INTEGRATED WATER RESOURCES MANAGEMENT OF A SUB-BASIN IN TAMILNADU-A CASE STUDY

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SYNOPSIS
The state has 17 river basins and 40000 small water bodies termed as tanks. These tanks were historically old and neglected due to poor maintenance. Considering the demand and supply in water sector it was felt that preservation of water bodies are vital. It is with this view the World Bank assisted program named as Irrigated Agriculture Modernization and Water-bodies Restoration and Management (IAMWARM) project is being implemented at a cost of Rs. 2500 Crore involving eight user departments namely Water Resources, Agriculture, Tamilnadu Agricultural University, Agriculture Engineering, Horticulture, Agriculture marketing, Animal Husbandry and Fisheries which made the project a unique one in the national context., The Project aims principally to restore water bodies and to provide more income per drop of water . The Upper Vellar sub-basin of Vellar basin where the developments planned were completed by line departments was taken up for rapid impact study. In order to assess the impact of the interventions with main focus on water conservation, a pilot study was undertaken by selecting one tank. The study reflects a visible positive change in the impact of increased storage, water management practices and livelihood of the stakeholders .
Key words :Water bodies, Global Water Sector, Yield

CONTEXT
Inspite of over a decade of global water sector reforms decade and substantial investments in the developing world, the water crisis has only deepened. Despite an annual investment of over $15 billion globally, 1.1 billion people live without clean drinking water, 2.6 billion people lack adequate sanitation and 1.8 million people die every year from diarrhea diseases. The economic cost of lost time in fetching water and environmental degradation is calculated at 1.4% of GDP for Bangladesh and 1% for Colombia. The world and particularly the highly populated countries like India are moving from water stress to water scarce situations. It is predicted that by 2025, 3.4 Billion people will be living in Countries defined as Water Scarce. Already nearly a billion go hungry without food In the face of such daunting challenges it is essential to reassess, rephrase and re-engage with Water. The UN World Water Development report 2006 states that *"(The) water crisis is largely our own making. It has resulted not from the natural limitations of the water supply or lack of financing and appropriate technologies, even though these are important factors, but rather from profound failures in water governance. Consequently, resolving the challenges in this area must be a key priority if we are to achieve sustainable water resources development and management."*
The UN further clarified that water Governance refers to "the range of political, social, economic, and administrative systems that are in place to develop and manage water resources and the delivery of water services at different levels of society. It comprises the mechanisms, processes, and institutions through which all involved stakeholders, including citizens and interest groups, articulate their priorities, exercise their legal rights, meet their obligations and mediate their differences". The declaration for the first time marked a substantive shift in the way the water sector was viewed. This shift is also echoed in the 2007 report of the International Water Management Institute (IWMI) titled, `*Water for food and water for life*' which studied the water resource crisis, especially in the agriculture sector. Stressing on the need to "Reform the Reform" process, the report highlights that "in the last 30 years attempts at agricultural water reform, have with few exceptions, shown disappointing results.

NEED
Neglected Infrastructure: Lack of ownership by Community and absence of grassroots level institutions resulted in dilapidated irrigation infrastructure, which was caught in a cycle of Built, Neglect and Rebuilt. The rehabilitation attempts were infrastructure centric & hardware driven neglecting partnerships, demand management or water productivity.
Lack of effective Strategies in the Supply side: There was no coordination amongst the Public Agencies in reaching the farmer at the grassroots. The Public Agencies who were working in the farm sector were working on the basis of targets without having any comprehensive strategy for integrating the functions of other Public Agencies as a result there was no synergy between the sectoral players.
Demand Management: There was a lack of perspectives amongst communities around water. Natural apathy fostering Individual greed overtaking the collective. The focus was on the here & now of exploiting the resource

for short term gains. The public agency and community interface was also that of supplier & beneficiary. Contrary to tradition, water was considered infinite, to be commandeered by the powerful and exploited as much as possible without consideration for conservation and sustainability. The community collective action was lost in a culture of largess recipient behavior, looking towards Government for everything.

Unreached Communities: There were limited interactions between farmers and Public Agencies. Elite capture to the detriment of the marginal farmers was common. The result was marginalizing of the small, reduced employment; farmers were loosing faith in agriculture as it was not remunerative in terms of both food security and family income. In a vicious cycle this further reduced their capacity and the buffer to face up to impacts of Climate change. An answer to meet these challenges lies in the IAMWARM project

Development Objectives: The development objective or the IAMWARM project is for sub-basin stakeholders to increase irrigated agriculture productivity in a sustainable water resources management framework.

Irrigation systems modernization in a Basin & Sub-basin framework: Seeks to improve bulk water delivery to irrigation systems through modernization of irrigation systems and service delivery and management in schemes in about 63 sub-basins. The two sub-components for this component include A1: Tank systems, and A2: Other irrigation systems

Agricultural Intensification and Diversification: Seeks to build on the improved bulk water delivery of the previous component to increase the productivity of agriculture-related activities through improved agricultural intensification and diversification in about 63 sub-basins.

Institutional Modernization for Irrigated Agriculture: Seeks to improve the institutional capacity for modern, efficient, and accountable irrigation service delivery. The scope of this activity is state-wide.

Water Resources Management: The objective of this component is to improve the institutional arrangements and capacity for sustainable water resources management

Project Management Support: This component will support the management and coordination efforts related to this project. A Multipronged Strategy has been adopted for realizing the aforementioned objectives.

Strategy 1: Deepening Democracy & Participatory Planning was the primary strategy which facilitated the involvement of primary stakeholders of the project (water users). The strategy also believed in inclusive approach, it included all water users in the village. Farmers were involved in assessing the water context in the village, expressed their felt needs which were incorporated in the objectives.

Strategy 2 : Convergent Continuum: The multi-sectoral issues in the field of 'Agriculture and Water' required different Departments, that were working in isolation, to come to a common platform in order to understand the problems of the farmer in a wholistic manner and ensure collective effort for achieving sustainable development in farm ecology and economics. The strategy is called "Convergence", IAMWARM initiated the process of 'Convergence' amongst 8 Public Agencies that are directly associated with Development of farmers in Tamil Nadu.

Strategy 3: Involvement of Civil Society. The series of "Think out of Box" exercises within the organization resulted in identification of like-minded individuals from NGOs, farmer orgnaisations, Women Self Help Groups, Students Forums and etc., This group is called "Critical Mass" or "Tipping Point Change Agents" through which expansion of change initiatives have been carried out.

Strategy 4: Model Villages: It is advisable to implement the change initiatives on pilot basis then expand it to other villages. 224 villages were chosen to pilot the change initiatives. These pilot villages showed the positive results and they are gradually being replicated in adjacent cluster of villages.

Strategy 5: Bringing Government to your door step: One of the innovative strategies was to establish "Single Window Centers" (SWC) in each of these villages; SWC is a place where a periodic interaction with village community is held by the Public Agencies. SWC has been functioning in 224 villages benefitting 112000 farmers, of which 65% are the small and marginal farmers who were not reached before the commencement of IAMWARM Project.

IAMWARM DESIGN

The Multi Disciplinary Project Organization (MDPU), an institution of the Govt of Tamil Nadu initiated discussions with all the water using entities like Agriculture, Horticulture, Agricultural Engineering, Agricultural University, Agricultural Marketing, Animal Husbandry and Fisheries Departments in the supply side and community & civil society in the demand side. The MDPU initiated consultations across 60 sub-basins through Water Walks, discussions with focus groups and a comprehensive participatory assessment was undertaken along with the farmers in order to assess the concerns, issues and opportunities prior to commencement of the project. It was a challenging context for TN-IAMWARM Project which had to think out of box for addressing Service Delivery in the context of Climate change. The MDPU led the implementation of the program involving multiple agencies working in partnership with MDPU around water in Agriculture,

Irrigation, Research and support in Aquaculture and Livestock (Water Resources Department, Department of Agriculture, Horticulture, Agricultural Engineering Department, Department of Fisheries, Animal Husbandry).

IMPLEMENTATION STRATEGY:

Consultative Planning: The program is an outcome of a bottom up consultative process of supply side agencies and more importantly water users. Water Users Associations & Farmer Associations were important partners in the programme. The MDPU Team introduced concrete answers through the IAMWARM Programme for mitigating the adverse impacts of climate change by addressing the challenges of "water crisis and food security" by multipronged strategy.

Addressing challenges of Water crisis: The programme enhanced the availability of water through series of interventions such as infrastructure development for improved storage, effective & efficient water Management by reducing water loss through propagating & promoting conveyance and application efficiencies, deepening democracy by community organization and formation of Water User Associations (WUAs) through democratic process and Capacity Building for realizing a Shared Vision towards improved service delivery.

The storage in tanks in 61 Sub-Basins has increased by additional 10% amounting to 2 TMC (Thousand Million Cubic feet). An area of 4000 hectares (9849 farmers) had been brought under Micro Irrigation Systems with high tech Cultivation leading to 40% water conservation.

Social Mobilization and Auditing: About 2500. Water Users associations have been established conducting elections to cover all the tanks in the IAMWARM Project area of 6.17 lakh hectares. The democratic process involved preparation of Voter List, Verification, Elections, and publication of results which is a huge task accomplished through IAMWARM Programme. The Community Based Water Management initiative has resulted in sharing of responsibilities for water preservation and conservation, equitable water sharing which is attributed for more land under cultivation.

Community Collaorative Water management: Vision, Water Budgeting

Training on the roles and responsibilities has been imparted to all the WUAs. A Community Based Water Management a Special training designed to bring about Perceptional Changes by Creating a Shared Vision on Water, Water Budgeting and Supply-side management has been imparted to select WUAs whose network is set to enlarge its coverage.

Improved Service Delivery through Convergence: Changes were catalyzed both at the supply side and demand side in order to improve the service delivery. The foremost initiative was Integrating the activities of 8 Public Agencies involved in water supply & usage through a process called "Multi-sectoral Convergence" with a shared Vision. The process facilitated the Public Line Agencies to device integrated strategies and plan collective action points to be implemented in 24000 villages.

Addressing the challenges of Food security:

The programme also addressed food security challenges by enhancing food availability through a Safety net comprising multi-faceted interventions to achieve improved productivity, Increased water Productivity, diversification from water guzzling crops to less water consuming crops, seed to Plate Market interventions - Commodity Groups, Agri Business Centres and evolving Public-Private Partnerships to build Nutritional Security with Pulses as focus.

IAMWARM Programme implemented interventions to augment the agricultural production through modernization and intensification. System of Rice Intensification (SRI), Crop Diversification (Low Water Intensive Crops with high profit scope) combined with Water Management activities were implemented jointly by the Public Agencies which resulted in savings of water, increased land under irrigation, augmented agricultural production and increased income for the farmer. It also generated more employment opportunities for a number of landless Agricultural Laborers who were trained in skills pertaining to SRI and other modern agricultural practices.

Crop Diversification considered as a major Climate mitigation strategy owing to its water conservation and nutritional impacts is a major intervention of the IAMWARM Programme. An area increase of hectares have taken over by less water consuming crops like Maize, pulses, Sun Flower Vegetables, and Fruits saving 5 TMC of water. This would mean so much of water is now available to the gap areas of unreached farmers**.**

'Seed to Plate' Market Interventions: 471 Commodity groups have been formed for Maize, Groundnut Chilies Vegetables etc. Public-Private Partnership with Poultry feed Manufacturers, and Retail Market Chains like Reliance and Heritage Foods which empowers them to get fair price. An innovative partnership with TATA SONS has been arrived to ensure Grow More Pulses with by back arrangement**.** These interventions have provided the resilience and acted as coping mechanisms against adverse impacts of Climate Change.

The obstacles: The obstacles were more of behavioral in nature than physical.

Programmatic: The Basin/sub-basin framework was not easily acceptable by the public line agency personnel. It was also not easy at the village level to make farmers understand the concept. A series of consultations and orientation programmes were conducted to mitigate the obstacle.

Perspective & Attitude: The Programme Managers had to deal with indifferent attitudes, both at Public Agencies and Community level. One of the main obstacles at the village level was lack of a common perspective in terms of management of water bodies. The village community was also gradually losing faith in Public Agencies.

Cultural: Water is being treated as God's gift but it is taken for granted. Particularly after the announcement of free electricity for pumping out water for irrigation from wells, the water bodies became orphans, there was nobody to foster water bodies which were primary source of water both for domestic and irrigation. A constant sensitization process of community has now brought different groups in the village to work together for the cause of water.

Sharing power & water: Power structure at the villages has its roots in culture and tradition. As far as water is concerned, a family would have been holding the responsibilities of maintenance and management and it is hereditary. There was frequent tussle between the traditional leaders and newly elected leaders. The long term water perspective with a water vision has brought them together. One of the critical achievements of the Water Users Associations (WUAs) has been the 'equitable distribution of water' which was achieved by overcoming obstacles relating to power sharing at the grassroots. These obstacles were addressed through series of IEC (Information, Education, Communication) and capacity building activities. Any change initiative will be opposed with iron hands. Here too, the Programme Managers had to face such people. They were met individually and in groups, gradually after witnessing the results they too wanted to be part of the change initiatives. Initially there was a small team which could not facilitate the implementation of change initiatives. This team was gradually expanded with more and more people. Showing the results removed many of the obstacles.

Human Resources: Human Resource has been the primary source of energy which was tapped, fine-tuned, utilized and fetched good results. The individuals who had inclination for change initiatives were identified and used effectively for up scaling the initiatives. The programme works with 4000 personnel of 8 Public Agencies, 40000 farmers from 3695 WUAs without additional expenditure on staff cost. Proactive and Change Champions from the civil society organizations have been identified and involved in programme facilitation. Traditional Wisdom of people in terms of water management has been rediscovered, rejuvenated and spread across effectively and widely. Technical expertise is already available, it was only fine tuned.

Policy: National Water Policy as well as State Water Policy of Tamil Nadu emphasize the need for development and management of water resources with a river basin as an integral unit.

Tamil Nadu Farmers Management of Irrigation Systems (TNFMS) Act: Now there is a policy and Act for strengthening grassroots level institutions for management of water and water-bodies. About 2300Water Users Associations have been formed under the TNFMS Act. The WUAs are permanent bodies electing the representatives through democratic process, once in 5 years.

SUSTAINABILITY: INSTITUTIONAL

Grassroots level institutions: Water Users Associations (WUAs) are the critical grassroots level institutions which have been constantly facilitated to enhance their capacity for implementing water management activities and carry out maintenance activities of water-bodies. More than 50% of the WUAs have started to run the programme on their own with little outside support from Public Agencies.

Public Agencies: The change initiatives have been systematically institutionalized within the 8 public agencies. The paradigm shift in service delivery has been deeply rooted in to the Public Agencies.

Basin/Sub-basin Boards: Basin boards have been formed, which are permanent and independent in nature, for protection and nurture of water bodies linked with the concerned river basin. The Basin boards have people's representatives of different levels, technical experts from public agencies and representatives from civil society organizations. The basin board prepare Integrated Water Resources Management (IWRM) plan for the basin and implement the same.

SWaRMA: State Water Resources Management Agency (SWaRMA), as the State-wide focal agency for environmentally and socially sustainable inter-sectoral water management, has been constituted as a permanent body. This is the critical institutional arrangement under the programme for ensuring sustainability of Integrated Water Resources management (IWRM). SWaRMA has started to function with objectives to improve the institutional arrangements and capacity for sustainable Water Resources Management in the state and to develop and manage the water resources of the State in a holistic way in a river basin.

OUTCOMES:

There is a New Paradigm in Peoples movement for the cause of water initiated and it has been moving forward with a long term water perspective. This is a significant step forward. The Physical impacts are

Increase in area under irrigation : 21000 hectares
Increase in storage : 10% in tanks,
Agricultural Intensification : 151313. hectares,
Agricultural Diversification : 74349hectares
Increased crop production : Paddy 30%, Maize 50%, Vegetables, fruits **and pulses 30%, Ground nut**

Crop diversification has also had health benefits by supplying proteins to the poor. It has been estimated that several agrarian families have been benefited by increase in income, thus helping themselves to overcome poverty. 150000 on farm employment opportunities have been created which had direct impact in reducing migration from rural to urban. Food security has been ensured through enhanced production, improved water productivity and increased intensity of irrigation. Repair, Renovation and Restoration (RRR) of water bodies has been the primary focus of TN-IAMWARM Project under Integrated Water Resources Management (IWRM). The convergence approach involving farmers and line agencies in Integrated Water Management has produced tremendous results in water savings attributing to increase in area under cultivation and increased food production. Impressed by above achievement, Government of India has advised other states to adopt TN-IAMWARM project's RRR and convergence approach. Tank Projects in Orissa and West Bengal have introduced these concepts. System of Rice Intensification (SRI) has brought a revolution in paddy cultivation which not only augments rice production but also contributes for water savings. Studies carried out by Tamil Nadu Agricultural University (TNAU) in 100 locations have indicated 32 per cent water savings, which is corroborated by farmers who could increase their cropped area by 40 per cent with the same quantity of water. The average yield increase was 40% compared to the conventional method. After witnessing the results, thousands of farmers have taken up SRI in their fields. Government of Tamil Nadu, in its Agricultural Policy note tabled in the Legislative Assembly has announced that SRI will be extended to 7.7 lakh hectares. Other State Governments in India have also been looking up to IAMWARM Programme to provide technical guidance for expansion of SRI technology in their respective states.
The World Bank, which has been keenly observing the SRI expansion process in Tamil Nadu, has invited the IAMWARM Programme personnel to provide assistance in Middle East and African countries like Kenya, Mali, Angola and others. Recently the World Bank President, Rober Zoellick, has appraised the Prime Minister of India saying that "*This emerging technology not only addresses food security but also the water scarcity challenge that climate change is making all the more dangerous. These area all lessons for our world"*.

UPPER VELLAR A CASE STUDY:
The river Vellar originates from Kalrayan hill (Fig 3) in Salem. District of Tamilnadu and empties in to Bay of Bengal near Cuddalore. The Vellar river basin is located in the Northern part of Tamil Nadu State in South India, between the latitudes 11° 13'N - 12 00' N and longitude 78° 13'E –79° 47 E. The total area and length of the basin are 7520.87Sq.Km and 150km. The river has six tributaries. The river is a seasonal one which receives only with flash floods. The total length of the river is 150km covering five districts In the present TN-IAMWARM project the Upper velar river portion was taken up (Fig 1) as a case study for a post project analysis.

HYDROLOGY
Vellar river basin lies in the tropical monsoon zone. Based on the hydrometero logical feature of the basin. One year is divided into 2 periods (i.e.) 1) Monsoon period from June to December and 2) Non-Monsoon period from January to May. The monsoon period is further sub-divided into Southwest monsoon period from June to September (4months) and Northeast monsoon period from October to December (3 months) similarly, the non-monsoon period is further sub-divided into winter period between January and February (2 Months) and summer period from March to May (3 months). But in the case of non-monsoon, the rainfall is insignificant**.** The weighted annual average rainfall works out to 847.5mm.

ANALYSES OF THE PRE PROJECT CONSTRAINTS
The Upper Vellar sub basin consists of 79 anicuts and 70 tanks. The total irrigated area of this sub basin is 10,572 ha. The livelihood of the people depend mainly on the agricultural and agricultural related activities. The irrigation systems have a significant role in the success of agriculture allied activities. However at present, this system and its tanks serve at most 30 to 40% of its potential.. The main constraints identified were the dilapidated conditions of the water bodies and conveyance systems, adoption of cropping pattern without any relation to water availability , lack of awareness of frontier technologies of water management and crop production, non cooperation among departments, inadequate post harvest facilities and livelihood support. The cultivation was mainly paddy with no diversification and the water was available only for the upper reaches. This has resulted a gap of about 30% in irrigation capacity. This indicates a gap in utilization of its full potential. With no new source to harness, the available source were to be revamped to utilize to its optimum.

STRATEGIES ADOPTED

The analyses of the pre project conditions by a joint walkthrough by multi sectoral and multi stake holder community brought to focus to light the needs of the system and community and a development plan was arrived at. In the present project the rehabilitation of structures which is one of the major constraint were carried out by Water Resources department and thereby improving the storage capacity (Fig 2). The proper utilization of the water was done in collaborating with other eight departments. The gateway to new technology was opened by T N A U. The crop diversification process was initiated by Dept of Agriculture. The adaptation to new irrigation systems and necessary trainings for minimizing water usage was the task of Agriculture Engineering Department. In order conserve water, less water consuming vegetables , introduction to tissue culture and hybrid varieties were initiated by Horticulture department. The post harvesting facilities and promotion of commodity groups were promoted by Agriculture marketing Department. The alternative concept of livelihood measures like improved artificial insemination and animal health care maintenance, increasing milk production and aquaculture were the contributions of department of animal husbandry and fisheries respectively.(Table 1).

SUCCESS OF THE INTERVENTIONS

The monthly rainfall pattern was studied and it was in the year 2008 rainfall is low and 2009 and 2010 year rainfall was above average. The maximum rainfall was registered in north east monsoon in all the years. The rehabilitation measures by water resources department has helped in turn for more storage of rainfall run off quantity. Yield run off quantity was estimated based on the USCS method as adopted by Jennifer Latha et al (2010).The quantities of runoff estimated are 0.76. 1.21 and 1.3 Million Cubic Metere (mcm) respectively for one selected tank. The rehabilitation measures in the form of increasing storage and reconstruction of bund has resulted in more storage of water. The bunds also served purpose of road conveyance for the harvested products which was a boon to the remote fields where roads were not in existence prior to the project. The repair works carried out for canals and anicuts have ensured service to tail end and brought in . The number of water storage days increased by 1 to 2 months and ground water table has risen by 1 to 2m. Effective functioning of Water Users Association resulted in timely water distribution service. There was a paradigm shift from conventional paddy to the new technology of System of Rice Intensification cultivation. The farmers also adopted crops like maize, pulses, coconut, arcnut etc as a part of crop diversification which resulted in decrease in Paddy area leading to water savings . The fodder cultivation and aquaculture activities started picking up resulting increase in milk production and more income which was not in existence prior to the project. The Agro Business Centers were started and conveyance vehicles for products provided played a major role in terms of value and remunerative prices which was not possible early. All the villages were sensitized about the Community Collaborative Water Management concepts to understand about their effective water management with the available resources

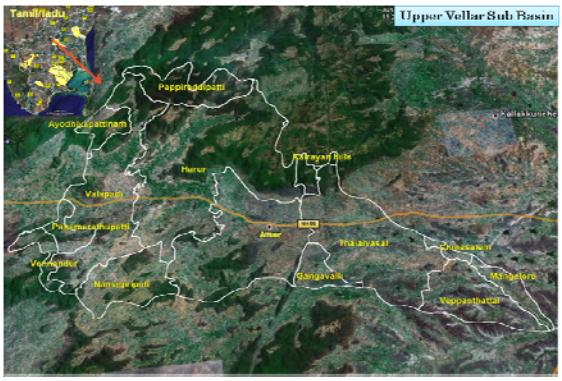


Fig-1Basin map

Fig-2 Rehabilitation of water bodies

Table 2 DETAILS OF INTERVENTIONS

Sl	Constraints	Intervening Departments

No		
1	Poor infra structure facilities and maintenance of field channels and Excess water received at a given point of time, not impounded and utilized	Water Resources Dept (W R D)
2	To increase the crop productivity and area by diversification and intensification, water saving technologies , Agro climatic suitable crops	Tamil Nadu Agriculture University (T N A U)
3	Lower crop yield and dissemination of new technologies, Information Education Communication	Dept of Agriculture (D O A)
4	Non – adoption of modern micro irrigation methods and new agricultural practices	Agriculture Engineering Dept (AED)
5	Introduction of Hybrid varieties in Vegetables	Dept of Horticulture (D O H)
6	Lack of post harvest management facilities	Agri Marketing Dept (AMD)
7	Other livelihood support like aquaculture and fish farm	Dept of Fisheries (D O F)
8	Adopting fodder cultivation and increasing cattle population	Dept of Animal Husbandry (D O H)

RESULTS OF THE INTERVENTIONS`

Tanks were selected randomly and social and economics were studied. The social impacts of the project were studied by Institute of Sustainable Development (2010). The farmers were able to diversify crop and saved water for one more crop. In selected tanks with insufficient water and adopting modern irrigation technologies had good yield compared to normal yield. This change was perceived only after project.. Before the project water was insufficient and traditional ways of irrigation was adopted resulting poor yield. There is an increase of about 25% in the cultivation of horticulture crops like banana, vegetables such as brinjal, tomato, bhendi, raddish, turmeric and tapioca.SRI cultivation of paddy was popularly adopted by farmers. Nearly more than 38% of paddy is cultivated under SRI. Average yield per acre for farmers practicing S R I showed an increment of nearly 912kg more per yield per acre. The agro marketing department provided facilities in the form of opening of agri business centers, collection centre, drying yard, storage godown and vehicles to transport goods. Apart from this commodity groups were also formed. Fodder crops were grown in the tank area which in turn resulted in increase in yield of milk. Moreover the green fodder replaces the concentrate feed which in turn has reduced feeding cost of the farmers. Aquaculture was promoted by fisheries department. It was carried out in five farm ponds .The fish production was increased by about three times. As per the study report of SMEC (2011) the farm economy was increased by 40%. The interventions have resulted in higher water table by 1.5m and water was available throughout the year. Apart from this the capacity was increased by about 2%. to 5% . The increase in area irrigated was by about 11% to 14%.The interventions resulted in improvement in ground water source and effective tail end service delivery (Fig 3 to 6).

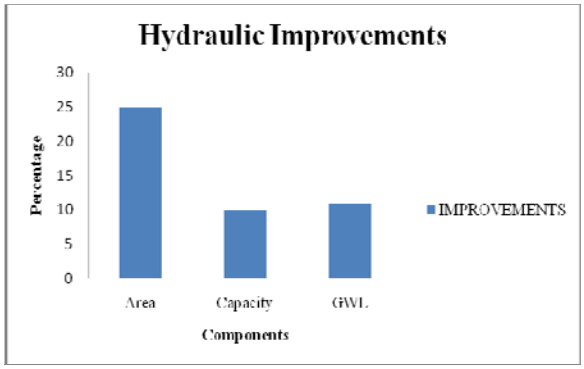
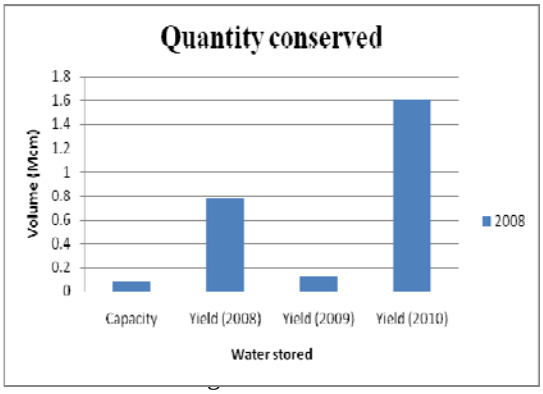
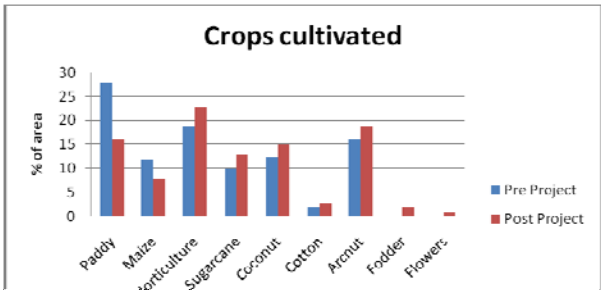


Fig-3 – Improvements





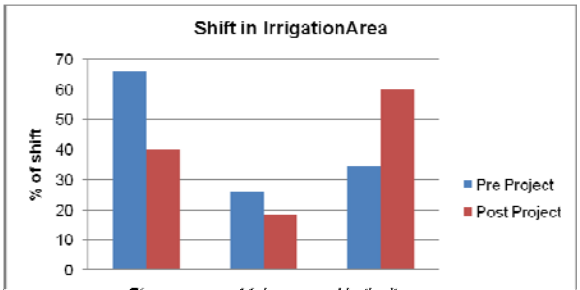


Fig-5 Improvement in crop cultivation

Fig-6 Increase in crop diversification

SUMMARY OF OBSERVATIONS

The post project impact analysis indicates a positive trend in the interventions of the line departments. The storage capacity of tanks were increased by 11% resulting in the increase in irrigated area by 12% and rise in water table by 10%. Initial surveys revealed that S R I adoption was less than 1 %. The introduction of new system of paddy cultivation (S R I) which saves water by 34% by Tamilnadu Agricultural University resulted in shift from traditional paddy by 40%. It has also saved around 90% saving in seed requirement, 38% in labour requirement and 44% in net incomeThe crop diversification strategy has resulted in reducing the pre project gap from 30% to 15%.The farmers also started adopting horticulture vegetable crops and the area increased the area from 27% to 62% and income also increased by 52%. According to Vibhu Nayar and Ravichandran (2010) the adoption of S R I will have one third increase in cost-benefit ratio.The adoption of crop diversification, new technology and implementation measures by Department of Agricultural Engineering resulted water savings of 14%. As a part of alternative incomes the aquaculture measures by department of fisheries resulted in additional income which was not prevailing in the pre project scenario. The efforts of Animal husbandry dept reflected an increase in milk yield by 35% and the farmers were encouraged to grow fodders. The post harvest marketing facilities in the form of construction of drying yards, providing conveyance and formation of commodity groups thereby avoiding middle men brokerage has lead to a rise in farm economy by 40%.

CONCLUSION

Integrated Water Management (IWM) through Multi Sectoral-Multi stake Holder convergence approach is the appropriate strategy that converges activities of stake holders to get maximum benefits. The case studies presented are a few clippings of the world bank aided IAMWARM project in the country. The project studies have revealed that the irrigation area increased by 10 to 14%.with the rehabilitation measures and income per liter by 40%.. The gap in irrigation has also reduced by 50%.

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