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TITLE: The Two Ancient Irrigation Systems of India

Phad System of Maharashtra & Overflow Irrigation system of Bihar.

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Abstract

The Two Ancient irrigation Systems of India

Phad System of Khandesh - Maharashtra – It is basically a system consisting of a diversion weir, the canal and the distributaries to take the water to field. The special about the system is the management of available water. The total land under command is divided in 3-4 parts, which is called as the phad. The land in each phad is irrigated by overflow system i.e. the whole land in the section is fully filled with the water for the fixed duration. After that the water going to the phad is stopped and transferred to 2nd phad and so on. The excess water goes either from 1st phad to 2nd hence to 3rd and then back to main river through the Nalla or minor tributary or goes directly to tributary and then to main river.

Overflow Irrigation system of Bhagalpur – It works without any dam or weir. It is based on principle to taking in the flood water to agriculture fields, flood them with the water, allow the suspended soil to settle down, water to percolate before, then allow the excess water to run back to main source when the flood in main river recedes.

Comparison Chart

Phad System	Overflow system
1. It is about 2300 years old system.	1. It is about 2300 year old system.
2. It has chain of Bandhars	2. It does not have any Bhandhara but has chain of inlets on river bank.
3. It has to have leveled fields with shallow river basin.	3. It has to have leveled fields around With shallow river basin.
4. It has not gates or valves at main tributary but has a control outlet to field.	4. It has a inlet so created as only water above the inlet can come into the field.
Allow over of excess water.	
5. The inflow of water can be controlled only at entry point and entry point of Each phad.	5. Once opened for water, it is difficult to control the inflow of water.
6. The excess water runs back to chain	6. The excess water goes back to main

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| source i.e. main river. | Source i.e. the main river. |
| 7. The proper care is taken by the water using body to distribute the available water proportionately. | 7. As the flood water is used, there is no need to control for the proportionate Distribution. |
| 8. The system can operate when there is water flowing on the river when it is Flooding or no floods. | 8. The system operates whenever there is flood is the river. |
| 9. The villagers who are benefication have a controlling/managing body for water distribution/crop sowing pattern etc. | 9. No such controlling body is observed. |
| 10. Fishing is not possible. | 10. Fishing is the side business. |
| 11. It mainly operated on rivers Panzara, Kan, Burai, Girna, Misom and Aram. | 11. It is mainly on Ganga in Baghalpur Dist. Of Bihar (former Bangal) |
| 12. It is stilling functioning the some Villages. | 12. It has fully stopped functionary |

The study of the systems, their similarities and their differences can guide us to accommodate some principles. So modern water distribution systems can be modified for the betterment.

Introduction – The civilization started flourishing by the river sides very soon the time come when people were successful in transporting the water nearer to their habitation by artificially managed methods. This water was used for all the human needs including irrigation. In this paper I am trying to compare the two very old irrigation systems of India one on river Ganga in North India and another on tributaries of river Tapi in South.

Before going into findings of irrigation works on both the rivers I will introduce both the systems.

A] Phad system of Maharashtra – It is the irrigation system mainly on river Panzara, Girna and Burai, which are the tributaries of Tapi. River Kan and Jamkheli which conjugate in Panzara and Mosam and Aram which meet Girna also have the same systems of irrigation.

It is mainly the systems of irrigations the agricultural land by the water diverted form the river by construction the overflow type of Bandhara [i.e.Bund]. The land getting the benefit of irrigation water is normally divided in 4 parts [may be 3 in some cases] which are called as phads and have local names like Hanuman Phad, Ambabaicha Phad etc. It is totally people managed water distribution & management system. In this system the Bund or Bandharas constructed either by the Sardar or any other Govt. authority or constructed by any rich citizen who in return got the reconsideration and returns like authority to collect tax from the ruler. It called as Deshmukhi or Patilki.

The writer proof of the age of those systems is available for Milvan Bandhare which was constructed by Mr. Shivram Dagadu in year 1328 [Shake 1260] n the memory and it cost them Rs.6000/- at that time [from the record with the irrigation dept. of Dhule circle.]

The exact period of the starting of this system is not determined scientifically. But the folk tales and folk information take these systems as back as 300 b.c. [similar conclusion is drawn by Dr.More in his thesis.] At that time these were the temporary loose boulder type funds, which the people had to construct every year after the

intense rainy period was over. When their knowledge could develop the permanent bund the temporary loose boulder structures were converted into permanent U.C.R. masonry Bunds, as mentioned above.

In this paper, I am not going into the details at how the Bund is constructed and how the canal and distributaries are laid and how the total system works managed and made workable. I will pass on to main topic with the only mention that it is the most ancient people managed irrigation system in the whole world known as most sustainable irrigation systems of the world [paper by Mr.D.H.Kulkarni and Mr. R.K.Patil in 1984 at 12th congress on Irrigation & drainage at Fort Collins, USA]

It has the chain of Bandharas on the river. The dist. between the two bunds is not fixed nor its height is fixed. The two bunds may be from 5 to 10 kms. away. The only conclusion that can be drawn that there is a bund upstream of each village location, which provides water for irrigation to that village. The river wise No. of bandhras which are still function in 2006-07 is given below .

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Name of rivers	No. of Bandhras
Panzara	25
Kan	9
Burai	9
Girna	6
Mosam	37
Aram	15
Jamkhedi	--
Others	11
Total	– 112

It is observed that there are similar type of Bandharas and irrigation system on river shivan, Rangewali, Nagini and Sarpini in Nandurbar Dist. [previously part of western khandesh or Dhule Dist.] All these rivers are tributaries to Tapi. But the irrigation on these rivers has a little different method and it is not popularly known as Phad.

The Irrigation – To mention earlier, it diverts water from main channel. It has no gate/outlet/ have to control the flow of water from the Band. Any quantity of water that can flow from Bandhara to Main canal starts flowing into the canal. There is the out let allows the regd. Quantity to flow further away and helps the excess quantity of water to run back to main river. Thus quantity of water in the canal is controlled.

The water reaches the phad and total process of irrigating the area is carried out by overflow system. The entire area of phad is flooded by incoming water upto certain desired period. After that period the excess water either goes and gets transferred to 2nd phad and then to 3rd and so on or the other option is runs back to main river through the escape.

As the system operates on diversion of water, it is essential that river must have the water. There is no necessity of having the flood.

3-4 decades ago, the system was operating through for all the 12 months of year.

Overflow Irrigation system of Bhagalpur, Bihar [farmer] Ganga Damodar Delta port of greater Bangal

– The discovery of this old system was accident. There was wide spread material in the region for long 10 years from 1922 to 1932. It was decided that only medicinal efforts are not sufficient and should be aided by some alternate measures. So it was decided to excavate canals from Ganga to Damodar. When the work was started, the engineers for the older canal below each newly designed canal. The astonished engineers started search about the oldness of these canals and they were traced as back as 2300 years old. [Er. Williams Willcocks had 3 lectures in the institute of Engineers Culcutta in 1928, where he elaborated this system and then written a book on it called **Overflow irrigation of Bangal**.

It was observed that there were small weirs called Kan and the canals called Kanawas. These systems had the similarity to the ancient irrigation systems in western India and Egypt as pointed out by Mr. Willcocks. I feel it necessary that somebody should take a careful search of other irrigation works in India of the same period and find out whether there are some similarities.

The parallel canals at nearly 5 miles interval is the main source of water. The

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practical condition for this type of irrigation to be successful is to have shallow river and canal bed with fairly level or gently sloping land. The Ganga Damodar Delta Wally units to these conditions.

Similar overflow canal is observed in Eastern part of Bangal [none know as Bangladesh] near Jasore Ekulana. It is known as 'Mathabhanga' canal which transfers water from main Ganga [from Nadia Barriage near Rampur] to Sundarban. It was the longest canal of such type.

It will not be deviation from main subject if I just mention that this must be the oldest successful attempt to transfer water from basin of one river [river Ganga] to river Damodar carried out nearly 2300-2500 years ago which we are discussing today. Some of the canals or Kanas reach the other river while some stop in between and therefore called as Blind or Kanawas.

The system is that the water from main river/main canal gets diverted to agricultural fields whenever the main channel is in floods. The Kai or the bund is used some times for this water diversion on may not be used. The river bank is cut by providing notch [which can be sealed just by putting obstruction again] and water is allowed to flow to the fields.

The diverted water is muddy and also carries the suspended silt along with it. It stands in the field for quite a good time when the silt settles down forming the fertile layer. This time is sufficiently long though to that fishing is possible in these artificially created temporary lakes. The crapping is possible when the water drain off say nearby after the monsoon is over.

When the railway lines were laid in the area, the constructed high-level tracks for it obstructing these parallel canal system. Bangal Govt. tried to revive it in late nineteen the century learn in twenty in century but was not successful in doing it. The estimates and bills of works prepared are available as a support proof for the revival attempt.

The main point of attention is that there is not control like valve/gate etc. for the incoming water. But the width and the depth of the canal control the flow provided. The canals are many a times 30-50m. wide or even more with the depth of just 15m. The size of notch out in the back just decided the spied and the quantity of water that could flow in.

This system was mainly used for high water consuming crop like rice. The speed and the time in which it will drain off will be decided by the monsoon rain interval and also by the return flow outlet opening.

It was observed that the system could not operate due to insufficient rain for only 4 times in 50 yrs. [This is the record of 1870-1930 when the system was partially in operation.]

Table

Name	Length of Canal [Miles]	Area [acres]	Width		Depth of water [Ft.]
			Head	Tail	
1. Kana Damodar	60	1,25,000	120'	90'	5
2. Kana Nuddee	40	2,10,000	200'	100'	5
3. Gya	30	35,000	40'	30'	5
4. IIsura	50	1,30,000	130	30	5
5. Gargur	50	1,10,000	110	30	5
6. Banka	50	1,05,000	100	30	5

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Comparison of both systems- As discussed in the previous paragraphs. Both the systems work on the principle of overflowing/flooding the entire land under cultivation by the water made available from main source by the knowledge and practice of the people living

In phad system the area irrigated under one Bandhara was just 300-600 acres where as in overflow system of Ganga-Damodar Delta it is in lacs of acres.

Both the systems operate under gravity flow. The record of how the people could manage and carry out/ calculates the levels are not known. May be that their observation skills and knowledge nature was helpful for them to make then understand these things.

A Phad system area has only one monsoon rain water available where as Bangala system has summer flood also.

In phad system the agriculturist could take at least 2 crops a year where as Ganga-Damodar Delta had the practice of one crop a year .

In phad system there was perfect water distribution management and control on the cropping pattern, which was decided and controlled by the body of villagers. Nothing of such can be observed in Bangal system.

There was the rotation of crops in phad system. If there are 4 phad on one Bandhara. The 1 yr. Crop can be repeated in 5th yr. Only. There is no such control in Ganga Damodar Delta.

The dist. Between Bund and irrigable land is small may be 3-5 kms. in phad system. The modified phad system [i.e. the block system developed and introduced by Bharatratna Visveswarayya has longer dist. and canal length upto 25kms. also. The Ganga Damodar Delta has av. subcanal length of 8 –10 kms.

Let me put all the described data in a compact tabular form.

Comparison chart

Phad System	Overflow system
1. It is about 2300 years old system. 2. It has chain of Bandharas	1. It is about 2500-year-old system. 2. It does not have any Bhandhara but

3. It has to have leveled fields with shallow river basin.
4. Can work where the subsoil strata is hard rock like basalt.
5. There is a crop rotation in all phads. Each phad has to take same crop & It is repeated after 4 yrs. again by Rotation system. The cropping pattern Decided by village body.
6. It has not gates or valves at main tributary but has a control outlet to Allow over of excess water.
7. The inflow of water can be controlled only at entry point and entry point of Each phad.
8. The excess water runs back to chain

has chain of inlets on river bank. There are the cuts on river banks which are called 'Kanwas.'

3. It has to have leveled fields around With shallow river basin.
4. Operates where the subsoil strata is 'allumina.'
5. There is no rotation system is crop. The agriculturist has the power and capacity is decide about which type of crop has can take. There is not deciding and controlling body for this.
6. It has a inlet so created as only water above the inlet can come into the field.
7. Once opened for water, it is difficult to control the inflow of water.
8. The excess water goes back to main

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<p>source i.e. main river.</p> <ol style="list-style-type: none"> 9. The proper care is taken by the water using body to distribute the available water proportionately. 10. The system can operate when there is water flowing on the river when it is Flooding or no floods. 11. The villagers who are benefication have observed. 12. Fishing is not possible. 13. It mainly operated on rivers Panzara, Kan, Burai, Girna, Misom and Aram. 14. The canal are narrow and shallow 1.00 wide x 5 to 10 deep about 5-10 km. Long. 15. There is only in one main canal on each bank for one Bandhara. Parallality Is no criteria. 16. The water goes from weir to Khajina [a shallow & silent pond] where all silt settle down and only clear water goes is fields so as to help To keep canal system free from silting. 17. No study on mosquitoes control is done as the fields are filled with water for a very short duration. 18. Divert water from main water channel and takes back excess water to some river. 	<p>Source i.e. the man river.</p> <ol style="list-style-type: none"> 9. As the flood water is used, there is no need to control for the proportionate Distribution. 10. The system operates whenever there is flood is the river. 11. No such controlling body is a controlling/managing body for water distribution/crop sowing pattern etc. 12. Fishing is the side business. 13. It is mainly on Ganga in Baghalpur Dist. Of Bihar (former Bangal) up to Damodar river section. 14. The canals are broad and shallow [13 to 50 m wide and about 1.5m deep 15. They are long continuous and parallel to each other. 16. Transfers suspended soil/ mud to fields thus carrying futility to land. It is carries the wealth. 17. Flowing water with the fishing side business is much helpful to control Mosquito borne dieses like malaria. 18. Diverts water with the use of canal from me rivers and takes it further Away to the basin of the another river [Ganga to Damodar]
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19. It is still functioning in some Villages.

19. It has fully stopped functioning due to obstruction created by railway track in Late 19th century.

Conclusion-

By observing the similarities and differences of both the systems on nearly 19 points. I will just like to conclude that **there was the water wisdom and knowledge of irrigation by our forefathers, which they could use for the betterment of their life. We are now working for the same purpose with modern methods. Can we take the note of this precious knowledge, which persisted for centuries together and add up to our modern systems so as to have the better results for the betterment of human life and culture.**

Thank you.