

**Revival of Traditional Irrigation Systems and Impact on Tribal Livelihood: A
Case of Phad Revival in Maharashtra
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Abstract:

Northwestern Maharashtra especially Dhule district had a rich history of Phad irrigation system. This system was largely a diversion based system with governance institution to promote equitable water distribution and efficient agriculture. The system gradually died out. In 2006, two civil society organizations namely Dilasa and CInI, with concerted effort of community undertook a revival of phad irrigation in Dhangarwadi village of Yavatmal district. The community was Dhangar - nomadic tribes in Maharashtra, who came from Sakri Taluka in Dhule district. Within 2 years, after one full agricultural year passed, the agricultural landscape in the village changed. The village experienced a much higher yield in cotton, the dominant cash crop in the area and also for Sorghum and Pigeon Pea. With ensured irrigation and advent of Rabi Cultivation the gross cropped area increased to 152.57 acres from Net sown area of 88.76 acres. Many farmers who had land outside the command or were landless leased in land for cultivating Wheat and Onion during the Rabi season. The advent of Phad thus contributed to both food security and income enhancement. A detailed cost benefit analysis of revival of Phad, using opportunity cost approach, showed that an investment of Rs. 6.10 Lakh resulted in providing irrigation for 59 Ha land and generated Gross Surplus of Rs 6.74 Lakhs. The cost for reviving phad came to Rs 10340 /Ha which shows that revival of phad can be an economically sensible policy decision; more so given the context of the district of Yavatmal which in recent years has witnessed agrarian distress and presence of similar resource condition as found in Dhangarwadi. While the results from agriculture are very impressive, its sustainability is still a question. Quite contrasting from other traditional irrigation systems, the phad in Dhangarwadi do not have a strong governance system. There is a community institution (Water User Association) in Dhangarwadi but it needs to be strengthened; if these optimism needs to be sustained. The study also argues that the current impressive outcomes will be constrained in the long run in absence of a strong community institution governing the phad operation and management.

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Brief History of phad irrigation in Maharashtra

Phad irrigation is one of the traditional forms of irrigation practiced in the Khandesh region of Maharashtra. They were prominent in the Dhule and Nashik district across the Panzara and Azim rivers in the Tapi river basin. The actual age of these systems is disputed. While Agarwal and Narayan (1997) conjectured that Phad irrigation may be 300-400 years old, while Banstola (2007) in his work on Phad has mentioned Bandharas as old as 1409 AD.

The system comprises of a diversion weir (*bandhara*) constructed across the stream/river and diversion of river/stream water to the *blocks of agriculture land (Phad)* through construction of main channel (locally termed as *Pat or Kalvas*), distributaries (*Charis*) and field channels (*Sarangs*). Phad system also had provision for drainage of water, back into the river through construction of waste weir (*Sandwa*) and escapes (*Sandams*). The command area of each phad (locally known as *Kayam Bagayat*) were divided into blocks of land which are known as Phad. The size of the entire phad varies from 10-200 ha with an average size ranging between 100-125 hectares. (Agarwal and Narayan 1997, Banstola 2007) The irrigation system draws its name from these blocks of agriculture land. Sengupta (1985) in his seminal work on traditional irrigation system had stated that the nomenclatures of these systems are often been associated with the more difficult operations. So, according to him as diversion is easier in hilly areas compared to conveyance of the water, the traditional irrigation systems in the hills are known by their conveyance systems like *Kuhls* while in the valleys and plains diversion of rivers are difficult and thus the nomenclature of these systems are derived from diversion structures like *Bandharas*, *Weirs* and *Anicuts*. Phad irrigation confirms with Sengupta's inference. Though phad system originated from diversion weirs and elaborate conveyance structures, the complexity of the system lies in its institutional arrangement for equitable management of the system at the plot level more so at the phad (*block of land*) level and hence the nomenclature. To ensure proper water management and distribution, each phad has Water User Associations (WUAs) locally known as *Bagayat Committees*. Canal Supervisors (*Hawaldars*), Inspectors (Patkaris) and Water Guards (*Jaglias*) ensure equitable water distribution by making proper arrangements within the system. (Agarwal and Narayan 1997). Each of these entities has different tasks and they are made accountable to the command area farmers by interlocking their incentives and remuneration with the amount of area irrigated and agriculture production (Banstola 2007). The *phad* level management of the phad irrigation system will be discussed under the governance section as a frame of reflection to the current governance pattern as being followed in the revived Phad in Yavatmal district.

In spite of elaborate managerial system governing the phad irrigation in North Western Maharashtra, the Phad irrigation has deteriorated over the years. Sengupta (1985) had attributed direct suppression of the colonial government and later on the Indian Government which further accentuated with advent of modern methods like energized water extraction mechanism and post colonial reforms in the form of civil reforms like the abolition of *Permanent Settlement (Zamindari)* system (Pant 1997) for the systematic decline of most of the traditional irrigation systems. Pant (1997) also noted that with advent of alternatives like energized pump sets and canal irrigation the traditional irrigation system had declined. Even Agarwal and Narayan (1997) had attributed the emergence of reservoir based canal system in the upstream of the rivers over which the diversion weirs of the phads were earlier located thus reducing the water flow in the river downstream. Lack of water control and guaranteed water supply to the phad, emergence of dug well and tube well and shifting priorities from water for irrigation to supply of river water to adjoining Dhule town for drinking purpose are the dominant reasons behind the gradual dying of the phad systems.

Reviving Phad irrigation in Yavatmal district in Vidharbha: The Process

The process of revival of phad irrigation in Yavatmal district was initiated by the Dhangar community and owes from the traditional practice of Phad irrigation in Sakri Taluka of Dhule district.

In 1965 the Dhangars, classified as nomadic tribes in Maharashtra, came from Sakri taluka in Dhule district and settled in Dhangarwadi village in Yavatmal district. They continued to practice rainfed agriculture for decades. In the 90's, one of the young progressive Dhangar farmer decided to tap the leakages from the adjoining percolation tank and irrigate the field. The percolation tank which was adjoining to the village was earthen dam and the leakages from the walls took the form of a stream which flowed round the year but was never utilized. This progressive farmer in his childhood had seen how farmers in Sakri Taluka used to construct *Bandharas* across Panzara river and practiced *phad* irrigation. He along with his father and five brothers decided to create an earthen bund across the stream and construct earthen channel along the contours to irrigate their patch of land. The entire activity was completed within a period of 11 days. In due course of time a 700 meter long earthen channel was constructed and they started irrigating their patch of land. This was in 1998. Within Dhangarwadi they had largest landholding and they were the first to practice irrigated agriculture. Cotton and Wheat were cultivated from the phad irrigation system. Till 2001, the entire endeavour was restricted to one family but gradually this progressive farmer household also started conveying water to adjoining fields to other Dhangar farmers. This resulted in some sort of group formation and around 15 hectares of land were being irrigated from the Phad channel.

In 2006, Dilasa a Yavatmal based Non Governmental Organisation and Collectives for Integrated Livelihood Initiatives (CInI) a national level Non Governmental Organisation initiated a process of strengthening the revival process. The objective of this process was to extend the existing phad system by construction of permanent check dam across the stream and extending the irrigation channel to benefit phad across the entire Dhangarwadi village. The process of revival was undertaken with active support of the community who contributed by providing voluntary labour (*shramdaan*) in the revival process. With time, 2 diversion weir of combined length 60 meters were built up across the stream to create storage and water was diverted from the stream to the fields through construction of 2 contours based canal system of combined length 2.5 kilometers. In due course a water user association named *Pani Baba Water User Association* was formed in the village comprising 44 members including 11 executive members.

Objectives of the Study:

The process of revival in Dhangarwadi village was more than 2 years old. The village has observed a full agriculture season (kharif and rabi season) after post construction of the diversion weir and conveyance channels. Under this context a study was undertaken to trace out the impact of the revived phad system on the agriculture based livelihood of the Dhangar community. Since, this revival process was a concerted effort of both the community and external organizations like Dilasa and CInI, and for further successful replication the study tried to critically analyze the sustainability aspects of such revival activities mostly in terms of institutional governance of irrigation management.

The district of Yavatmal is dry with thin irrigation coverage. But most of the farmers have been cultivating rain fed cotton in the kharif season. In recent years this district have often come in prominence because of rising trend of agrarian distress in the year due to monsoon failure, low yield ,high cost of cultivation and rising debt, cumulatively which has manifested in increasing tendency among the farming community to take drastic action including committing suicides. Under such a context it also becomes important to see whether the revival activity of phad irrigation can be extended beyond Dhangarwadi and spread across the district to ensure enhancement of irrigation coverage and improvement of cotton yield. So this study also focuses on the economics of revival of Phad irrigation to see whether it makes sense economically to take up revival activity at the district level at a large scale.

Methodology of the Study:

The study took a mixture of qualitative and quantitative approach to trace out the impact on the agri based livelihoods of the Dhangars with the advent of Phad. A complete census was undertaken across the farmers who practiced agriculture over the phad command. Recall method was used to find out the change in their agriculture practice mostly manifested in terms of crop choice and productivity. Personal Interview was undertaken with some of the farmers to trace out the governance pattern over the phad system and also trace the impact of phad at the household level.

To trace out the direct impact of Phad, use of *control* was also undertaken whereby respondents from two adjoining rainfed villages were randomly selected. A cost of cultivation survey and agricultural practices survey was administered over both the phad command and the control area to trace out the impact of phad. Thus this study undertook both *with-without* and *before-after* method to assessing the impact.

To trace out the economics of phad revival, the study computed the cost of revival of Phad using *Opportunity Cost Approach*. A focus group discussion was undertaken with the project staff of Dilasa and the community to trace out both the *material cost* (which included both actual paid out cost and shraamdaan) and *time cost* of the community. To compute the *time cost*, detailed information of the duration of community participation during the entire revival period was undertaken and they were converted into *labour days* and finally converted into money value by incorporating the male or female daily wage rate.

$$RC_{Phad} = MatCost_{Phad} + TCost_{community} \dots\dots\dots (1)$$

$$TCost_{community} = LD_{male/female} * W_{male/female} \dots\dots\dots (2)$$

Where: RC_{Phad} = Revival Cost of Phad (in Rs); $MatCost_{Phad}$ = Material Cost of revival of phad (in Rs); $TCost_{community}$ = Time Cost borne by the community in the revival process(in Rs); $LD_{male/female}$ = Male/Female Labour days (days); $W_{male/female}$ = Daily Male/Female Wage Rate (Rs/day).

The study also computed the cropwise Cost of Cultivation and Gross Surplus and then they were compiled together seasonally to infer about the Seasonal Surplus and finally the Gross Surplus over the entire Phad command. The area follows an intercropping system and different agriculture operations are jointly applied to different crops. In western countries, the following methods have been recommended to suit their respective farming system:

1. Cost should be shared according to their relative market.
2. The analysis of joint-cost should be based on the food values of the two parts of the crop (starch equivalent)
3. To charge whole cost of production against the principal object of production and assessing no cost to the by-product excepting the labour cost incurred in handling it. (Singh pers. Commn. 2008)

To resolve this complexity and compute Cropwise Cost of Cultivation, this study followed Dhondyal (1987) method whereby the ratio that exists in the income of the crops that are intercropped is the ration in the apportionment of their cost of production.

$$I_x = P_x * O_x \quad I_y = P_y * O_y \dots\dots\dots (3)$$

$$C_x / C_y = I_x / I_y \dots\dots\dots (4)$$

Where: I_x = Income from Crop X(in Rs); P_x = Price of Crop X (Rs/Quintal); O_x = Output of Crop X (in Quintals); C_x = Cost of Cultivation of Crop X (in Rs)

The Cost of Cultivation was calculated on actual *paid out cost* for the cost of Fertilizer, Pesticides, Seeds, Farm Yard Manure, Ploughing and Labour but where own farm Manure, self plough were used *Opportunity Cost* approach was used to compute the total cost.

$$TC_x = SC_x + PIC_x + LC_x + FC_x + PC_x + FYMC_x \dots\dots\dots (5)$$

$$TGS_x = P_x * O_x - TC_x \dots\dots\dots (6)$$

$$GS_{phad} = TGS_{Kharif} + TGS_{Rabi} = (TGS_{x1} + TGS_{x2} + \dots) + (TGS_{x3} + TGS_{x4} + \dots) \dots (7)$$

Where: TC_x = Total Cost of Cultivation of Crop X (in Rs); SC_x = Seed Cost of Crop X (in Rs); PIC_x = Ploughing Cost of Crop X (in Rs); LC_x = Labour Cost Under Crop X(in Rs); FC_x = Fertilizer Cost under Crop X (in Rs); PC_x = Pesticide Cost under Crop X(in Rs); $FYMC_x$ = Farm Yard Manure Cost under Crop X (in Rs); TGS_x = Total Gross Surplus under Crop X (in Rs); P_x = Price of Crop X (Rs/quintal); O_x = Output of Crop X (Quintal).

Results and Discussion:

Demography and Occupation: The size of the household was similar in the command area and control area. On an average there were 6 members in a household in the area. The occupational pattern among the phad command area farmers, who were traditionally nomadic tribes, was dominantly animal husbandry. Around 41% of the respondents reported animal husbandry as the dominant source of occupation while 26% reported agriculture being the dominant source of livelihood. In the control villages, 64% of the respondents reported agriculture as the dominant livelihood activity while 18% who were mostly Dhangars but outside the command area reported animal husbandry as being dominant occupational source.

Land Ownership: Among the farmers over phad command, 56% were owner cultivators. The average cultivated area among these owner cultivators was 6 acres. Irrigation literature at different point of time has drawn relationship with the tendency of leasing in of land within the command area with the advent of irrigation. (Choudhury 2007, Webster 1992). The phenomenon seems to get repeated over the phad command. With the advent of phad *lease in* of land has been rampant. Around 56% of the respondents (some of them have land over phad command and still they have leased in land) reported *lease in* of land across phad command. Average *leased in* area was around 3.6 acres. The pattern of *lease in* was heavily biased towards seasonal leasing in of land. Around 67% of the leased in household reported to lease in land for the Rabi season and only 25% leased in land on annual basis. In the command area and in the control areas the lease rent was mostly in terms of cash payments, made either seasonally or annually. While phad was the dominant source of irrigation with 78% respondents reporting phad to be their only source of irrigation, rest of the farmers drew water directly from another leakage channel.

It was found that the rainfed farmers from the control villages have larger land under cultivation in comparison to the phad command farmers. On an average 9 acres was the average cultivated area in the control villages with high degree of variation (CV 90%). Only 14% respondents among the rainfed farmers reported *lease in* of land.

Change in Agricultural Landscape: A macro view

With the advent of Phad, the agriculture landscape in Dhangarwadi village has changed from being an extensive rainfed irrigation largely characterized by higher sown area-high cost of cultivation-low yield to intensive kharif-rabi cultivation. The cropping cycle in the village now spans two seasons. In the last agriculture season, the Net Sown Area was 90 acres and the Cropping Intensity was around 172% (Refer Table 1) which was much higher than the cropping intensity in the control Villages (which was 95% with 33% CV).

Table 1

Season (2007-08)	Irrigated area (in acres)
Kharif	69.76
Rabi	81.28
Summer	1.53
Gross Cropped Area (in acres)	152.57
Net Sown Area (in acres)	88.76
Cropping Intensity (in %)	172

(Based on authors survey)

Change in Agricultural Landscape: A Micro View

The cropping pattern in Dhangarwadi and the adjoining control villages are quintessential Vidharbha cropping pattern. In both these areas Cotton is the predominant crop which is inter-cultivated with pulses mainly Pigeon Pea. The dominant cereal crop cultivated in the kharif season is Sorghum. In recent years there has been increase in the area under oilseeds, mainly Soyabean. It was seen while 80% of the respondents reported intercropping of Tuar and Cotton in the control villages, only 57% reported Irrigated Cotton Pigeon Pea intercropping in the phad command. Around 79% of the respondents in the phad command reported some patch of land under Sorghum cultivation which is 52% in the control villages. Around 33% respondents in the phad command area and 29% respondents in the control villages reported soyabean cultivation. With the onset of irrigation, Dhangarwadi village has witnessed advent of Onion cultivation during Kharif. Around 29% of the respondents over phad command reported cultivating Onion for the first time.

Detailed cost of cultivation survey shows that advent of Phad has resulted in yield enhancement in cotton, which is most important cash crop of the area and Sorghum which is the dominant food crop in the area during Kharif season (refer Table 2) When compared with control villages it was found that both Cost of Cultivation and Gross Surplus from cultivation across the phad command is more than in the Control villages (Table 3). Thus the advent of phad has contributed to both the cash economy and food security of the area during Kharif.

Table 2

Crop	Average area under Cultivation (acres)	Yield (Q/acre)
Cotton (Dhangarwadi)	3.72	4.65
Cotton (Control)	5	3.9
Pigeon pea (Dhangarwadi)	1	8
Pigeon Pea(Control)	1	8
Sorghum(Dhangarwadi)	1	5
Sorghum(Control)	2.2	3.98
Soyabean (Dhangarwadi)	4.77	2
Soyabean(Control)	5.7	4

(Based on authors survey)

Table 3

Crop	Average Cost of Cultivation (Rs/acre)	Average Gross Surplus (Rs/acre)
Cotton (Dhangarwadi)	3738	6204
Cotton (Control)	3870	4870
Pigeon pea (Dhangarwadi)	4225	13704
Pigeon Pea(Control)	6207	9040
Sorghum(Dhangarwadi)	1013	1320
Sorghum(Control)	N. A.	N.A.
Soyabean (Dhangarwadi)	2896	1784
Soyabean(Control)	N.A.	N.A.

(Based on authors survey)

The greatest benefit of Phad is observed in Rabi season when 81 acres are under cultivation in the Phad command while the land is completely fallow in the control villages. In the Rabi season the cropping pattern is predominantly biased towards wheat cultivation. Around 92% respondents reported wheat cultivation in Rabi and 23% reported Onion cultivation. Since wheat was both cultivated for sale and domestic consumption, and looking at the *predominant rabi season lease in* phenomenon, the greatest contribution of phad has been its contribution to the household consumption basket leave alone the income enhancement (refer Table 4).

Table 4: Rabi Cultivation Status over Phad Command

Crop	Yield (Q/acre)	Cost of Cultivation (Rs/acre)	Gross Surplus (Rs/acre)
Wheat	5.69	2370	3630
Onion	31.5	4972	6512

Credit Scenario in the Phad Command:

Recent literature on agrarian distress has identified credit as one of the major source of deficiency. The study wanted to trace out how with advent of phad irrigation, which is a community resource generation the credit pattern has been affected. Also this becomes important when it is taken into account that access to cheap credit is important to practice profitable agriculture. Thus indirectly the access to credit would have implications on the sustainable and profitable utilization of the created community resource like an irrigation system. During the course of the study it was found that around one third of the respondents depend on informal credit source (moneylender) as dominant source of credit. Around 59% reported formal credit source like banks as their source of credit. Strangely in the control villages the situation was quite contrasting with as high as 77% of the respondents reporting formal credit source like Banks as dominant source of credit while only 9% reported to take credit from moneylenders.(Refer Table 5) The authors' could not interpret the results.

Table 5: Credit Behavior among the Irrigated and Rainfed Farmers

Source of credit	Phad command (in %)	Control villages (in %)	Annual Rate of Interest (in %)
Moneylender	33	9	47-60
Bank	59	77	12
Relatives	32	9	27-60

Another interesting thing pertaining to credit was credit from relatives. In Dhangarwadi, the phad command, around 32% respondents, mostly Dhangars, had reported credit from relatives. The Dhangars have a strong sense of community feeling and they also follow a system of *saalaana*, which is a system of providing credits markets in exchange of young idle male labour. Thus in some form the labour markets are interlocked with credit through this practice. Such practices were prevalent among rich Dhangar farmers who would lend money to their poor counterparts in exchange of idle male labour, as a part of patronizing their mates to start of new ventures. Since the household size of the Dhangars are large (in one instance it was found one household has 21 members), idle labour was easily available. This labour was explicitly used to look after the large herds of sheep's that the Dhangars possessed. This practice of *saalaana* strictly takes place within the Dhangar community.

It was observed that agriculture is the main purpose for loan seeking. Around 88% respondents over the phad command who opted for credit from moneylenders reported agriculture to be the major purpose of loan. The picture was similar even in the control villages. Loan sought from relatives were mostly used for domestic purpose like marriage and house repair. It was found that among the persons over the phad command, who had opted for loans from moneylender, 78% were fresh loans taken this financial year. 22% reported having outstanding loans with moneylender and they did not opt for any fresh credit this year.

With regards to loan sought from formal sources like banks it was found that 61% were fresh loans which were sought this year while 38% were old loans, and the people who had outstanding loans did not opt for fresh loans this year. *What was more important to note was that among this 38% respondents, equal percent respondent has gone back to the informal credit source for fresh credits.*

Currently the formal credit coverage is low over the phad command than in the control villages. During the course of fieldwork the researchers came across some SHGs which are currently struggling to perform. Also the trend of farmers reverting back to informal credit source from formal credit source is also an ominous sign. Under such a context it becomes important that in future livelihood enhancement activities through promotion of agriculture or water resource development needs to go hand in hand with better credit provision. By going back to where the section started, better provision of credit would ensure sustainable and profitable utilization of a community resource system like phad.

Pattern of Migration and Phad:

The Dhangars are nomadic tribes and as such move around with their herds for majority period within a year. For most of the nomadic tribes migration is an important economic activity and also an integral part of their culture (Kher 2006). Before the advent of phad, the entire family would move out of the village and would migrate with the herd for 9-10 months in a year. While they remained settled for 2-3 months in their village, they used to depend heavily on adjoining forest for fodder and fuel wood. At that time the agriculture yield was too low to generate sufficient by-product from the farm which could be used for domestic purpose and for fodder. Hence the dependency on the forest was large.

Even after the advent of phad irrigation, Dhangars migrate out of their village with their herds. This has not changed as migration is a part of their life process. What has changed is the pattern of migration. Now the entire household does not migrate out with the herds, 2-3 members in the family would remain in the village to practice agriculture. Moreover with advent of irrigation most of the members would remain in the village till December and send one or two members with the herds, while earlier they use to move out immediately after the rain stopped or as early as in September. The change in the pattern of migration can be attributed to advent of phad irrigation since it assures kharif crop and also allows the Dhangars to go for Rabi cultivation, which as mentioned above contribute to both food security and cash income. Also for nomadic tribes like Dhangars, it will be utopic to think that with advent of phad irrigation their age old nomadic

lifestyle would suddenly transform to sedentary in couple of years. But the change in the pattern of migration that is observed over the phad command can termed as an considerable impact of phad on the migration habits of these tribes.

Change in Asset holding with advent of Phad:

It has already been observed that with advent of Phad irrigation, the farmers have benefited in terms of both yield enhancement and increase in gross cropped area. This has resulted in both enhancement of food security and income. According to the *recall* of the command area farmers prior to the advent of Phad, Cotton intercropped with Pigeon Pea and Sorghum used to dominate. On an average each household use to cultivate 5.2 acres of Cotton and 1.5 acres of Pigeon pea. The rainfed cotton used to yield 2.8 Q/acre while the yield of pigeon pea was around 5q/acre. The yield now has increased to 4.65 Q/acre and 8 Q/acre for cotton and pigeon pea respectively. Moreover the village has witnessed bumper production of Onion and as reported by the villagers for the first time in the history truck load of Onion has left the village. These changes have already manifested itself in terms of enhancement in the asset holding among the Dhangars in the last one year. It was reported that around 33% of the respondents over the phad command has bought some kind of asset last year. Of them 20% bought land, 33% bought consumer durables, 33% bought vehicle and 20% repaired their homes. On an average these households have spend Rs 38,850 last year on purchase of assets.

Is revival of Phad economically sensible policy decision?

The above observations lead to a very important question at the policy level. Will revival of phad, which is an example of concerted effort of community and civil society, remain as an isolated case or can such efforts be promoted across the district and across the state? The answer partly lies in the economics of the revival of the phad. It thus becomes important to see whether the revival of phad can be an economically meaningful policy decision.

During the course of this study, the research team computed the Gross surplus generated from various agricultural operation over the phad command area for an entire agriculture season. The term *Gross Surplus* was used because the calculations did not considered the rental value of land either paid or received in case the land has been *leased in* or *leased out* and also the interest on outstanding or fresh credits. According to the computation the Gross Surplus across the entire command came around Rs 6.74 lakhs for the last agriculture season (Refer Table 6).

Table 6 Gross Surplus over Phad Command

Net Sown Area (Kharif) in acres	69.39
Gross Surplus (Kharif) in Rs. Lakhs.	3.61
Net Sown Area (Rabi) in acres	77.75
Gross Surplus (Rabi) in Rs. Lakhs.	3.12
Gross Surplus over Phad Command	6.74

The study also looked at the cost side of the venture and computed the total cost of revival of the phad using *opportunity cost* approach. For this the research team sat with the project team of Dilasa and computed both the material cost required for Phad revival and the cost incurred by the community both in the form of voluntary labour (*shramdaan*) and their participation in terms of time spent in meetings, discussions and planning during the revival phase. It was found that the total cost of revival such a system which actually irrigated 59 hectares came to around Rs 6.10 lakhs, which is around Rs 10340 Rs/hectare.

Combining the cost side and the revenue side in the form of Gross Surplus it was found that the venture of reviving the phad system seems to *break even* at the end of first year itself. Thus revival of phad also seems to be economically sensible.

Governance over Phad irrigation: The issue of sustainability:

In the previous sections we have systematically documented the changes in Dhangarwadi village with the advent of phad irrigation. The changes observed were for better and seem to have a positive thrust towards livelihood improvement of the nomadic Dhangar community. This section would deal with a far more important issue, the issue of sustainability of the observed phenomenon. It becomes important to question whether the observed exuberance observed over the phad command is just a phenomenon that runs for the project period like many other decentralization programmes. Or is this development sustainable and carry forwards on its own by the community members beyond the project period? The questions move beyond the domain of technology and agriculture economics and moves into the domain of institutions and governance as observed over the phad command.

During the course of the fieldwork the researchers' could not see a strong community based governance system over the phad command. There were 2-3 enterprising farmers, one among them being the proponent of phad in the village who seem to show some interest in the management of the phad. But as of now there was no systematic way of community based irrigation management system being institutionalized over the phad. The *institutional organizers* like Dilasa have promoted a WUA, but the institution needs lots of strengthening. Sengupta (1985) had noticed that often the community based management which was self emanating in the most of the traditional irrigation system and more so over *ahar pynes* in Chottanagpur seem to operate at an informal level with little formal structures. But we could not trace any such community level management even at the informal level. The 2-3 farmers who also happened to have large landholdings over the command (and one of them being the same farmer who started phad irrigation in the village) had some interest of developing a strong community based management system over the phad command. According to them, in the first agriculture season there were no conflicts and the distribution of water took place with mutual understanding. While the researchers argued that in absence of any community institutions the system cannot be maintained or managed, these farmers argued that some informal meetings do take place before the start of the agriculture season where the farmers communicates their crops and based on it the water released and distribution takes place. But the same was not echoed by the majority of the farmers. The observation that most of the cultivators over phad command were not owner cultivators but seasonal lease holders, institutionalizing a strong community based management system over the command becomes both operationally difficult but at the same more important.

The observations are quite in contrary when we look into the contemporary literatures on traditional irrigation systems. Agarwal and Narayan(1997) and later Banstola (2007) have given detailed account of the management of the phad systems in Dhule district. They have mentioned how different actors like the canal inspectors, water guards , the Water User Associations played a role in maintenance of the irrigation channels and more importantly the distribution of irrigation water among the command area farmers. The traditional irrigation systems literature has identified the locale management system as the unique proposition of most of such traditional systems. Sengupta(1985) had noted that "*the traditional management systems have developed and were perfected over centuries and more likely to be complex and very efficient*". Pant (1997) had observed large scale community mobilization among a hierarchical society in Bihar where farmers had small and scattered landholdings towards maintenance and management of the traditional irrigation systems. Not just maintenance but traditional irrigation institutions geared towards effective water management and more so under stress situation is also been observed over command over irrigation command. Sengupta (1985) and Pant (1997) has quoted how homogenous cropping pattern evolved over the irrigation system and the homogeneity implied easier and effective management and facilitates collective action among the farmers. Agarwal and Narayan(1997) based on an approach paper of WALMI Aurangabad on Phad Irrigation gives detailed description of how the WUAs decided upon the crop rotation and crop choice across the phads and across seasons were means for better water utilization and equitable water distribution. Most of these authors have noticed a phenomenon where land is fragmented and each command area farmers have some land in head, middle and tail reaches of the command

ensuring that the WUA have some incentive for ensuring that water reaches to all the parts of the command.

While collating the observations from the command area of phad irrigation under the context of the traditional irrigation literature, following inferences can be made:

- The observed exuberance in terms of improved agriculture that is currently noted over the phad command can be attributed to the generic benefits brought in by the irrigated agriculture from an autarkic rainfed situation. This initial exuberance brought in by the advent of irrigated agriculture will tend to die down in due course and then the role of community institutions in drawing collective action across the command area farmers will become important.
- In the last year rainfall was abundant and water scarcity in the stream coming out from the minor irrigation dam was not felt by the command area farmers. So complexity pertaining to water distribution under scarcity situation did not arise. But this may not be the case in future and under scarce scenario the role of community institutions in ensuring proper water management will be very important.
- Revival of Phad irrigation cannot be an isolated technological solution to a natural problem of rainfall erraticity and scarcity. It is also a social solution to water scarcity. As has been noted Pant (1997), Sengupta (1985) and Agarwal and Narayan (1997) the greatest strength of the traditional irrigation system was there locale specific technological and social innovations which also proved to be their greatest weaknesses. With advent of modern technology like energized pump sets and large canal irrigation and with changes in the social structures like abolition of *Zamindari* system the traditional irrigation systems have gradually died in different parts of the country. Choudhury (2006) also noticed how decades old lift irrigation co-operatives in western Maharashtra in spite of having strong linkages with sugar factories were facing imminent threat from outgrowth of tube well irrigation within the irrigation societies command. These observations have important implications over phad system also. Currently a lot of importance is given to the engineering aspect (like the canal systems being drawn across contours) but within few years if there is advent of well irrigation within the command, the current engineering may fall flat. This can be more expected given the progressive nature of the Dhangar farmers who with accumulated wealth in few years may start digging wells within the command. All these imply that a strong community institution at the command area level needs to be institutionalized from the beginning itself to ensure equitable and efficient water management.

Institutional Strengthening of Dhangarwadi: Some initial thoughts

Currently the phad command may have an informal system of organization, informal system of water distribution and crop planning which needs to be formalized. This can be undertaken by organizing a meeting of all the members of the WUA. In the meeting the informal rules of water distribution and crop planning needs to be clearly specified before each member, discussion/debate needs to be initiated among them and a final set of rules has to be reached which will be signed by all the members of WUA. In this way we do not change their informal practices but strengthen them by formalizing their informal practices.

Prior to this meeting selected member of this WUA should be taken for exposure visits to WUAs in Maharashtra which have sustained over time. May be visit to Ojhar where the members directly interacts with the WUA leaders there will be useful as they come to know about the complexities of water management that creeps over time and various activities that WUA needs to undertake. May be a training or two organized by WALMI Aurangabad may be useful.

A definite crop planning exercise needs to be initiated. Initially this can be done jointly by Dilasa and WUA but gradually this task will have to be taken by WUA. This may include raising demand on a piece of paper which includes name of the farmer, survey number, landholding size, crop type and cropped area, number of irrigation required, duration/ after how many days and actually

number of irrigation applied etc. Based on this, subsequent issues pertaining water scheduling and water productivity can be addressed. One of the members of WUA can be assigned to undertake this exercise before every agriculture season.

Dilasa have to do an intelligent scheduling of the activities like exposure visit and training needs which needs to be followed by a meeting of WUAs and an elaborate crop planning exercise. There are well known Water User Associations in Maharashtra who have been promoted as a part of Participatory Irrigation Management over large canal commands, mostly promoted by civil society organizations. The WUA over Dhangarwadi may learn from their experiences of institutionalizing collective action over phad command.

Way Forward

In a district like Yavatmal which in recent years has been infamous for agrarian distress, outcomes from revival of phad in the village of Dhangarwadi have been very impressive. There has been improvement in both agriculture production and productivity which has been manifested in terms of improvement of food security and cash income. In one instance one of the farmers, with the income from his irrigated agriculture could release his son from *saalaana*. While the initial responses are very positive the issue of sustainability still needs to be addressed through proper designing of governance institutions over the command area.

The more important question within the policy arena is whether this revival that was undertaken as a concerted effort of community and civil society can be replicated across the district where similar resource condition exist. Already it has been observed that revival of phad in Dhangarwadi is an economic decision. As on date there is a good scope of Phad irrigation being promoted; at least in the district of Yavatmal. There are many streams which flow through the forest areas and checking these streams, water can be utilized for irrigation purpose. There exist 580 check dams in 16 blocks of Yavatmal district constructed under Tribal Development Scheme, Zilla Parishad and Minor irrigation Division. Many of these tanks have leakages which flows out as streams and which can be harvested to promote irrigated agriculture in the hitherto rainfed areas. The economics of revival also portrays that such revivals can also be a sensible policy decision.

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