

Case Studies conducted by International Water Management Institute (IWMI)

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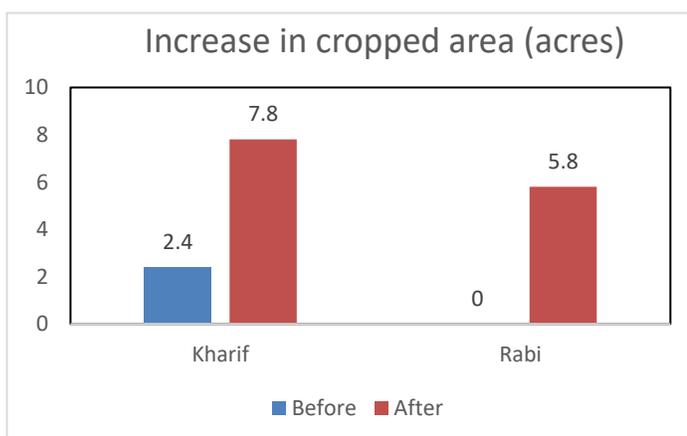
1. Solar irrigation: Kanmora Solar Pump Dug well

A case of small dynamic community where no-cost solar irrigation has led to high and efficient community participation

Kanmora solar pump-dugwell (cluster 1) located in Rajnagar block of Birbhum district is an example of how solar irrigation, about which only a few villages had heard before the WBADMI project, is bringing significant positive changes in the village's agro-economy. Kanmora solar PDW is a cluster of five dug-wells, each powered with a solar pump (2 kW solar panels attached to a 2 HP pump) which covers individual command areas of 12 bighas. The cluster consists of a total of 23 WUA members.



The village has an uneven topography and an arid landscape. With no source of irrigation and exorbitant cost of constructing private pump-dugwells, there was no Rabi cultivation before the arrival of the WBADMI scheme. Even in Kharif, due to uneven topography and non-reliability of rainfall, cultivated area was very minimal. However, this changed soon after the implementation of WBADMI scheme. Currently, among sampled farmers, 7.8 acres and 5.8 acres of area is under irrigated agriculture in Kharif and Rabi, respectively. It shows a significant increase from just 2.8 acres in Kharif and no cultivation in Rabi before the project was implemented. Due to this, seasonal migration has reduced to a large extent and there is more demand from villagers who are not part of WUA. However, this is attributable not only to the irrigation infrastructure but also to how the community manages it through WUA.



Power of Solar

In this village, where electricity is a recent phenomenon, solar energy is paving the way for prosperity among members. The often reported benefit by villagers was that *it runs without any cost*. This availability of free power and freedom from electricity bills that solar irrigation brings helps achieve two things:

1) It significantly reduces WUA water fee, making it affordable and equitable for all the water-user members and leads to prompt and efficient fund collection.

2) All the fund collected can be utilized for regular repair

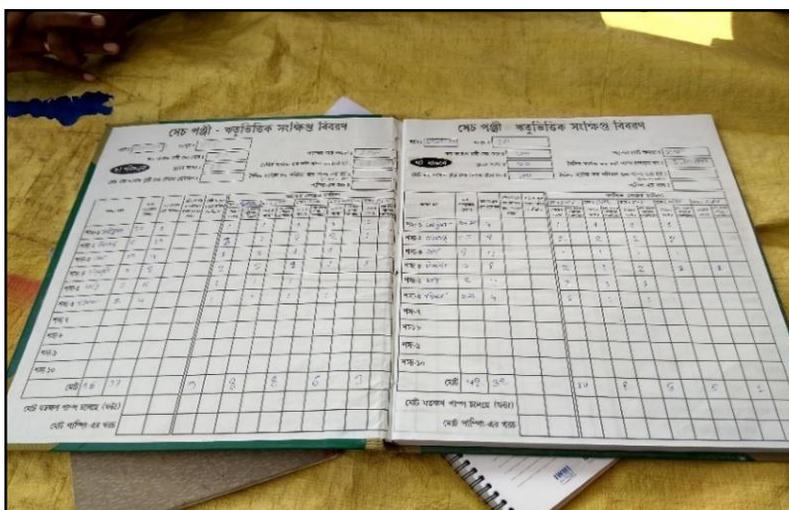
The above are necessary to make WUA sustainable by making community participation stronger. This is evidently visible in the WUA's planning and management. The only hindrance to widespread adoption of the solar pump dugwell once the project aid is withdrawn is due to its high costs of setting-up and maintenance of solar panels.



This could also be explored through on-going solar irrigation schemes.

Efficient cropping pattern planning and management

The WUA has demonstrated an impressive water management. Before each season, the members hold a meeting to plan cropping pattern and water distribution schedule based on availability of water. They maintain very robust and detailed records of such decisions and record what was achieved against their planned targets. This has helped WUA become more efficient in planning and managing water by way of past records acting as learning for subsequent seasons.

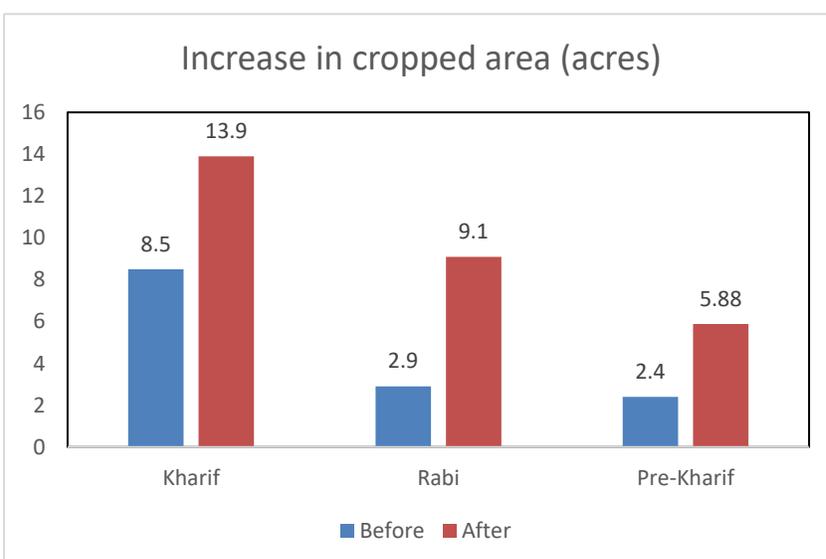


2. Baida River lift Irrigation Scheme – Paschim-Medinipur

A case of strong local leadership leading to increase in productivity and crop diversity

Baida River Lift Irrigation (RLI) located in Jhargram district (previously part of Paschim-Medinipur) is an example where the WBADMI scheme has energized a community led by strong leadership. WBADMIP has made accessible the river water that was flowing nearby but was always out of reach. Farmers relied on diesel pump sets to draw water. This was expensive and it limited the area cultivated by the farmers. This RLI scheme, which consists of two electric 10 HP pumps and supplies water to a large command area of 80 bighas using 13 distribution spouts, has replaced the diesel pumps. The WUA for this scheme has a total of 72 members.

The positive impact of the RLI scheme is clearly observed in increased cropping area across all seasons. There used to be very minimal Rabi cultivation as irrigation with diesel pumps was expensive and not everyone could afford it. Even in Kharif, due to uneven topography, upland areas had limited cropped area and non-reliability of rainfall led to regular crop damage. However, this changed soon after the implementation of the WBADMI scheme. Currently, among sampled farmers, 13.9 acres, 9.1 acres and 5.8 acres of command area is reported to be cultivated in Kharif, Rabi and pre-Kharif, respectively, increasing significantly from just 8.5, 2.9 and 2.4 acres. However, achieving this was not easy and straightforward in a large WUA comprising of



72 members, 80 bighas of command area and expensive infrastructure and machinery that requires regular maintenance.

Strong and young leadership

Leadership provided by their young WUA president has gone a long way in setting-up a smooth and sustainable operation of RLI schemes where annual electricity costs of running the schemes goes over 1 lakh rupees and infrastructure requires regular maintenance.

This was achieved through clear communication and bringing transparency and accountability in financial operations, supported by robust reporting mechanism that went beyond the training they received. The financial books kept here for 72 farmers was among the most detailed, keeping track of each transaction (however small the amount) along with records of all receipts. This transparency and accountability was identified to be critical by the WUA leadership for smooth operation.

Do it yourself

Another area where this particular WUA showed remarkable attitude was in how they managed the infrastructure. The large command area with 13 spouts came with a long underground pipe system which is prone to leakages. The farmers understood at the start itself that leakages would need to be dealt with regularly and that it wouldn't be financially feasible to pay for repair each time. The young and enterprising farmers took the initiative and learned how to repair the pipe themselves by observing the technician at work. This has made the WUA independent and able to sustain with little outside support.

One reason of such dynamic involvement was also that people were already doing irrigation and cropping before WBADMI scheme was implemented, and awaited the opportunity to expand, which they grabbed when it came. With this scheme, they adapted to a low-cost way and expanded rather than starting from scratch, which is the case in many other schemes. Involvement of youth in WUA leadership brought more ingenuity and dynamism in its operations. Market linkage was another crucial factor that paved the way as during Rabi Season large number of buyers of potato & vegetables come into the village – crucial for their success.

3. Water Detention Structure Gokulnagarpally Unnayan

WUA: Purulia

Tribal Women Empowerment- The success of Purulia

Gokulnagarpally Unnayan WUA located in Purulia district, though being only a year old, is setting an example in tribal movement empowerment. The WUA is comprised of only women who are vibrant and courageous. This has been possible through effective outreach, support and extension activities provided by WBADMI project. The support has been on two sides: institutional and agri-technologies. This has brought the paradigm change on how women contribute and participate in agri-economy along with a welcome shift in attitude among the village males towards the women.



Institutional linkages and introduction in agri-technologies

On the institutional side, project focused on strengthening connections with local authorities and linkages with other government schemes in the area. This helped in getting additional and complementary support from other schemes to multiply the benefits. On the agri- technologies side, project introduced new technologies and practices including short-duration drought-resistant paddy, SRI practices and line sowing, seed treatment and preservation. They also installed a community pump. The outcomes of above activities have been remarkable. It has led to inclusion of other IGAs (income generating activities) like nursery for drumsticks and fishery. These have helped increase income substantially and have reduced migration among the local youths from 40% to 5 % at the end of Kharif. The WUA earned Rs. 50,264 from drumstick nursery that was established with project assistance. Spawn



to fingerlings culture which was introduced under the project's fisheries wing fetched them Rs. 1,40,880 by selling the fingerlings to other WUAs.

With better agricultural practices and technology provided, Kharif paddy crop is harvested earlier, vacating land sooner for crops like potato (use of residual moisture reduced irrigation requirement) and at the same time has reduced overall mortality of the crops. In one case, assured irrigation as well as drought tolerant short duration paddy variety has doubled the production from 2.5 quintal per bigha to 5 quintals per bigha.



Bringing social change

The empowerment brought by the scheme to the women in the WUA has implication for social issues as well. The empowered women contributing to economic activity have taken the lead and their collective effort led the local authority to stop illegal liquor from being sold in their village. This brought about more participation of men in farming and also improved the status of women in their community.

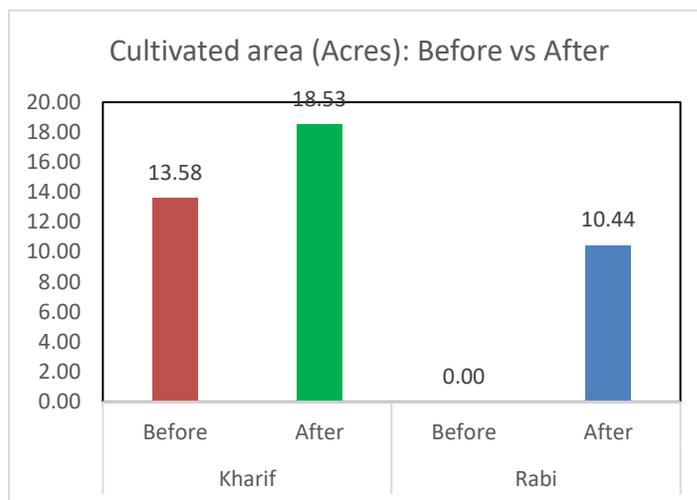


4. Bankati River Lift Irrigation scheme: Bankura

A case showing the way towards convergence

Bankati river scheme is located in Kharta-1 block of Bankura. The scheme was handed over to the WUA in September, 2015. The WUA has strong connections with local panchayat, which has led the way to convergence of multiple government schemes centering around the WBADMI scheme. This was made possible through local leadership and strong community participation.

Under the WBADMI scheme, the funding agency invested Rs. 32,97,277 in the project. However, WUA has till now attracted investment worth Rs. 59,35,000 through convergence of government schemes, which is in addition to other inputs (like seeds, fertilizers, fingerlings) that have been provided. The success of scheme is visible with cultivated area of sampled farmers increasing by 36 % in Kharif and in Rabi, where no cultivation used to take place before, now more than 50 % of Kharif area is cultivated.



Below gives list of works that has been done under convergence drive in WUA:

Plantation through MNREGA

Extended Pump House for smooth water lifting through Central Finance Commission (CFC) & State Finance Commission (4th SFC) grants

Irrigation Channel by 14TH FC

Pond Re-excavation by MGNREGS

Cashew nut Garden

Converting complete village to village of pulses

Fishery and horticulture

Field channels through Department of Agriculture



Case of Bankati WUA sets an example on how convergence with other government schemes can help make WUA stronger, multiplying the benefits and can ensure long term sustainability of WUA. This model should be used in other project schemes.

5. Uluberia Water User Association (WUA): Carp culture

Improving health, food security, and livelihoods through training in scientific management of fisheries

Uluberia WUA located in Purulia, westernmost district of West Bengal, has shown the way on how WBADMIP schemes has brought positive and remarkable changes in fisheries, adding to both income, food and nutritional security. There are six water bodies suitable for aquaculture in Uluberia village.

Prior to implementation of the project, the beneficiaries used to stock mixed seeds (both fry and fingerling) of Indian Major Carps (Katla, Rohu & Mrigel) in the same water body without any regard to scientific stocking. No



scientific management was followed and fishes were grown only for domestic consumption. Such extensive management practice and zero maintenance of water quality parameters resulted in poor fish growth and reduced environmental hygiene leading to disease out-breaks and mortality. As a result, annual productivity was very low and generally varied from 600-800 kg /ha. Poor health of the fish also fetched negligible price of around Rs. 50/- to Rs. 60/- per kilogram of fish. Lands were mono-cropped where *kharif* paddy was only grown. Most of the villagers used to migrate to other districts, cities or even other states to work as daily laborers. Access to food was limited and malnutrition was rampant, particularly visible among children.

Turning failure to success

Intervention by WBADMIP mainly started from the year of 2015 (FY 2015-16) by providing inputs and hand-holding training in the following water bodies with ten FIG (Fisheries Interest Group) members and 20 secondary FIG group members. But, the results were not

Year	Type of intervention	No of ponds and area	Net income (Rs.)
2015-16	Direct and secondary	4 ponds and area of 5.98 ha	220064
2016-17	Market linkages	3 ponds and area of 5.56 ha	818874
2017-18	Mass production	4 ponds and area of 7.98 ha	924704

very encouraging due to drought situation and rapid early utilization of water for providing lifesaving irrigation to agricultural crops. Due to such adverse climatic conditions, in 2016-17 financial year, another initiative was taken up in the project for sustaining carp culture technology through fisheries market linkage scheme, with additional number of beneficiaries. Results were far more encouraging this time around and building upon this success, in 2017-18 under the fisheries mass production scheme, beneficiaries were provided with proper training and essential critical inputs like carp fingerlings, supplementary feed, dragnet and *handi* to get an ideal productivity commensurate with scientific carp culture practice. Due to these interventions, net income from fisheries increased from Rs. **2.2 Lakhs in 2015-16 to 8.2 Lakh in 2016-17 and 9.2 Lakh in 2017-18.**

Improving livelihoods while reducing migration

After completion of the project period, it seems that a significant change has taken place with regard to fisheries activity, socio-economic status, nutritional status, and job opportunities in Uluberia. With the harvested rain water in the pond, farmers have started cultivating vegetables,

pulses, oilseeds, maize etc. in Rabi and summer season in addition to the now assured Kharif paddy cultivation. Scientific fish culture techniques like pond preparation, water testing, scientific stocking, feeding, netting, liming, etc. are now meticulously followed. In addition to Indian major carps, exotic carps and even high value fish like the featherback



fish (*Notopterus chitala*) is also stocked in the pond. Area of fish culture has increased and more farmers are becoming interested in pursuing fish culture. There is even a growing interest among women to get involved in fisheries activities. Migration has sharply declined and fish productivity has now increased to 2000-2500 kg/ha. Surplus fish production has also given the farmers the viable option of earning livelihood from fish culture.

6. Kalidaha Purbundh WUA: Spawn-fingerlings

In 2018, through spawn to fingerling production scheme of WBADMIP under DPMU Purulia, Kalidaha PurBundh Water User Association (WUA), the members of which are tribal women of Kashipur block, were engaged in spawn to fingerling production activity. The age-group ranges from 23 to 58 years old and education level is from primary to secondary, although 5 members, out of the 10, don't have even that much education. The group selected one of their village seasonal pond with 0.25 ha effective water area called "Barir Bundh".

It was noted that **before the intervention**, the group members did not have adequate operating capital, knowledge or technical skill regarding scientific fish culture practices and were only engaged in domestic work. **Thereafter**, efforts were taken by the project staff to empower this



group of women with technical skill, providing critical inputs for fingerling production and create market linkages for selling the produced fingerlings to other farmers who have demand.

Leap in income and social standing

At the end of the culture duration, women FIG members saw a production of 20,115 nos. of fingerlings, which were purchased by WBADMIP, DPMU, Purulia at stipulated rate of Rs. 2/- per piece, which helped the group earn Rs. 40,230 /-. The group also sold 16,300 nos. of fingerlings to DPMU, Burdwan, from which Rs. 32600/- was generated. Furthermore, they sold about 7390 nos. fingerlings to the neighbouring farmers at Rs. 3/- per piece from which INR 22170/- income was generated. Hence, a total of INR 95000/- was generated by this group within four months against an expenditure of INR 22450/- (INR 12450/- by beneficiaries and Rs.10000/- as project contribution).

The project has helped the group to inculcate self-confidence among them, raise their socio-economic status and earn money within a short period of time without much drudgery. At

present, the remaining fingerlings have been sustained in the pond at stunted growth condition and the group is planning to culture them in a nearby water body called Kalidaha Mahato Bundh SFMIS scheme, after taking lease from the available balance they have from selling fingerlings.



Within a year, this group has established that fish culture offers lucrative returns. As a result, more and more women have shown interest in joining the group for which the members have decided to include another 20 of them for next year's culture and utilize five remaining feasible seasonal water bodies for the purpose of fingerling production.

7. Ma Mangal Chandi: Hatchery of indigenous fish

Ma Mangal Chandi SHG was formed in 2005 in the village of Chotobazar in Rajnagar block of Birbhum. In July 2017, the WBADMIP provided necessary funds for capacity building of 12 women members of the group, from Ramkrishna Ashram Krishi Vigyan Kendra, Nimpith, and South 24 Parganas.



Accordingly, three of the members were trained in indigenous fish breeding and hatchery technologies, and the remaining 9 received training on culture of the indigenous fish in ponds. All the trainings were over the duration of five days and the members participated in the training programmes along with other WBADMIP selected beneficiaries of different districts and State Fisheries Dept. personnel of each of the districts.

After receiving the practical-oriented training, this particular SHG started construction of the hatchery in 2017 itself, according to the RAKVK hatchery and budget plan with the active support of the State Fisheries Dept. of the district and financial support from WBADMIP. By this time, it was almost end of September and the breeding season of the indigenous fish



(desi magur) was coming to an end. In spite of this, the group members tried their level best and were successful to breed the fish, for the first time ever, in this semi-arid zone of the state. Their

perseverance yielded 2000 fingerlings in 2017. They sold 1300 at the rate of INR 4/- a piece and stocked 700 in their pond. Last year, i.e. in 2018, they could produce 60000 fingerlings of desi magur of which 15000 were sold at INR 3/- a piece and hence earned INR 45000/- which is deposited in their bank account. Rest of the seeds is released in the pond and its management is continuing till date. The members are expecting a rich haul and more income from table catfish, which are very expensive and have huge consumer preference.

The success of this SHG has changed the outlook of the villagers who are now eager to learn the trade from this group and are also interested to form their own group. The socio-economic status of the group members has also changed drastically with more leaning towards educating their children, improving healthy food intake and they wear a pride on their face to be able to eke a decent livelihood by adopting this particular technology.

Problem, need and suggestion:

There is a genuine problem of iron in the water used for breeding the fish for which the hatching percentage is not up to the mark. Hence, the group needs help from concerned quarters to install an iron filter to facilitate proper hatching of the fertilized eggs.

Recommendation: Harvesting rooftop rainwater, via PVC pipelines, and storing in big PVC containers, as the rain water is suitable for undertaking breeding operation of any type of fish. This may be a very simple yet cost effective technology than installing an iron filter.

The hatchery trays are placed on the floor which is “kuchcha” and the room in which the trays are kept is a bamboo enclosure. So, the wind brings dust from all over, including the floor, into the hatching trays resulting in mass mortality of the larvae/fry. Hence, the groups want a concrete floor and a proper room for carrying out their trade.

Recommendation: Till help in this regard comes from concerned quarters, the members may consider plastering the floor with a mixture of cow dung, mud and water (which is a common practice in villages of Bengal) to suppress the dust from the floor. Likewise, the bamboo structure all around may also be plastered up to a height of 4-5 ft. to prevent the dust from entering.

8. Ashna WUA: Spawn-fingerlings

Ashna WUA is located in Simlupal block of Bankura district. In Bankura district, fisheries play an important role in the economic development and the district ranks first in pisci-culture within West Bengal. The WUA was registered in 2013 and scheme handover took place in 2015 with a total of 75 members. Fisheries Interest Group (FIG) formation took place in 2016 with a total of 15 members (ten men and five women).

In 2016-17, schemes demonstrated Composite Fish Culture in one hectare of effective water spread area and provided inputs (IMC fingerlings, Feed – 7600 kg, Lime – 500 kg, KMnO₄ – 2 kg, drag net, aluminum hundi, insulated vending box). With this, a significant increase in production took place with total production of 4.9 tonnes compared to 1.2 tonnes before. In 2017-18 – practice of spawn to fingerling through local women SHG (Maa Garam Mohila Dal) was started with ten members in effective water area of 2 Bighas (0.26 ha). Inputs in term of spawn and feed were provided. However, it turned out to be unsuccessful with total profit of only INR 755.



Critical observations/reasons for failure of spawn to fingerling culture

Lack of proper skill and training before initiating culture.

Large water body, not ideal for such culture. It was considered perhaps due to dearth of small, shallow ponds.

Heavy rains led to an increase in the water depth, which in turn increased mortality of growing fry

Heavy rains resulted in flowing of agriculture run-off water into the pond which deteriorated the water quality.

High rate of pond lease resulted in reduced profit margin.

Recommendation for reviving the group

The group may be trained in indigenous fish breeding to earn livelihood through selling of seeds. This trade does not require a pond and, as none of the group members possess one, income from fisheries may be done by pursuing this activity. Moreover, this activity requires clean freshwater which is available in plenty through artichokes and freshwater aquifer in the region.

9. Ketankari WUA: Mixed fruit planting

In Ketankari WUA located in Kashipur block of Purulia, mixed fruit plantation program was initiated in the month of August 2017. After doing induction meeting with the farmers and motivational camp, the WUA themselves selected the types of plants to be planted and did the plan for land preparation, fencing, pit digging, pit filling, plantation, inter cropping, nurturing the plants etc. The plantation included mango (Amrapalli, Himasagar, Baromasi), jack fruit, mosambi and citrus. The WBADMIP provided finance



for the orchard in such a way so that the farmer on whose land the orchard was being

Name of Plant	Plants Supplied	Survival Percentage
Mango (Amrapalli)	220	94.55
Mango (Himsagar)	120	86.67
Mango (Baromasi)	30	73.33
Jack fruit	20	25.00
Mosambi	15	93.33
Citrus (kagji)	30	96.67
Total	435	87.82

developed could earn some wage during the process of developing orchard. The DPMU has already imparted training to the farmers related to land preparation, pit cutting, hapa digging, plantation, application manure, and application of termiticides, weed managements etc.

Mixed fruit plantation has been a success with current average survival rate of 88% (which could be improved further). The mixed fruit plantation has converted the barren land into a cultivable one which, within 2-3 years, will yield sustained returns. Introduction of inter cropping resulted in early returns and confidence in the gestation period. The extra income made through wage earning from orchard development has added value in childcare and child development. Overall, mixed fruit plantation, taken-up as a group, adds positive value to group dynamics by building a community approach of crop management and conservation.



In the next two to three years, when this plantation matures, WUA is expected to get good return for the effort they have put in.

Some gaps and recommendation are as below:

Mortality rate is >10%

Recommendation: Pitcher irrigation/ modified pitcher method would result in less mortality and high-water use efficiency.

Jalkund (small 3-4 cubic meter HDPE or silpoline pit) for harvesting and storing direct rainwater and applying water through hand watering for life saving irrigation. For more effective results, Jalkund may be covered with locally available thatch material to check evaporation.

Number of Mosambi plants is less

Recommendation: Number of plants is to be adjusted in such a way that a marketable volume produce may be available.

10. Siyarbinda Rimil WUA: Arjuna plantation

Siyarbinda Rimil WUA located in Binpur-II block of Jhargram district started the Arjuna plantation (including some pineapple) plantation program in June 2018. After the induction meeting with farmers and conducting a motivational camp, the WUA themselves selected Arjuna plant as the villagers are skilled to cultivate cocoon for Tashar. WUA members did the activities of land preparation, fencing, pit digging, pit filling, plantation, inter cropping, nurturing the plants etc. and WBADMIP provide finance for the orchard with wage for



preparation activities paid through the bank account from DPMU to the bank account of WUA. DPMU has been following up all the activities from land preparation to plantation along with inter cropping of the orchard field where they facilitated the farmers to cultivate pulses & vegetables i.e. Arahara, Black Gram, Bottle Gourd, Pumpkin etc.

Name of Plant	Plants Supplied	Survival Percentage
<i>Arjuna</i>	1780	88.03
Pine Apple	180	91.00
Total	1960	86.68

The survival rate of the plants is quite satisfactory depending on the rainfall and the moisture retained through the dapa developed in due course which would help the plants sustain for long. Overall survival rate was high, at 88% in Arjuna and 91 % in pineapple, but vegetative growth was not satisfactory at the time of visit. This could be due to a hail storm which caused growth loss just few days before the visit. Inter cropping with low water requiring crops like pulses is adding to crop diversity and income of WUA. The newly formed WUA with horticulture as one of the main activity is well organized in implementation, monitoring and supervision.

Specific gaps and recommendations:

Mortality rate is < 10 % but stunted vegetative growth due to natural climatic event.

Recommendation: Pitcher irrigation/ modified pitcher method and use of liquid fertilizer through pitcher method will lead to better vegetative growth.
Use of organic matter is less



Recommendation: In-situ vermi-compost preparation using fallen forest waste would reduce costs of fertilizer and increase use of organic matter.
Knowledge gap in sericulture

Recommendation: Knowledge up-scaling training/workshop can be held for both, the specialist and WUA members, especially on cocoon-rearing and disease management.

11. Mati Dundra WDS and Bara Natun Bundh SFMIS, Purulia

Not successful cases of surface water storage schemes

Mati Dundra Water Detention Structure WDS

WDS, a surface water storage system for harvesting and storing runoff from nearby local micro-watershed area in Mati Dundra in Purulia district is designed with proposed command area of 5 ha in the lateritic soils. Field visit to the WDS and discussion with local community and WUA members revealed a case of unsuccessful and underperforming minor irrigation system. Photographs depict the deteriorated condition of the structure just within a span of three years after its handing over.



It appears that the locally existing site was remodeled in the present WDS. Based on the field inspection of the WDS, the following specific points have emerged:

Severe soil erosion from body and slope of the earthen embankments due to poor slope stabilization measures.

Severe undercutting of the structure on the inflow side and this could possibly be due to shallow depth of structure and exposure of its foundation.

Lack of pitching

In the absence of DPR of the scheme, it's not possible to examine design details. It's recommended that lessons from such failures may be re-visited and thoroughly examined from hydrological, hydraulic and structural design aspects.

Bara Natun Bundh Surface Flow Minor Irrigation Scheme (SFMIS)

Similar case of underperforming surface storage schemes was observed in Bara Natun Bundh SFMIS in Purulia. In this case, improper location of inlet was observed with catchment area on inlet side at lower elevation. Due to this, inflow to SFMIS is limited and very small area in Rabi is cropped.

