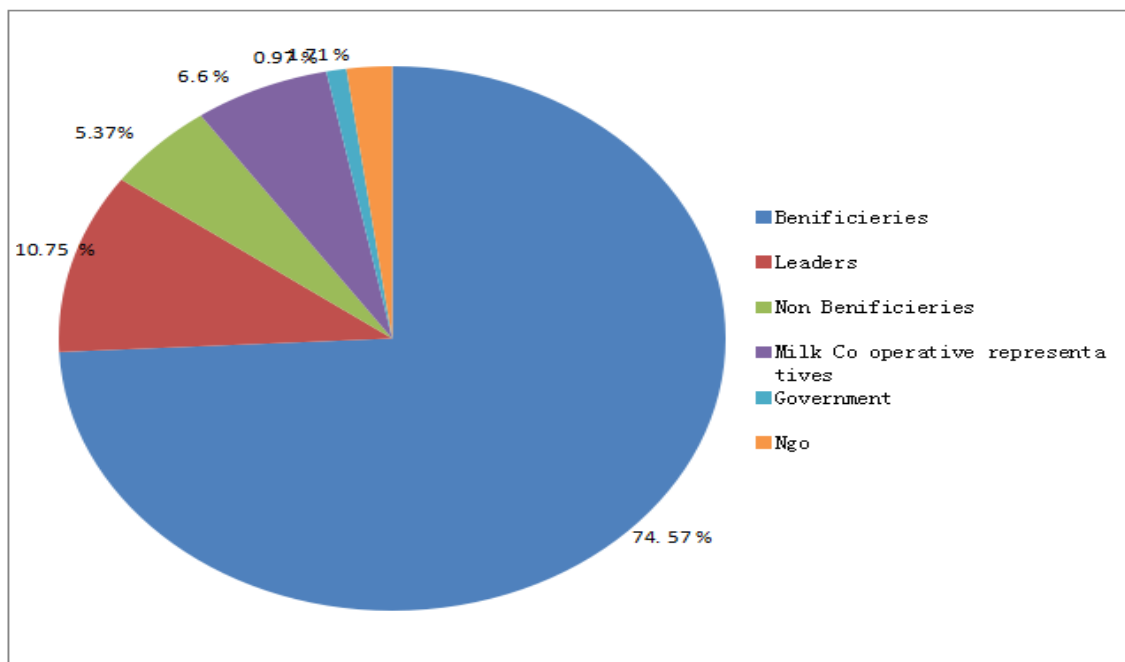


Table showing different types of respondents covered for research

Sr.No.	Types of Respondents	Nos. of Respondents
1	Beneficiaries of the Project – eleven water user associations	305
2	Village Farmers	22
3	Government staff – 4 staff members	4
4	Leaders of water user association – 11 WUA @ 2 members from each	22
5	Village leaders of Milk Co-operative : two society 3 from each	27
6	Gram Panchayat Representatives : two Panchayat – Sarpanch	22
7	Non-Government Organization's representatives	07
	Total	409

As per the above table total 409 samples took as respondents which types showed in following graph.

Graph showing types of respondents covered for research



Data Collection

Research is an important aspect whenever we are planning to undertake a new endeavor or a want to study about something. Thus research is the basis on which the success of the work is depended. Thus research method is used as a part of rural management. Each research is undertaken through a fixed method. Specific techniques and tools are used for the consolidation and analysis of the data. Various techniques have to be used for consolidating the data. There are two major sources to collect data for research related work, which are used for the study presented.

Primary information:

The information collected by the researcher himself for the first time is known as primary information. Information collected through observation, visits, questionnaire, schedule etc. is known as primary information. The presented information is collected from the research field.

Primary data collection done by personal visit, use of questioner and schedule, by doing case studies and taken from observation during visit and during group discussion with farmers and other respondents.

Secondary information

Information collected for any other purpose but used for the research purpose is known as secondary information. If a researcher uses the information received from any other individual or institution for his study during the research, than such information is called secondary information. Secondary information is mainly received from the documents. Such information is used in the presented study.

Secondary information collected by use of library in library related information collected through reference books, magazines, newspapers, scholarly articles, prior conducted researches etc. from the library. Apart from library information collected from government offices and panchayat like geographical area, population of the village, infrastructural facilities in the village, number of farmers, irrigation area, water recovery, information related to rain, technical details of the plan, details of amendment plan of the scheme, maps of various kind of projects, details of the production in the project area etc. Also Information collected from NGO, the organization at village level and through internet.

Data Analysis and Interpretation

Classification is a part of the detailed process of analysis. Until and unless the classification is done, it is not possible to identify and relate its various units. Tremendous information gathered by researchers is in the form of a raw complex data. No direct meaning can be extracted from it. Therefore to meaningfully interpret this information, it is essential to classify by corresponding it to the research issue. Coding of information basically comes under classification. Encoding is a process by which related diverse information is divided into sections or categories. To understand what the information says about the research issue, raw data is encoded and classified according to the groups. Through encoding the information is arranged in a manner suitable to the computer. Also the summary of this information is presented through charts and tables and interpretation of the same is done.

Corresponding to the research subject, collected data is simplified and clarified through different process. To analyses the collected data for research purpose, it passes through the below given process:

As part of data analysis first had done classification of collected data than done tabulation of data. After that comparison done of data and also interpretation of data. In this whole data analysis exercise use of computer also very important by using of computer programme like SPSS and excel whole data analysis done.

Method of report writing

As the study presented here is totally descriptive, it is divided into different chapters, with the aim of making it more interesting. Concise information related to the study is provided in these chapters. Sub-chapters are provided in each chapters as well as tables and classification is presented wherever required.

Limitations of the study

It is difficult to maintain the neutrality, authenticity in social science studies as it is maintained in natural science research because social science is mainly related to human reactions. These human reactions are impulsive. In the same way the scope of social science studies are steady and difficult to measure specifically. Each coin has two sides. Similarly, this study also has its utilities as well as limitations. In relation to the collected information for the research undertaken, “**Study of Participatory Irrigation Management (PIM) system and its impact on Sustainable development of Tribal Community** (A case of Ver Medium Irrigation Project in Mandvi Taluka of Surat District in South Gujarat) is able to achieve to some extent. Keeping in mind the decided objectives, efforts are made to provide information regarding the research study. Despite of this, according to the researcher, some limitations still appear in the research operations which are as follows:

- Samples collected for the study area limited.
- This research is conducted only for a project in the selected area of Mandvi Taluka.
- As the researcher is not a specialist in the research subject, it is possible that there are certain limitations or the subject is not fully explored.
- It is also possible that the respondents, who are farmers, have not answered appropriately for numerical questions or have provided false information which results in the possibility of error.

Result and Discussion

1. Respondents General Information

- 97 % respondents were from tribal community
- Out of total 31 % from head region, 32 % from middle region, 37 % from tail region
- Average family size was 5 members per family
- Average land holding 2.75 acre per family
- 95 % respondents engaged with animal husbandry activities

2. Institution Building and Management

A. Formation of Institution

1. Awareness about formation process: Out of total respondents 68 % respondents replied for the question of awareness about formation process of water user association and internal discussion among farmers during formation process, out of that 34 % respondents from head region, 39% from middle region and 26% from tail region. 32 % respondents not aware about this process out of that 28 % from head region, 33 % from middle region and 39% from tail region. The major part which not aware is from tail region out of 32 %, 39 % was from the tail region.

During formation process came to know that main five areas motivated farmers to join and form water user association. 92 % respondents said that assured water will provide by institution, 88 % said that water will provide easily, 69 % said that minimize the conflict, 53 % said that control on waste of water and 50 % said that management will done by villagers. It shows that the above main five areas motivate farmers to form water user association.

2. Immediate readiness for joining in water user association: Total 30 % respondents said that they are immediate ready to join in Institution out of that 21 % from head, 32% from middle region and 47 % from tail region. Readiness of head region farmers to join was 35 % and tail region farmers were 59 %. It shows that major part of tail farmers were ready to join in Institution and it also came out that initial very less part of farmers were ready to form water user association.

3. Role of Different Institution in formation of water user association: Respondents replied for the role of Non-government organization, government organization and water user association role. 71 % respondents aware about non-government organization role, 34 % respondents aware about government department role and 63 % aware about role of water user association. The main role of NGO was Individual contact with farmers, motivate them, plan training and exposure for knowledge, facilitate for Institution formation and take responsibility by farmers and concept development work. The role Irrigation department was to participate in meeting, gave cooperation to Ngo and help for construction planning, registration of water user association and technical guidance. The role of water user association was to join in meeting and as member, form Institution, get information and convince other farmers.

4. Awareness about Contribution for formation of Intuition and structure of institution: Out of total respondents 71 % aware about contribution for joining in water user association and 78 % respondents aware about structure of water user association. It shows that major part of respondents aware about that both area.

5. Membership in water user association: As per data shows farmers started to join in year 2008 as a member in first year 45% farmers become member, second year reached up to 71 %, third year covered 79 % and today 3057 farmers member in water user association. As discussed with leaders of water user association now no any farmers remain to join in water user association. If there increase new area than there is a possibility to increase members of water user association.

B. Water Distribution

1. Water Demand system: Out of total respondents 70 % respondents replied for the question of how they put the water demand, it shows that 70% farmers aware about water demand. The demanding water system was 45 % informed by filled up form and 45 % informing water operator. Rest were directly individually inform not by system. Related to the water demand 30 % respondents replied that they faced problem in that out of that 21 % from head region, 33 % from middle region, 46 % from tail region.

2. Awareness about water rates, water distribution and supervision system: Out of total respondents 79% respondents aware about water rates of water user association out of that 84 % respondents literate and remaining were illiterate respondents. It shows that major part of that were literate respondents. About water distribution part 55 % respondents aware about that and supervision of water distribution 64 % respondents aware about that.

3. Assure and enough water and complaint of water distribution: Out of total respondents 58% respondents said that they get assured and enough water for irrigation, out of that 42 % from head region, 32% from middle region and 26 % from tail region. It shows that for assurance of water tail area has less compare to middle and head region. About complaint in water distribution 46% respondents complained about water distribution and out of that 85% complaint resolved by water user association. It shows that the ratio of problem solution is good. About upper area farmers takes water without turn 25% respondents agreed in that this types of problem happened.

4. Water logging problem : Out of total respondents 30 % respondents said that they faced this types of problem, out of that 56% respondents from head area and 38 % respondents from middle area. It shows that the water logging problems was in head and middle region more.

5. System for conflict resolution and water distribution monitoring : During water distribution conflict came to water user association during that time 20% conflict resolved by understanding and convincing to farmers, 35% problem resolved by use of rules and regulation, 45 % water distribution related conflict resolved by supervision. The water user association supervised properly. The monitoring system for supervision of water distributions 70% done by water operator and 30 % supervision done committee member during water distribution.

6. Awareness about water recovery and system for water recovery: Out of total respondents 92% respondents aware about water charge and recovery system. 33 % responders said that recovery collected by operator, 44 % respondents said that recovery collected by secretary and 23 % said that recovery collected by chairman. Data shows that there were three types of system in place in different water user association.

7. Water recovery Comparison: Data shows that till today there is Rs. 57 lakhs due before PIM period recovery. After management taken by water user association from last six years 100 % water charges paid to government and got rebate (financial incentive) of Rs. 33.0 lakhs and paid to government of RS. 68 Lakhs.

8. Problems Solving Systems of Water Use Association: The problem solved by water user association by organized regular meeting, discussion meeting in presence of external person from government and Ngo also, plan training for farmers, make rules and regulation and follow that, supervision during water distribution with farmers involvement. As shared by respondents in 16 % cases of conflict they took help from NGO for solving that, in 10 % cases they took help from irrigation government. Remaining solved by themselves out of that in 7 % cases they involved village leaders like Sarpanch, other village leader for solving the conflict. So the water user association had a system to resolve their problem.

During discussion with NGO representatives and government officer it came out that the main area was from problem was turn in water distribution, recovery, area measurement, filed channel issue and problems between farmers to farmers. The main technique or strategy they used for minimize this tension were maximize individual contact and canal site visit, plan meeting and training ,with it tried to increase common understanding and motivate farmers. Plan “Shramdan” and activity done by farmer’s participation like area measurement so minimize the confusion and leaders discuss the work of water user association in social function regularly.

C. Canal Repair and Maintenance

1. Awareness about canal protection: The view of respondents about canal protection was 91 % respondents replied and out of that 92 % said that the responsibility of canal protection is Water user associations, 8 % said that that is responsibility of irrigation department. It shows that farmers accepted that canal is for the farmers.

2. Awareness about canal repair and Maintenance: The view of respondents about canal repair and maintenance was 89 % respondents replied and out of that 44 % said that government responsibility, 41 % said that WUA responsibility and 15 % said that it is a responsibility of both. It shows that the maximum respondents aware about that and as per respondents view ratio of responsibility were same.

3. Awareness about canal repair planning and tail area repairing planning: Total 63 % respondents replied about that and out of that 35 % from head region, 34 % from middle region and 31 % from tail region. About tail area planning 54 % replied, out of that 36 % from head region, 31 % from middle region and 33 % from tail region. It shows that awareness among canal planning was in all regions but overall awareness about canal planning and planning for tail area was less.

4. Participation & Awareness in “Shramdan”and canal repair work done by whom? : Total 98 % respondents replied and 96 % respondents participated in “Shramdan”.it shows that maximum farmers participated in this.

Respondents replied about repairing of canal, out let and field channel by government done 24 %, water user association done 36 % in canal and out let, 55 % part for field channel and NGO supported for canal, field channel and out let for 33 %. During discussion it came out that impression on respondents for repairing like new approved work take as a government,30 % of rebate given by government work done by wua was count wua work and also “Shramdan” count as a wua working support for repairing count as a Ngo supported work. It shows that wua took good responsibility to repair the canal. Data shows that wua work from incentive by government, contribution as 10% and “Shramdan” total amount is Rs.13 lakhs and NGO supported work also implemented by WUA was around Rs. 10 lakhs.

D. Management of Water User association

1. Awareness and participation in Annual Meeting: As per respondent’s views total 77 % respondent aware about regularity of annual meeting, about last meeting organized 77 % aware, 68 % respondents aware about what discussed in last meeting and out of that 47 % respondents participated in that discussion. It shows that major part was aware about annual meeting. Participation in discussion is less.

The area discussed in Annual meeting was timely water to farmers, timely recovery, rotation plan, control on waste of water, canal cleaning, leader’s selection, irrigation area plan.

2. Awareness about committee and other meetings: As per respondent’s views total 77 % respondent aware about regularity of committee meeting, 88 % committee meeting organized monthly and 12 % organized quarterly. Apart from this 49 % respondents about other types of meeting. It shows that for

committee meeting major part of respondents aware but for other meetings only 49 % respondents aware about that.

3. Meeting: During discussion with leaders ,NGO representatives and with Irrigation department officer it came out that there were seven types of meeting organized for management of whole work of water user association with clear agenda and discussion, during discussion it came to know that leaders were very aware about that.

4. Decision making system and communication system of decision: The views of respondents were 7 % respondents said that decision taken by chairman, 61 % respondents said that meeting, 32 % not replied about that. The respondents shared about how they came to know about decision.55 % replied and 48 % respondents get information in meeting, 26 % get by water operator, 20 % get individually and 6 % knew by Vethiya means local system to inform by some local person. It shows that major part of decision taken in meeting. Communication system with farmers 48 % connect by meeting and major 26 % by operator.

5. Communication system for farmers to water user association (how farmers raise their voice?) out of total respondents 66 % replied for that and the major system for approaching WUA was 38 % raise in meeting,28 % informed to water operator,13 % informed to secretary and 13 % Chairman, rest do individually. Data shows that major part approached in meeting, second way was with water operator and third chairman and Secretary.

6. Regular Contact with farmers: Out of total respondents 40 % said that water operator meet them regularly, 26 %,Said that secretary meet them regularly, 22 % said that Ngo and Go representatives meet them and 12 % respondents said that chairman and leaders meet them regularly. It shows that water operator and Secretary were the major part for regular contact with farmers.

7. Awareness about selection of leaders and responsibilities of them: Out of total respondents 60 % respondents aware about selection of leaders and 57 % respondents aware about selection of chairman.42% respondents aware about role of selection of leaders and 49 % respondents participated in discussion of selection. About awareness of responsibilities 49% aware about chairman responsibilities,48% aware about leaders responsibilities and 52 % aware about rules and regulation of water user associations.

8. Change in leadership: Among 11 water user association in last six year there were change in leadership in 3 water user association. During discussion farmers said that the existing leaders were ok for them, where they found to change they changed in 3 water user associations.

9. Success to giving water in tail area: Out of total respondents 86 % replied. Out of that 28 % said that success up to 25 %, 34 % said that success up to 25 to 50 %, 28 % said that success up to 50 to 75 % and 10 % said that success respondents more than 75 %.It shows that the major part is ratio 50 to 75 %.

10. Satisfaction to farmers due to WUA works: Out of total respondents 96 % replied. Out of that 20 % said that success up to 25 %, 29 % said that success up to 25 to 50 %, 10 % said that success up to 50 to 75 % and 41 % said that success more than 75 %.It shows that 96 % replied and out of that 41 % said that the ratio was more than 75 %.

11. Satisfaction to respondents due to WUA works: Out of total respondents 96 % replied. Out of that 20 % said that success up to 25 %, 25 % said that success up to 25 to 50 %, 16 % said that success up to 50 to 75 % and 39 % said that success more than 75 %.It shows that 96 % replied and out of that 55 % said that the ratio was more than 50 %.

12. Satisfaction to other respondents due to work: About other respondents view of work NGO representatives said that that was more than 75 %, Irrigation department officer 50 % said that ration is 50 to 75 % and 50 % said that more than 75 %, sarpanches view was more than 75 % and Milk co cooperative representative 25 % said that 50 to 75 % and 75 % said that more 75 %, It shows that major part of respondents ration is more than 75 %.

13. Key area which involved more farmers: Out of total respondents 72 % replied. Increase rotation is very important activity for farmer's involvement, than second 'Shramdan: involved more farmers than enough water for all farmers. Those were main activity which supported for farmers involvement. There were others activity also timely repairing, good management and water up to tail area also supported.

14. Women Participation: Out of total women respondents women farmers more aware about water distribution system ,water rates, getting water or not, opinion about water management and about canal protection they were gave answered for that, about 35 % to 40 % respondents from women gave answer. So these five areas they were more aware compare to others areas. 24% respondents aware about decision. Remaining area about formation, structure, water demand, meeting awareness less than 20 %.

15. Financial Sustainability: If we see financial status of water user association they were in profit after deduction regular expenditure, the income source of water user association was water charge income, 20 % rebate of water charge from government for administrative purpose and 30 % rebate of water charges from government for regular repair & maintenance, they charge farmers water charge higher than government. Every year they finalized water charge in annual meeting based on government water rate.

3. Livelihood Impact:

1. Change in Cropping pattern :

- a. Sugarcane increase from 12 % area to 84 % in canal command
- b. Vegetable crops increase from 2 % area to 5 % area in command
- c. Fodder increase from 1 % area to 3 % area
- d. Juwar crops decrease from 48 % area to 1 % area command
- e. Paddy crops decrease from 24 % area to 4 % area in command
- f. Groundnut crops decrease from 7 % area to 3 % area in command
- g. Farmers not grown Tuvar (pigeon pee) and wheat now before the area was 2 % and 4 % in command

2. Change in crop productivity :

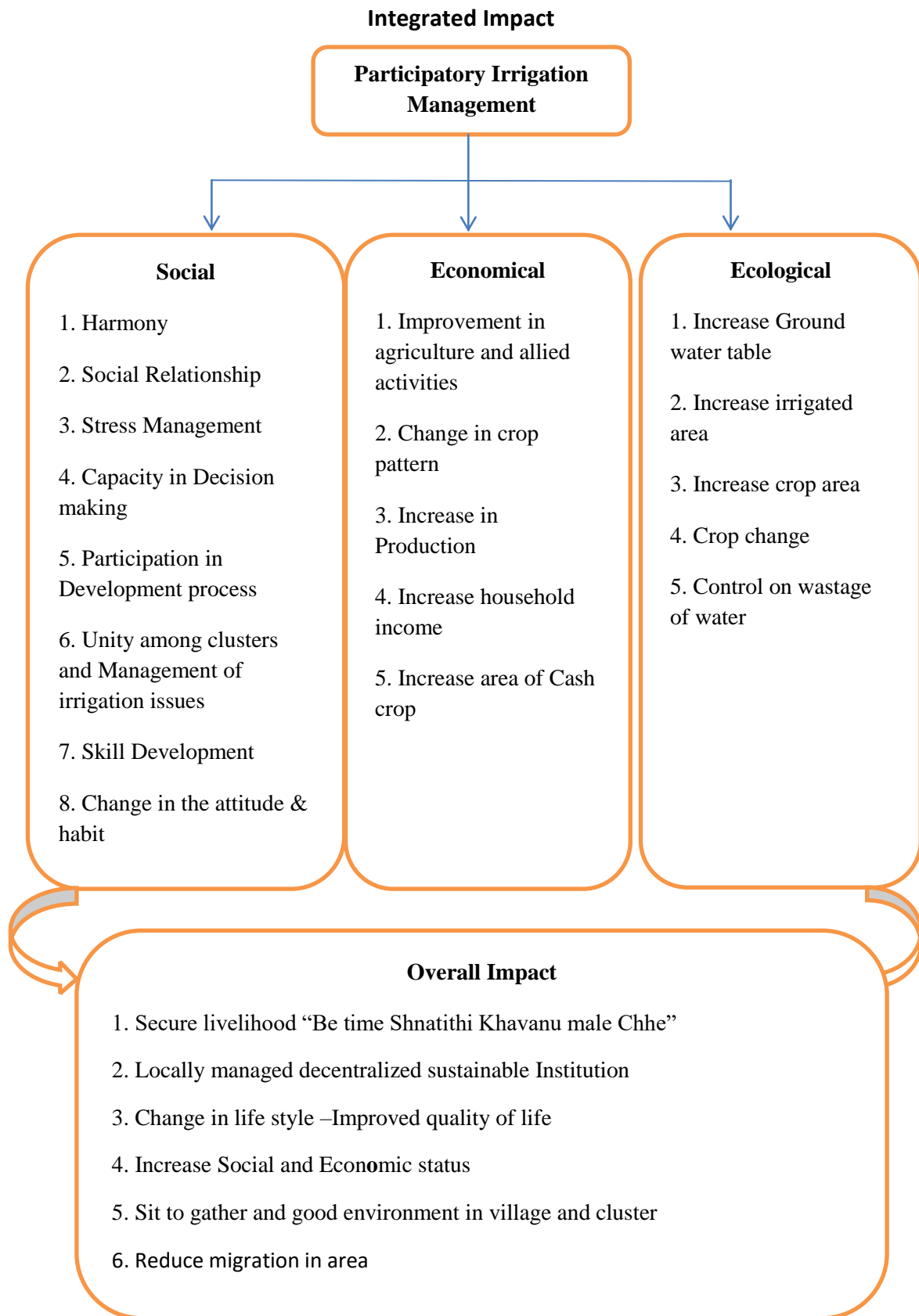
- a. Productivity increase in paddy from 6.2 quintal per acre to 11 quintal per acre, so increase productivity 56 %.
- b. Productivity increase in Sugarcane from 32 tons per acre to 42 tones in acre ,So productivity increase 76 %

3. Change in Crop intensity in Project :

- a. It shows that sugarcane crop area increase by 60 % against planning
- b. Wheat crop area decrease by 25 %, when project design the area plan was 28 % of total area and now 3 % area is covered under wheat area
- c. Groundnut area decrease by 4 %,when dam design the area plan for groundnut was 5 %,now area covered from ground nut is 1 %
- d. Fodder increase up to 18 % area. When the dam design there was no planning of fodder .currently total 16 % area under crops.

4. **Change in Asset Position:** The Asset position of farmers indicates the prosperity of farmers. Following is the change in asset position of farmers :
- a. Tractor in command area increase from 7 % to 13 %
 - b. Electric motors increase from 10% to 24 %
 - c. Diesel engines increase from 25 % to 46 %
 - d. Well increase from 12 % to 29 %
 - e. Bore well increase from 16 % to 47 %
 - f. TV/Dish increase from 24 % to 82 %
 - g. Mobile/Telephone increase from 36 % to 97 %
 - h. Freeze increase from 9 % to 47 %
 - i. Gas /Bio gas increase 28 % to 65 %
 - j. Two wheeler increase from 27 % to 79 %
 - k. Four wheeler increase from 3 % to 13 %
5. **Non Agriculture activities :**
- a. Household increases in Animal husbandry activity from 84 % to 95 %
 - b. Household decrease in labour work from 41 % to 37 %.
6. **Change in Non-Agriculture Income per year per family :**
- a. Per family non-agriculture average income per year increase from Rs.16852 to Rs. 33128, it is increase 96 %.
 - b. Per family average income per year in Animal husbandry increase from Rs.10885 to 21397 Rs.
 - c. Per family average income per year in Labour work increase from Rs.5967 to Rs. 11731.
7. **Change in Agriculture Income :**
- a. Per acre agriculture average income per year increase from Rs.10163 to Rs.58887 .It is increase up to five times.
 - b. Per Household average income per year increase from Rs. Rs.27885 to Rs. 160455 .It is increase up to five times.
8. **Change in Village level Milk Cooperative :**
- a. Data analysis from two village milk co cooperative one from head region and one from tail region shows that milk production increase.
 - i. Head region village milk production increase 33% and tail region milk
 - ii. Production increase 77 %.
 - b. Data analysis from two village milk co cooperative one from head region and one from tail region shows that Milch animal increase.
 - i. Head region village milk animal increase 14 % and tail region milch animal increase 20 %.
9. **Change in Animal Husbandry activity on respondents :**
- a. Household increased in Animal husbandry, 3 % household increased in buffalo and 4 % household increased in cow.
 - b. Milch Animals increased 18 % cow and 19 % buffalo.
10. **Change in Irrigation area :**

- a. Ver Project Irrigation area increased up to 2024 hectare, Before PIM maximum area covered under irrigation up to 1786 hectare in last five years. After PIM area covered under irrigation up to 2024 hectare.

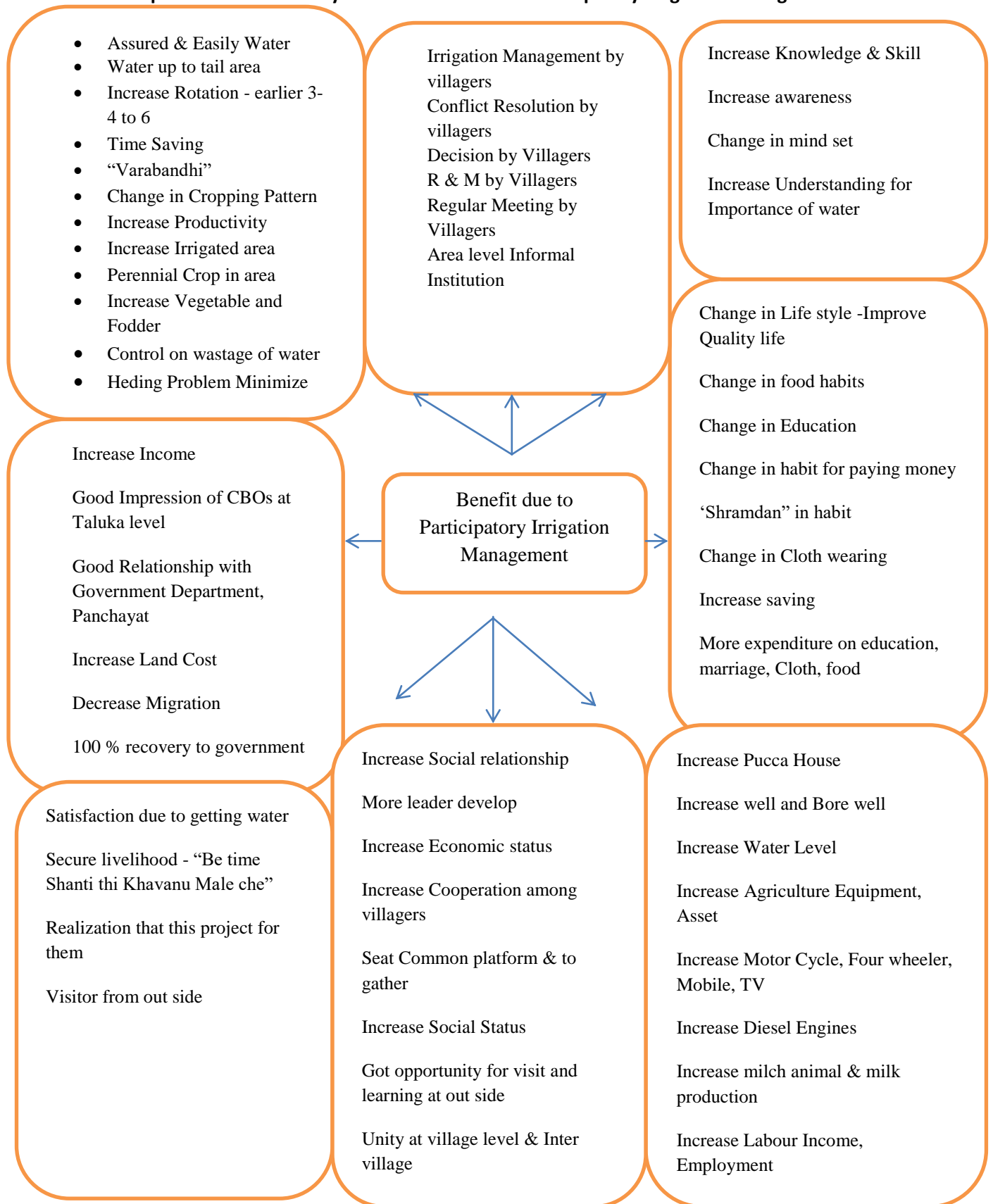


1. Sugarcane crop increased in the more 80% area in command, during discussion of group of farmers and respondents views it came out that the reasons behind that was :
 - a. Sugarcane give a good income
 - b. Market easily available for sugarcane in nearby area
 - c. After sawing this crop less labour work required for that.
 - d. Day by day due to irrigation labour shortage also in area
 - e. Schedule of irrigation project is on rotation base it is also supporting factor for this crops those who have not private source of irrigation.
 - f. Vegetable also giving good income but vegetable need more day to day monitoring, work compare to sugar cane and regular watering also.
2. Food crops decreased and cash crops increased in command area so farmers have to purchase food from market, may be in future food security problem can be rise one day. Food crops Juwar decreased, as per respondent's views the reason behind that was Juwar gives less financial income and need more days to monitoring and work.
3. Animal husbandry increased in command area and due to that fodder crops also increased.
4. Household level Income increased
5. Asset Increase : household level facility increased like mobile,gas,motor cycle,tv,freeze and agriculture asset like diesel engines, electric motor,tractor,well,bore well increased.
6. Bullock decreased in the area the reason behind that is good machinery available, young generation doing agriculture so they prefer machinery, required , skill problem also for using bullock, land decreases division of land among family members , buffalo increase in area means buffalo gives milk and also compost , bullock pair costly and also food expenditure of bullock also costly. Young generation also like to use machincary compare to bullock.
7. Farmers have lack of knowledge about sustainable farming they are more think on money and labour work instead of sustainable farming. Became much more dependent on fertilizers.
8. Role of Institution training in better management of project : Increased skill and knowledge among farmers :
 - a. Skill to manage construction work, accounts writing and knowing, Liasoning with government department.
 - b. Decision making skill about decision of water distribution, construction, repair and maintenance, management of water user association. (For examples, if any type of conflict occurred then WUA take decision quickly on the same day).
 - c. Conflict management of water management issue.
9. Strengthen from unity through federal system: Increase the cooperation among villagers. It helped to build healthy environment in command area and within and Inter village also, it also helped to build social relationship.
 - a. For example earlier due to water rotation there was problem between farmers to farmers in village, Now due to management by water user association everybody have turn for watering, also understanding and assurance, also operator for support and guidance so there were no tension about that so due to that there is a smooth relationship between two farmers and it effect village level, village level cooperation also increased and now due to that village level unity also increased. As per Sarpanch view it helped in panchayat development work also.

- b. Earlier due to water distribution tension there were problem between village to village also ,now there are 11 water user association and they planned water distribution and management jointly for that they together regularly and decide jointly. So conflict also minimize between villages so it helped to increase social relationship among command area villages and now due to that people also do the engagement and marriage of their children. They meet each other in social function also discussed about common development things
 - c. Change in mind set – ownership about project,"Shramdan",Regular pay to water charges, Irrigation with understanding, minimize conflict.
10. Decrease the conflict between them and strategically they motivate farmers ,Increase awareness among them
 11. Satisfaction due to getting water ,Secure livelihood - "Be time Shanti thi Khavanu Male che"
 12. Visitor from outside for visit their project.
 13. Well managed society system: Habits of Institution with system like regular meeting, Decision taken meeting with discussion. Sitting together regularly, Good impression of CBOs at taluka level in government.
 14. More leader due to decentralize management and Increase Social status.
 15. Increased ownership towards project and realized that the project is for them, they Work together for '**shramdan**' i.e. in rainy season the soil deposited and also grown unwanted plants in minor and sub minor canal. At the end of kharif season, from each household one member come and participates in Cleaning, Repair and Maintenance of canal.
 16. They also **learnt about water use efficiency** i.e after PIM they irrigate their crops according to growth stages of the crop or crop calendar.
 17. They follow the '**Wara Bandhi**' rule, it means when the Minor canal gate is open one by one they irrigate the farm sometimes if needed firstly the tail farmers take water then middle and end. Improve environment
 18. Recovery also occurred on time. Before PIM farmers did not pay the irrigation charges at the time some did not pay the money even after requesting. But after PIM they paid money at the right time so, government give rebate 50% of the total amount of charges and in last six years water user association paid 100% charges to irrigation department.
 19. Increased irrigated area and Increased ground water level also.
 20. Change in Standard of Living :
 - 1) Increase the standard of living of the villagers. After PIM, due to increase in income their living styles also improve. For examples, they reconstruct their house in better condition, starts using mobile, motorcycle, T.V, children go to school regularly and also send nearby town school by spending yearly 25000 to 30000 Rs.
 - 2) Earlier they compromise with cloth one pair for two year, three year now purchase new cloth every year
 - 3) Food habit also changed purchased basmati and Tuar dal from market for eats.
 - 4) Improve the health status of the villagers. They start growing vegetables in the small patch of the field or intercropping with main crop. So, daily get green or fresh vegetable. Eat vegetable from farm and also purchase from market (95 % family eat vegetable), earlier difficult to eat vegetable.

- 5) Drink tea with milk (90 % family) earlier compulsory Black tea (90 % drink black tea) ,60 to 70 % house hold eat milk with food
 - 6) In marriage earlier spent 35000 Rs. and in food they prepared rice and dal.Now there is a change in expenditure they spent minimum 100000 Rs. and in marriage they have called DJ sound system now, in food Sweet and Basmati rice, mineral water.
 - 7) Earlier they take money from money lender now take from credit society & Bank also
21. Based on discussion with respondents and during group discussion following area came out as an impact :

Respondents view on Key achievements due to Participatory Irrigation management



SOME FLAWS

1. Earning money is main objective of canal command area farmers So they using fertilizer more in agriculture ,they use four to five times more than earlier, so
2. Agriculture land will be unproductive in future.
3. Food crops decreased and cash crops increased in command area so farmers have to purchase food from market, may be in future food security problem can be rise one day.
4. Farmers have lack of knowledge about sustainable farming they are more think on money and labour work instead of sustainable farming. Became much more dependent on fertilizers.
5. They are facing problem of leakage and seepage due to that in summer they face shortage of one rotation and also water logging in area

Suggestion and Recommendation

- Due to objective of getting more money farmers grown Sugarcane and also using more chemical fertilizer, in future it will be impact on productivity of land and also in long run shortage of food so think also on
 - Water efficiency part may be use of drip
 - Change of crop like vegetable
 - Sustainable farming ,use of farm yard manure
 - Organic farming
 - It can be overcome through increase production of vegetable
- Annual meeting and committee meeting are organized with plan; focus should on regularity of village meeting connect all members with this meeting. So people can aware about all activity of water user association.
- More focus on leadership development and change leader as a part of system, Prepare alternative leadership
- The major part of farmers get message and regular contact with water operator and Secretary so it recommended ,take care about selection of employee and give regular training and update about wua work so farmers get proper information.
- Registration of federation of all water user association
- Whole Canal Network Rehabilitation ,Control on wastage of water
- Volumetric water supply
- Regular Evaluation of water user association should be plan with participation of farmers may be participatory evaluation with indicator like Water distribution and management system, administration (decision making, women participation, leadership, and meeting), asset management and efficiency, community participation, financial sustainability.
- Regular training for leaders for management and coordination meeting with government
- There should be plan of women participation in meeting, decision making system because more than 50 % of work in agriculture done by women.
- Regular plan of saving and create balance by water user association it helps to do future agriculture plus activities like credit for farmers, Agriculture input supply, marketing, may be in future agro processing things,education,health and may be other development things

- Plan of organize women members of area in institution form and in future they become women federation of 28 villages, they can focus on women issue and development issue of them and also area.
- As per data 97 % having mobile and more than 50 % having Television, think on use of that in as a part of communication and awareness programme of water user association so the awareness can increase among farmers.
- As per NGO & Go representatives views the recommendation were following :
 - NGO support at least five to six year – Gradually withdrawal , Do work Intensive for four year than Gradually decrease support from two year so slowly withdrawal from two year so total six year work plan should be there
 - Before handing over to WUA, Construction should completed 100 %
 - Regular Coordination meeting between WUA and Government
 - Panchayat and Sarpanch involvement from initial process of project.
 - Involvement of women from initial process
 - Linkage other agencies also like milk cooperative, agriculture department, panchayat from starting
 - Plan work on integrated way not only PIM ,do first two year PIM work than do plan of Agriculture, Animal husbandry
 - Project officer Training & Exposure plan regular , once in six month
 - Plan regular Sammelan, experience sharing work shop
 - Regular award,appreciation and evaluation system of work
 - Recommending of cropping patterns and Package of agriculture practices suitable for the WUAs farmers
 - Soil testing, water quality testing, water table monitoring salt-sodic correction
 - Post-harvest practice(grading, packaging storage and marketing)
 - Cooperating with others WUAs by federation (external area)
- Certification of person based on skill, so person can work as resource person in within area and also outside for the area.

**During discussion with respondents and group of farmers the following suggestion came out from them
foo need to support or do this.**

Need support from Government Department

- Regular Visit of Government Officer and provide updated information (Irrigation Department, Agriculture)
- Linkage with Government Scheme (Drip, Greenhouse, Seeds)
- Work for credit linkage & Animal Husbandry
- Need help for implementing rule, Defaulter recovery Collection Information about New technology
- 20 % local fund should give to WUA
- Not increase every year 7.5 %
- Improve Canal Structure
- Linkage Ukai to Godadha for enough water for Increase volume water
- Control on wastage of water
- Lining of Field Channel & Repair outlet
- Desilting of Dam

- Provide water as per Design in canal with full capacity up to tail area

Need support from water user association

- Increase Farmers Cooperation & Integration
- Increase understanding on co operation
- Regular Meeting & awareness programme – Change in mind set for free water
- Motivational Scheme for farmers
- Follow rules Regulation
- Accept new things
- Take responsibilities
- Integration of Other programmers for improving livelihood

Need support from Non-Government Organization

1. Long term Support
2. Guidance and
3. Extend Support of NGO

Verification of Hypothesis

1. Water user association manages the Irrigation management as per PIM act 2007

True : Water user associations manages the Irrigation Management as per rules declared by government of Gujarat and it is similar to PIM act ,because PIM act declared by government in 2007 but rules are not declared by government so now at present there are rules for PIM is on place for managing participatory irrigation management.

2. PIM policy is favorable in the interest of those farmers who are having land in command area and are the members of water user association.

True: By seen the impact of participatory irrigation management this hypothesis is true.

3. In this Participatory irrigation management the water user association receives rebate on time from irrigation department so repair of the canal network are in place.

True: Data shows that and during discussion found that all water user association got rebate after taking responsibility of water management. The water user associations done post moon soon repair and maintenance timely by using of rebate money and also doing by “Shramdan”.They have freedom to decide the post moon soon work on their own way and time.

4. Water user association is financially sustainable and addressing the need of farmers for their development.

Partially True: Water user associations are financially sustainable for managing their current Irrigation management business and they can provide water to farmers. But need to do whole canal rehabilitation for long assurance and for fulfilling tail area farmers need. Need to work on farmers other need like agriculture plus and other social need.

5. Participatory irrigation management provides timely irrigation to farm thus helps to increase crop productivity, change in cropping pattern and increase area under irrigation.

Partially True : Impact shows that defiantly increases productivity, change in cropping pattern and also increase area under irrigation but same time there are also need to focus on women active participation in water user associations and also on cropping pattern like food crops decrease,cash crop like sugarcane increase and also more use of chemical fertilizer.

6. Due to PIM system in this area people become more powerful to bring sustainability in the development effort

True: During research it's prove that due to this work people become more powerful of overall management of system on family base.

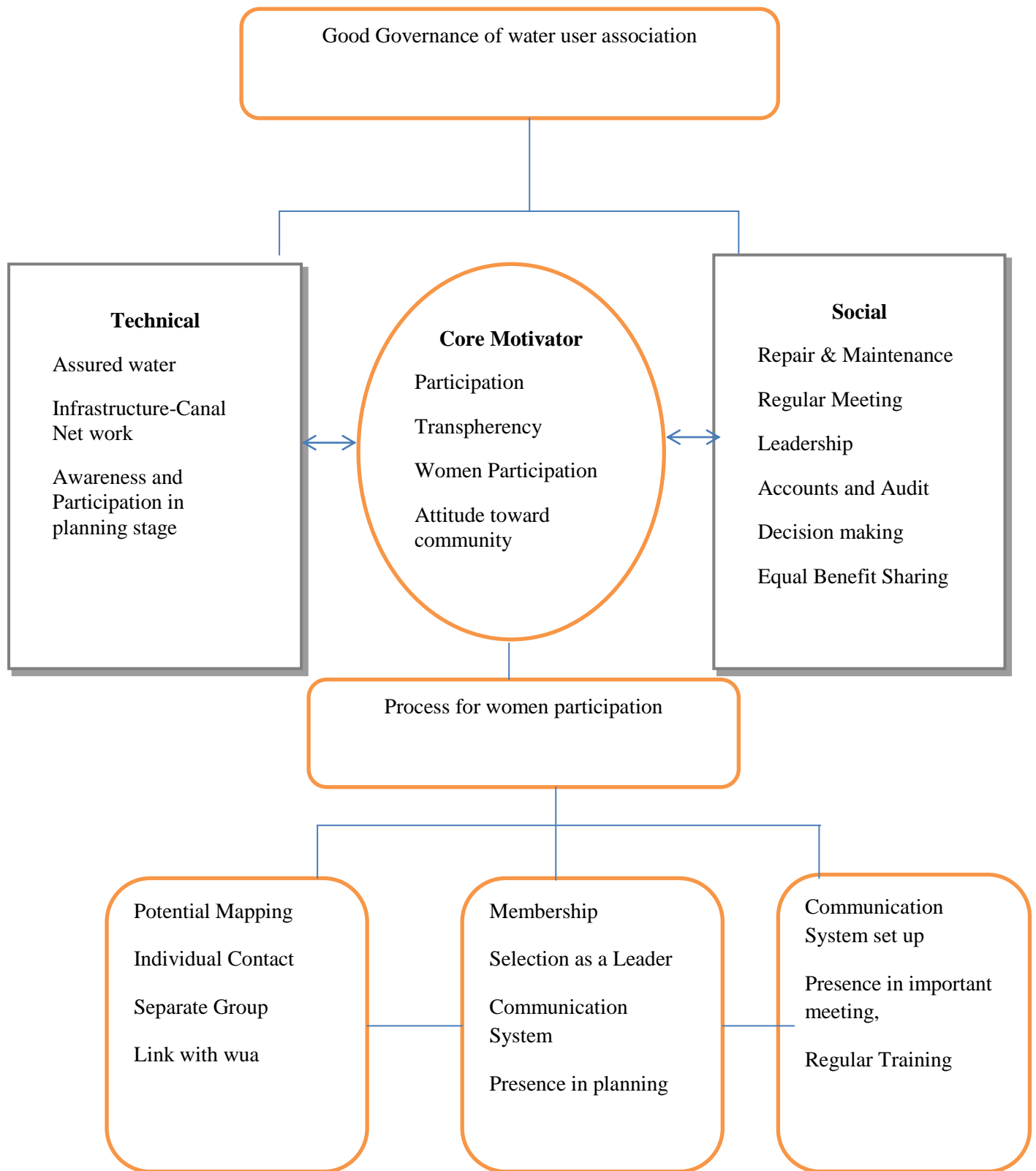
7. In Comparison of other system in Gujarat, the Proposed Research project is working more effectively.

True: It's found that compare to other project like manage by irrigation department this project 100 % managing by local people with 100 % recovery and with getting rebate and done repair and maintenance by own way. Decide water rotation and water charges by people. Conflict management by villagers and whole system management decision taken by beneficiaries.

8. The Government and NGO support to Water User Association and ensure Participatory Irrigation Management at the field level.

Partially True : It's found that in this project there were good support given by irrigation department and non-government organization but there scope of way to support by GO and NGO.

Proposed Model for work in Participatory Irrigation Management



Part – 1 Training Plan for water user association

Type of Training	Description	Content
Institutional Training	Member Awareness Training	Annual General Body Meeting Leadership Selection Participatory Irrigation Management Canal Irrigation Society
	Leadership Training	Budget,Accounts,Liasoning Employee Review Management, Conflict Communication
	Secretary Training	Account, Fund Management
Project Training	Project management training (Water operator, Chairman etc.)	Water Distribution Management, Monitoring of system
	Technical training/Construction training	Supervision of Construction Rehabilitation plan Quality of Material Workmanship Estimate & Rate
	Water Management training (Classroom and Field)	Water Management practices
	Agriculture training	Crop Planning, Agriculture Extension
Exposure	Internal	For visit of Good model
	External	For visit of Good model of PIM
Work shops	Work shop	Experience sharing & finalize Action plan
Mass awareness	Mass awareness	Awareness campaign in village level
Co-Ordination Meeting	Lower Level, Project Level, Circle Level	Review & Planning

Part – 2 Suitable approaches towards Sustainable development:

1. Goal Setting: Introduce MBO approach in finalize of individual and overall goal for water user association. Bottom up approach and assured the participation in decision making of all stakeholders rationally.
2. Change Mentality: Participation from Planning, Implementation and management. Hand over to community from initial stage act like community is owner and other stakeholder as supporter

3. Management as cooperative way, Demonstration of Value and system of communication to all beneficiaries.
4. Participation of Youth in all level and also regular participate for value addition among youth
5. Develop a second line leadership by using proper techniques and by delegation of authority as well as decentralization
6. Towards Self sufficiency
 - a. Resource naturally manage
 - b. Control over change in cropping pattern according to local needs
 - c. Water Efficiency –Volumetric use of water
 - d. Control on wastage of water – water logging
 - e. Manage and maintain – Diversity according to nature
7. Infrastructure development without disturbing the flow of nature and natural asset
8. Policy level management: timely direction, motivation at field, Education, TOT for farmers, work integrated way for betterment of life.

Brief about model:

The proposed model says that there are two major important aspects in water user association one is technical aspect and one is social aspect, when we work in technical aspect it is important that in canal project water source should be assured so there is no any issue in water availability, with water source the network of canal should be technically good means water can flow easily as per plan and design capacity. Most important things in technical part user participation and awareness from initial stage is very important. So the beneficiaries involved from day one in planning, discussion, decision making, contribution and implementation. It is important that the main role is should be users and supportive role from external agencies like government, on-government organization. So in this process the main owner will be community.

The second part is social aspect, after completing the project the repair and maintenance responsibility should be taken by water user association. Regular meeting for discussion, decision, and implementation and for future plan should be part of system and all stakeholders aware about that. One more important thing is leadership selection, development should be part of system. So institution has an alternative and second line leadership always. Decision making system should be strong and Transphorent. The most important part is benefit sharing is should do in meeting and equal. All types of users should be presence in meeting.

The core areas for work and also cross cutting common important area for good governance of participatory irrigation management are 1. Participation of user at all stage 2. Transpherency in work and system for this 3.women participation and attitude of all those who work with this should be towards community. This core area will be support for sustainable model and model will decentralize, representation of poor, managed by local people with taking care of natural resources.

Model also gives route map for training plan for water user association based on research study and discussion with respondents during research .Model also provide some suitable approaches for work like

participation, setting goals with bottom to top approach, management as cooperative way and leadership. May be model will be helpful for decentralised – local people managed sustainable water user association towards rural development for betterment of community.

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