AgWater Solutions Project
Case Study

Impact Study of hapa and its multiple uses in Bankura district

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The AWM Project
The AgWater Solutions project was implemented in five countries in Africa and two states in India between 2008 and 2012. The objective of the project was to identify investment options and opportunities in agricultural water management with the greatest potential to improve incomes and food security for poor farmers, and to develop tools and recommendations for stakeholders in the sector including policymakers, investors, NGOs and small-scale farmers.

The leading implementing institutions were the International Water Management Institute (IWMI), the Stockholm Environment Institute (SEI), the Food and Agriculture Organization of the United Nations (FAO), the International Food Policy Research Institute (IFPRI), International Development Enterprises (iDE) and CH2MHill.

For more information on the project or detailed reports please visit the project website http://awm-solutions.iwmi.org/home-page.aspx.

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1. Background

Bankura District in West Bengal consists of two agro-climatic zones; an undulating red and lateritic zone and Vindhyan alluvial zone. Except for Patrasayer, Indus and Kotulpur blocks, all the other 19 blocks fall in the first category. Climatically, the red and lateritic zone is within a tropical dry sub-humid area with an annual rainfall ranging from 1100 to 1400 mm. This region is primarily undulating with mounds and valleys where soils are well-drained and is susceptible to soil erosion due to rapid external drainage or run off.[1] Because of this topographical condition, agriculture in this region has always been at the mercy of natural variations with little irrigation.

The amount of rainfall in this region is not at all insufficient, but due to high runoff and lateritic soil, the moisture content of the soil is quite low. Hence, the principal problem of agriculture is the lack of water retention and moisture absorption in the soil, which is required for crop survival. Under these circumstances, people in this region principally depend on production of paddy and some vegetables cultivated in the kharif season, depending almost wholly on rainfall. But these crops are vulnerable to any shortfall of rain during this season. A short spell of dry weather might be fatal for a crop, with disastrous effects on the lives and livelihoods of the local people who are dependent on agriculture for their sustenance. Frequent draught and erratic rainfall pushed the predominantly Scheduled Caste and Scheduled Tribe populations in this region to a famine-like situation. If, however, ways are found for integrated development of natural resources, high rainfall and a complex ecology might turn regions with such characteristics into engines of growth. These regions are almost uniformly poor and among the most food-insecure in the country.[2]

The hapa, a water harvesting structure, was introduced in this region over the last three-four years and has assumed some significance. A hapa is a water conservation structure made by excavation on private plots. The ideal size is 5% of a farmer's land holding, but in practice the size varies according to the requirements of the farmer (in our study the length varies from 30-60 feet and the breadth from 20-50 feet, while the depth varies between 10 to 12 feet). The typical shape of a hapa an excavation with vertical sides (sometimes with a few steps), which gives it good water retention capacity in comparison to village ponds that generally have a wider open area with less depth causing quicker evaporation and they dry up before the summer season.

The construction of hapas is being funded by the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), the flagship scheme of the central government in India. MGNREGS was initiated to provide employment to rural people and thereby create assets in the countryside that would further help livelihood-generating activities. hapas seem to have matched well with the goal of employment generation through the MGNREG scheme, as well as meeting the irrigation demand of the local people in this region. The present study reveals that hapas have been beneficial to farmers in a number of ways including: securing and enhancing agricultural production, transforming mono-crop land to multi-crop land and fallow land to cultivable land and creating new livelihood practices like aquaculture, and fulfilling domestic needs. In brief, the introduction

of hapas has brought some hope by providing an impetus to peoples' struggle for economic self-reliance with a wider impact on social and ecological conditions.

Study method

This study is intended to capture the benefits derived by the beneficiaries of hapas from its multiple uses, assess the agricultural, economical, ecological and social impacts, and make a cost-benefit analysis to understand the potential for investments and identify the rate of adoption by farmers. The study was conducted in three sites of Hirbandh block in Bankura District in the villages of Damodarpur, Biradi and Bamni.

The study involves both quantitative and qualitative methodologies. Two sets of questionnaires were formulated: one set was administered to 64 beneficiaries and the other set to 36 non-beneficiaries, i.e. people not having hapa. The questionnaires were designed to make two comparisons:

1. Compare changes in livelihood practices of hapa-owner farmers by assessing the benefits derived after hapa construction with what they had derived previously. As 2010-11 was a draught year, we took cropping data for 2009-10 and compared it with the cropping pattern of the last year when the farmers had cultivated without a hapa.

2. Compare the present livelihood practices of farmers who have hapas with those who don't.

Semi-structured interviews were conducted to get the views of Gram Panchayat Pradhans and other officials, members of Self-help Group (SHG) and Gram Unnayan Samiti (GUS), BDO and the field-personnel of PRADAN, and the PIA of the project. Case studies were also conducted with farmers along with village walks with the beneficiaries. Group discussions are held at each site to assess the general mood and attitudes of the local farmers towards hapas. Government literature and previous research materials are also studied to gather relevant data and information necessary for the study.

The study area

Hirbandh block is one of the most under-developed blocks in Bankura District. This block is situated within the command area of the Kangsabati River dam) project. The dam was built to provide irrigation facilities to the farmers of Bankura and West Medinipur Districts. Farmers reportedly have not benefitted much by the dam. The block population comprises 25% Scheduled Casts and 28.5% Scheduled Tribes according to the 2001 Census. Both combined to form the majority in the block. Twenty percent of the block population belongs to the OBC category, reported the Joint BDO of the block.

This block mainly produced kharif paddy (21,400 metric tons on 8080 hectares of land in 2004-05). The same block produced only 190 metric tons of boro paddy on 80 hectares. Comparatively, this block had more land devoted to mustard cultivation: 490 hectares of land producing 330 metric tons.[3] The kharif paddy along with mustard have been the principal crops in this block. According to Minor Irrigation Census 2000-01, Hirbandh block had no STW or DTW for irrigation. It had 268 dug wells irrigating 59.49 hectares, 509 surface

flow irrigation systems irrigating 20,066.42 hectares, and 14 surface lift structures irrigating 195.3 hectares of agricultural land.[4]

Among the three study sites, Damodarpur is situated in Molian Gram Panchayat area, with a population of 211. Among them, 39 belong to a Scheduled Caste and 104 to a Scheduled Tribe. Biradi village is situated in Mashiara Gran Panyachat and has a population of 600, of whom 426 belong to a Scheduled Caste and 51 to a Scheduled Tribe communities, as per 2001 Census. Bamni village is also situated in Mashiara Gram Panchayat and is inhabited by 1,148 people, 336 of whom belong to a Scheduled Caste and 342 to Scheduled Tribe communities.[5]

The land use patterns in the study villages show there are no irrigation facilities in the study sites, although there is a natural canal in Biradi that provides some f irrigation mainly during the rainy season. Table 1 also shows that a substantial portion of the village land remained fallow.

Table 1: Land use patterns.

Village	Total area (hectares)	Un-irrigated area (ha)	Useable waste (ha)	Area not available for cultivation (ha)
Damodarpur	207.54	60.07	56.66	53.17
Biradi	289.94	61.23	54.63	48.74
Bamni	182	79.15	44.92	36.69

Source: Panchayat Chalchtitra, a database prepared by the Panchayat and Rural Development Department, West Bengal in the year 2004.

With few water retention mechanisms, cultivation of the principal crop in the area has always been highly uncertain, often suffering from occasional shortfalls of rain. Government officials reported that the whole block suffers from a severe shortage of water during summer every year. From February on, all ponds go dry and water cannot be extracted even from tube wells, leading to a severe drinking water crisis. People rush to the BDO and Gram Panchayat offices demanding a solution. Ironically, while the block administration was wary of resolving the almost perennial water crisis, the bulk of the MGNREGS fund remained unused due to a lack of proper project planning and local people were migrating to other areas in search of work. Individual Gram Panchayats could not find ways to spend the allocated money.

In this situation, the concept of the hapa appeared as a breakthrough. The development agency PRADAN brought the concept to the district and block administration in 2006. The then BDO of Hirbandh readily accepted the concept and took a personal interest to ensure implementation. The Individual Beneficiary Scheme (IBS) was conceptualized to facilitate the construction of hapas on individual farmers' land. The concept was transmitted to the state government. The then Secretary of the Panchayat and Rural Development Department of West Bengal personally visited Hirbandh to get acquainted with the idea. IBS was included in NREGS and the initiative for hapas was launched.

Molian Gram Panchayat is leading in construction. Sixty hapas were constructed in 2008 and the number leaped to 868 in 2009-10, showing the growing enthusiasm among the local

population. In Mashiara Gram Panchayat, 96 hapas were constructed in the first year of its introduction i.e. in 2009-10. In the next year the number of hapa constructed in the Gram Panchayat area rose to 211. Presently hapa has spread to four Gram Panchayat areas under Hirbandh block.

2. Planning and construction of hapas

hapas are built to address the challenge posed by the undulating land in this region. For best use of land, the area is divided into four types: high land (locally known as *tora*), medium-high land (locally known as *baid*), medium-low land (locally known as *kanali*) and low land (locally called *shol*). With high runoff of rainwater, the high and medium-high lands cannot retain water and mostly remain fallow throughout the year, while the low and medium-low lands, with higher moisture content and seepage from the uplands, are used for agricultural production, but with uncertainty in the absence of irrigation facilities.

The hapas are planned in such a fashion to get the maximum benefit by ensuring and enhancing crop production and at the same time increasing land use in a particular village. Generally, a number of hapas are planned in a particular patch of land serially, so that maximum land can be irrigated and brought under cultivation. As the high and medium-high lands require irrigation most, more hapa are planned on such lands. With a number of hapas constructed on the high and medium high land, the lands in the lower plains are getting the advantage of seepage in addition to direct irrigation facilities. It can be found from our study that 89% of the hapas are constructed on high and semi-high lands.

Villagers were initially reluctant about constructing a hapa. As most farmers in this region have little cultivable land, a hapa would further reduce their small landholding. Government officials, with the help of PRADAN, had to undertake a sustained campaign to create awareness of the benefits. Teams of villagers were sent to visit villages already using hapas in the neighboring district of Purulia. Hamlet-level meetings are also organized to explain the effectiveness of hapas.

Plans for a hapa in a village were discussed and passed in a meeting of villagers in the presence of SHG and GUS members. It was ensured that both the incumbent panchayat member and the losing candidate were present in the planning stage to avoid political disputes. The plan prepared at the grassroots were placed in the Gram Panchayat office, where it was discussed in a meeting of the NREGS monitoring team, attended by the NREGS supervisors and SHG members along with officials of the Gram Panchayat and PRADAN. The Gram Panchayat office then prepares an estimate of the work and sends it to the BDO office for approval. After approval, work orders are given to the SHG members (or supervisor in the absence of SHG) who immediately call a villagers' meeting, where both the land owner and laborers are called to discuss the construction method for a particular site and deciding in which order the hapas are to be constructed and which group of laborers will provide labor for which hapa.

The process from planning to implementation involves the whole village. To expedite the process, weekly dates are fixed both in the Gram Panchayat and BDO offices to process the applications and finalize the release of work orders. Weekly meetings are held in the Gram

Panchayat offices with NREGS supervisors to evaluate and monitor the progress of hapa works done in the Gram Panchayat areas. After a few successful implementations that increased crop production and rendered many other benefits, farmers began to take an interest in the project.

Initially, the political parties did not take much interest in the implementation of the hapas scheme. Once it became successful and the demand for hapas began to rise, they tried to interfere to favor of their own candidates. To overcome any political discrimination, two steps are carefully followed: 1) one member from each political party who has a presence in the village is appointed as the supervisor of the work, and 2) representatives of all the parties in a village are invited to participate in all the meetings, from planning to implementation. Everyone reported that no political bickering occurred over hapa construction in the Hirbandh block. Even though the Mashiara Gram Panchayat has been run by the Trinamul Congress party since 2008, most of the hapas in this Gram Panchayat have come up in Biradi and Bamni villages, both of which are known strongholds of the CPI (M) party.

Most hapas have so far been constructed in villages having larger Scheduled Caste and Scheduled Tribe populations. Demand for hapas is higher in such villages because: 1) there is greater availability of labor , and 2) farmers with small land-holdings are more forthcoming in constructing small reservoirs while farmers with big landholdings in caste-dominated villages generally have their own ponds. Availability of labor is one of the key factors in success.

Findings

The caste composition of the respondents selected from the three study sites shows that most belong to Scheduled Caste and Scheduled Tribe communities and the rest from other castes (Tables 2 and 3).

Table 2: Composition of respondents.

Status of the respondents	Scheduled Caste	Scheduled Tribe	Other caste
hapa-owners	24	28	12
Non-owners	13	10	13

Table 3: Principal sources of income of the respondents.

Status of the respondents	Agriculture	Day labor	Animal husbandry	Service	Business
hapa-owners	57 (89%)	2	3	1	1
Non-owners	26 (72%)	6	4	0	0

Most respondents depend on agriculture as their principal source of income, all except five also engage in day labor as a supplementary source of income. Eighty-nine percent of the hapa-owners now depend on agriculture as their primary source of income in comparison to 72% of the non-hapa-owners (Table 4).

Table 4: Annual income of the respondents.

Status of the respondents	Below INR 20,000	20,000 to 50,000	50,000 to 1 lakh
hapa-owners	3 (4.7%)	60 (93.75%)	1
Non hapa-owners	19 (52.8%)	13 (36%)	4

From the annual income data it can be hypothesized that farmers with a hapa are more likely to come out of the lowest income category than those without. This hypothesis is corroborated by the estimation of BPL families done long before the introduction of hapas, showing that a larger number of the hapa-owner respondents were recorded in the BPL category (57.8% of the hapa-owners and 41.6% of the non-hapa-owners belong to the BPL category). That status of hapa owners, most of who were poorer before construction, have financially improved after compared non-hapa-owners.

The average agricultural land presently owned by hapa-owners is 1 acre and by Non-hapa-owners 0.97 acre. Our study reveals that the average agricultural land holdings of the hapa-owners has increased by 0.31 acre since the construction of hapas. Eighty-three percent of the hapa-owners use some kind of pump to lift water, the rest lift water manually. While 39% use their own pumps; 44% have to hire or rent. Rent varies between INR 60-80 per hour. More than 60% of the hapa-owners are still unable to have a pump-set of their own. Owning a pump would cut down the cost of cultivation. While all the respondents use hapa water for agriculture, 4 use it also for gardening, 25 for livestock, 30 for domestic purposes and 63 for fisheries.

3. Benefits derived from hapas

87.5% of the hapa-owners interviewed have converted some amount of fallow land into cultivable land with the help of their hapa. The average increase in agricultural land has been 29.4%. This has been possible by using the hapa in two ways: a) by providing irrigation to fallow plots; and b) by leveling portions of slopping land with the mud extracted from hapa excavation and making them cultivable. Leveled land on the banks of the hapa is fertile and particularly suitable for growing vegetables, with easy access to irrigation water.

78% of the hapa-owners have cultivated at least one more crop after construction of their hapa. Mainly maize, mustard and are newly added in the cropping pattern. As a consequence, 95% of the hapa-owners presently cultivate multiple crops on their land in comparison to 50% of the non-hapa-owner respondents.

All the respondents said that their yield of crops has increased considerably with the use of hapa irrigation. The increase in mustard yield has been 100% in some cases, and in one case study, mustard production doubled from 1.8 quintals/acre to 3.6 quintals/acre, while paddy production has increased by 20%.

Altogether, an overwhelming 97% of the hapa-owners have benefited from increased production of early crops or by diversifying to new crops, leading to increased sales and greater consumption of agricultural products by their families. The average extra benefit

derived by these hapa-owners annually from increased agricultural production, after deduction of all costs, amounts to INR 5,792. This constitutes a 34.27% increase over income from agriculture before hapa construction. Exact overall income has not been collected.

In brief, the farmers with a hapa on their land have drawn both short-term and long-term benefits having multiple effects on their agricultural practice. First, agricultural production has been enhanced by expansion of the area of cultivation, an increase in the cropping intensity and yield of crops, and finally by a change in the cropping pattern. Earlier agricultural production was completely dependent on weather. Subsistence agriculture has now changed to commercial cultivation to a certain extent. This year, with a good monsoon, hapa-owning farmers are planning to cultivate newer produces, particularly vegetables, in a more diversified manner, using better fertilizers being prepared by them, to reap higher profits.

Increase in livestock

Raising livestock is an important livelihood practice in this region. The number of livestock has increased considerably for the respondents with hapas on their land. The number of cows increased by 9.34%, goats by 56.8%, and duck and hens 34.8% since adoption.

Income from fish cultivation

Income and nourishment from fish raised in the hapa is another direct benefit derived by almost all the hapa-owners we surveyed. After agriculture, aquaculture has been the most beneficial activity for hapa-owners. Marginal farmers in this region never imagined catching fish from their own ponds. We have seen that all the hapa-owner respondents, except one, cultivate fish in their hapas. Initially, the block office supplied fish fingerlings to hapa-owners. Now they are investing in fish cultivation and reaping good returns.
While the benefit from aquaculture in terms of money is not much (on average INR 11,26 in a year), it has helped to increase the status of the hapa-owners in two way. First, by adding fish to their meals for at least a few months of the year. Fish is a relished food for the Bengali people and out of reach for the poor. Availability for a few months is considered to be of great value and prestige. And fish provide the much needed nutrition. Second, by increasing their social standing. They can now entertain their guests by preparing fish dishes caught from their own ponds.

Other benefits

The families of 89% hapa-owner respondents use hapa water for domestic purposes as well, like bathing, cleaning utensils and washing clothes. In this water-scarce region, it is usually the women who have walk long distances to collect water for their domestic chores. With a hapa, people now have their own source of water.

Migration in search of work was rampant before hapa construction and has considerably decreased. For 68.75% of the hapa-owners, migration has become a thing of past as they reported that none from their family members have migrated since the construction of the hapa. 93% of the hapa-owners said their social prestige has increased because of their possession of a hapa.

The case study of Budhan Mandi of Damodarpur village

Budhan Mandi, a local tribal leader, was the first to come forward to offer his land for the construction of a hapa. As a progressive farmer, he readily accepted the proposal to construct a hapa on his land and reaped good benefits from its use. He became a model farmer and farmers from other villages are now contacting him to learn new ways of improving agricultural production. Before construction of the hapa, his family condition was poor. He had to work as a laborer and often migrated to neighboring Bardhaman District in search of work. The hapa has brought about a change in his life. He no longer works as a day laborer. His status has changed and he is the proud owner of a mobile phone, which he said has been possible because of his hapa.

He owns 1.67 acres of land, but could only cultivate 1 acre before the hapa. The rest remained fallow throughout the year. After construction in 2009, he could transform the fallow land into agricultural land. That year he cultivated a number of vegetables with the help of hapa water and earned a profit of INR 25,000. He also harvested enough paddy to feed his family for the whole year.

This year he is cultivating paddy along with tomatoes and cabbages. During the rabi season he is planning to cultivate a number of other vegetables along with mustard. From the subsistence-level cultivation he was practicing, he has become a commercial farmer with an eye on the market prices of different crops.

He also getting the benefit of fish produced in his hapa that help provide better nourishment to his family. His family members use the hapa for bathing, washing clothes and watering their cattle. Other villagers also use the hapa for bathing. He said that because of the hapa, his family now gets fish-rice instead of just salt-rice. Their clothing has improved. His connection to the outside world has increased due to vegetable marketing. His two sons are now studying, one is near graduation. He expressed confidence because he is able to continue his sons' education after the overall change in his family condition brought about by the construction of a hapa.

According to Mashiara Gram Panchayat Pradhan, even landless people are presently leasing-in land to cultivate different crops with the help of hapa water. Farmers in Biradi now cultivate so many vegetables in large quantities that it has boosted the local economy as a whole. With the help of PRADAN, people are not only planning cultivation of vegetables that are more suitable to grow in that area and can fetch more profit, they are also presently applying the SRI system of paddy cultivation that will help to reduce the cost of production and increase productivity.

Employment generation

Construction of hapas has led to an enormous increase in employment generation in an area where people normally have to migrate in search of work. hapa construction has helped to a large extent to stop migration by both escalating agricultural activities in different seasons and increasing employment availability in the lean seasons when agricultural work is not available. Construction of a hapa involves 15-20 labours for around 20 days. To construct a hapa of 60 x 40 x12 feet requires 424 person days of labor. A hapa 40x 30 x 12 generates 216 person days of labor. In the Molian Gram Panyachat, employment generation through NREGS was only 12-15 days per family in 2007-08. This increased to 70 days per family in 2010-11, principally due to hapa construction work. Similarly, in the Mashiara Gram Panyachat, employment generation through NREGS

increased from 36 days per family in 2007-08 to 79 days per family in 2010-11. As reported by the Gram Panchayat Pradhans, many families have worked for 100 days and even more as they are needed for employment. The Panchayat negotiated the issue with the block office to employ them with a separate project. The Gram Panchayat officials said that there should be no ceiling to the number of days a family can work in the NREGS, as livelihood options are very limited in this region.

The hapa-owner families are the biggest beneficiaries from the increased employment generation in NREGS, as the supply of labor usually comes from the families constructing a hapa on their land and from the local villagers. In some villages it is reported that hapa construction work is hampered due to non-availability of labor. As supply of labor is readily available in villages inhabited by Scheduled Castes and other communities, more projects for hapa construction can be taken up in such villages. With the construction of a hapa, the villagers are simultaneously getting benefits of increased employment and from the use of hapa water. These multiple benefits have reduced migration to a great extent.

Ecological benefits

Ecological benefits are realized over a longer period of time. It would be too soon to evaluate the extent and effects of ecological changes resulting from the introduction of hapas. There is a discernable trend however. Most of the people interviewed reported rising groundwater tables in the area, which they attribute to improved water retention capacity created by the construction of hapas. This is crucially important for the extraction of groundwater by tube wells for drinking purposes that usually suffer during the summer season. The local Gram Panchayat Pradhans said that in the dry season sometimes water tables go down to such a low that water cannot be extracted even by installing pipes 500 feet below ground level. However, they reported that even after the draught last year, the tube wells in this area did not go dry during the summer because of hapas.

The barren landscape is slowly changing with increased greenery as more fallow lands are converted to agricultural lands with the help of hapas. With the reduced rate of runoff and consequent check in soil erosion, increase in water retention and moisture content, the quality of soil will change to be more agriculture-friendly in the long run and will boost agricultural production. A study[6] on hapas shows that the soil in the area has been changing color (from red to yellow) and turning more loamy. The far-reaching impact of hapas might be achieved by creating a sufficient number of hapas and thus turning this draught-prone area into a vibrant agricultural area that would bring substantial change to the lives of the local people.

Social benefits

Apart from economically gains from hapas, people have also gained socially in the following terms:The local people are being involved fully in the planning and implementation processes of hapa construction. This helps them to gain confidence in their own abilities with the realization that if plan they themselves can change their own destiny. Even in the absence of government funding, community labor might be used to construct hapas for mutual benefit. Owning a hapa increases the social standing of the hapa-owner. The domestic chores of the women have become more easy with the help of hapa.

As migration has largely reduced for hapa-owning families along with an increase in financial status, hapa-owners gain more time and ability to educate their children. This will have a long-term effect on the status of these families.

Production of crops on a commercial basis has not only increased hapa-owners' connections with the outside world, it gives them a new status. Earlier they were connected with the outside world mainly as sellers of their labor. With hapas they are now sellers of their own produce. or example, the village Biradi has been known in the whole block for its immensely improved agricultural production, particularly vegetable production.

4. Cost-benefit analysis

A cost-benefit analysis is necessary to evaluate whether a project is viable in the long term. We calculate the present value of cost, internal rate of return, net present value and present value of benefit assuming the life of a hapa to be 15 years, and calculate the benefit-cost ratio on that basis. As per the data-sheet provided by PRADAN, 348 hapas were constructed in 2008-09 at a total cost of INR 93, 64,000. The average cost of hapa construction comes to INR 26,908. As the hapas under the present study were constructed in . 2008-09 and we have calculated the benefits in . 2009-10, . we have added one year's interest at 9% on the cost. Hence, the present value of cost amounts to INR 29,329.

For calculation of benefits, . we have two measurable benefits, one from agriculture and the other from aquaculture. Ecological and social benefits are difficult to measure in terms of money and hence excluded from this calculation. The average incremental income from agriculture for the hapa-owners, deducting all expenses, is INR 5,792 and that from aquaculture is INR 1,126. These two incomes combine to make the aggregate annual financial benefit from a hapa INR 6,918. The internal rate of return (IRR) on the cash flow calculated over 15 years comes to be 24.8%. The net present value (NPV) calculated on the basis of a 2% discount rate, assuming that the rate of interest is 2% higher than the rate of inflation, is INR 61,984. The present value of benefit, calculated on the same basis, is INR 8,8891. Hence, the benefit-cost ratio (BCR) is 3.03.

	Value (INR)
Present value of cost	29,329
Internal rate of return	24.8%
Net present value	61,984
Present value of benefit	8,8891
Benefit-cost ratio	3.03

(Source: Fundamentals of Financial Management, 2nd Edition, Prasanna Chandra, 1993)

The IRR is much higher than the interest rate of lending in the market. The BCR is also quite high (more than three times) showing that investment in a hapa is a reasonably viable project.

Adoption

The small and marginal farmers in our study overwhelmingly expressed their eagerness to construct a hapa on their land. Many have applied for a hapa to be constructed on their land to the respective Gram Panyachats and are waiting for approvals. Two farmers are still reluctant because of their small land holding size. The rate of hapa adoption is very high in the study area. The study period was the monsoon and sowing season and NREGS work was temporarily halted, but farmers are eagerly asking when their hapas are going to be constructed. We did find one paradox. A few farmers reported that their hapa work cannot be completed due to non-availability of labor as substantial number of hapas have already been constructed and people are getting busy with their own cultivation work. Once a farmer gets a hapa on his land, his other interest in agricultural works seems to undergo a change and getting their own family more involved in their own fields. In an area where lack of employment generally poses a severe problem, there is now enough interest to the extent that even marginal farmers are taking a greater interest in cultivating their lands rather than working on NREGS projects, particularly in the months when hapa water is available for irrigation purpose. The chronic deficit of employment generating resources seems to have found an appropriate remedy with the advent of hapas. The normal inertia found in the functioning of the government machinery has been shaken in this region by the earnest efforts of all the stakeholders and the spread of hapas in the area has been quite high in the previous two years. The same might continue till the whole area reaches a stage of abundance in hapas leaving no land un-irrigated.

5. Conclusion

Several field-level researchers have observed that the multiple use of water services improves health, freedom from drudgery, increases food and income considerably, more effectively and sustainably than conventional single-use of water services (MUS).[7] Our study of hapas corroborates the effectiveness of the MUS strategy. Our study also correlates with the findings of an earlier field-study on hapas undertaken by Sevak Kumar Jana that reveals that hapas have a "strong impact on the livelihoods of rural people as well as 'environmental impacts like soil and moisture conservation of the watershed area."[8] Farmers in water-scarce regions with an abundance of rainfall can easily replicate the hapa model to receive similar benefits. Our study shows that hapas can bring substantial changes not only to the livelihoods of hapa-owners, it also bring changes in their attitudes to life. The most important change seems to be that the hapa-owner farmers are slowly turning into entrepreneur farmers, planning and cultivating crops with an eye to the market. Such entrepreneurship is perhaps the most important element inculcated in the small and marginal farmers that can bring more deep-rooted change in the socio-economic dynamics of the whole region.

The study has applications for agricultural development for the whole of West Bengal as well. In this state, agricultural growth since the 1980s has been achieved principally depending on the entrepreneurship of small and marginal farmers. These farmers constitute around 97.7% of the total number of farmers and possess almost 85% of the total agricultural land (2002-03[9]). These small and marginal land-owners engage their family labor to raise agricultural production by optimal use of their small plots of land. Not only

labor, they also put their entrepreneurial intelligence to work to plan cultivation of a variety of crops in different seasons, as suitable to the particular soil quality and according to the demand of the market, to get the maximum profit. The potential for agricultural development based on small land holdings is evident from our study on hapas as well. The present study shows that this potential can be best tapped when small and marginal farmers are supported with a source of irrigation water.

For the bulk of small and marginal farmers in West Bengal, one of the main constraints is their lack of ownership or control over the sources of irrigation. Most of these farmers in the alluvial plains of the state have so far depended on small diesel pumps to extract groundwater for irrigating their plots. But of late, the sky-rocketing diesel price has rendered most of the diesel pump sets defunct, bringing a severe crisis to these farmers who are unable to afford electric pumps. Even farmers able to afford electric pumps are not getting connections for several reasons. Only 10% of all pump sets used in agriculture in West Bengal had been electrified as at 1999[10]. As there has been little change in the situation since, it would take quite a long time to bring electricity to the rest of the state. Hence, the crisis of irrigation might be resolved at least to some extent by replicating the hapa model even in the plains. Marginal farmers, even when they are able to purchase water from pump-owners, have to bear higher charges increasing their cost of production. Small water harvesting structures on their cultivable land might reduce their irrigation costs considerably.

If widely implemented on the plains, hapas could conceivably help to mitigate a number of problems. It would help generate employment for the ever-increasing numbers of landless people[11] by opening up more ways to use the NREGS funds (during 2010-11 average employment that could be given to the employment-seeking families in this scheme in West Bengal was only 27 days[12]). It will also help to recharge groundwater and thereby act as a check to its further exploitation.

The study shows that the dynamics of change by incorporating hapas in Bankura have been brought about by the positive approach of all the stakeholders related to the project. The development NGO not only introduced the idea of hapas, they played a vital role as facilitator from beginning to end in the process of project implementation. They are even helping farmers to plan their crops to get the highest production and best return out of their small plots of land. The government officials (particularly the BDO at the initiation stage) and the panchayat officials (both elected members and Gram Panchayat staffs) seem to have been involved and concerned in effective implementation of the project. The principal stakeholders, i.e. the small and marginal farmers of the area, have readily accepted the new idea and invigorated their agricultural practices with a completely renewed attitude gained by their involvement in the process of project implementation. Finally, no political bickering is allowed to take place disturbing the implementation process. All these factors combined for the successful implementation of the hapa project.

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[1] www.bankura.gov.in, website of the state government.
[2] *Opportunities in Green Finance*, Resource Management Centre, NABARD, Kolkata.
[3] District Statistical Handbook of Bankura, 2005, Bureau of Applied Economics and Statistics, West Bengal government.

[4] Third Minor Irrigation Census (2000-2001) in West Bengal, Water Investigation and Development Department, Government of West Bengal. 2003.
[5] Panchayat Chalchitra, Panchayat and Rural Development Department, Government of West Bengal.
[6] Sebak Kumar Jana, Sustainable Small-scale irrigation experiment in the dry zone: A case study of hapa model in the state of West Bengal, 2011
[7] B. Van Koppen, S Smits, P Moriarty and F Penning de Vries, Community-level multiple-use water services: MUS to climb the water ladder. 2006.
[8] Sebak Kumar Jana, Ibid, page-2.
[9] NSS Report No. 492, Some Aspects of Operational Landholdings in India- 2002-03, NSS 59th Round (January-December 2003), NSSO, Ministry of Statistics and Programme Implementation, Government of India, August 2006.
[10] NSSO (1999), 54th round, Cultivation Practices in India, January 1998-June 1998, Department of Statistics and Programme Implementation, Government of India, August 1999.
[11] The proportion of landless rural households in West Bengal increased from 39.6% in 1987-88 to 49.8% in 1999-2000. Source: West Bengal Human Development Report, 2004, Development and Planning department, Government of West Bengal, page-39.
[12] www.nrega.nic.in.