

# Water and Its Management for Better Living in the Bengal Delta — A Case Study of Radhaballavpur Village

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ベンガルデルタにおける生活改善と水利用

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## I. Introduction

### 1. The objectives and the compounds of the study

Water is a prime natural resource, a basic human needed and a precious national asset (India, Govt. of, 1987 p.1). Distribution of water is uneven in space and season. Therefore, water brings not only benefits but also disaster like drought and flood. It is one of the most important factor for rural development, which revolves around on measure of control and utilization of natural water resources. The water facilities and their utilization portray the level of rural development.

The objective of this paper is to clarify the changes of an Indian village in the Bengal delta in the last 25 years with focusing upon water facilities and its water

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utilization. The main topics of the study are; (1) the water facilities, (2) the water utilization and (3) the relations between living standard and rural development, especially agricultural development, and water use.

## **2. Study methods**

The team of geographers from Hiroshima University carried out village survey taking Radhaballavpur as a study village. It was recognized as the typical rural village in the Bengal delta, the first survey conducted in 1967. In 1992, we took the same village (viz. Radhaballavpur) for the return survey to understand the changes of Indian village in the Bengal delta during the period of quarter a century.

The return survey consists two parts. One is census survey(using schedule paper), and the other is intensive survey. Information of ownership of water facility- tank, well, pump-set and of sanitation- toilet and bath room were collected from the census survey. On the other hand, location of water facilities and information of water utilization were collected through the intensive survey. The field survey was carried out between 19 September and 4 October 1992. On the basis of collected data, we shall describe the water facilities and their utilization in the study village, and try to understand relations between living and rural development and water use comparison with the result of the first survey.

## **II. The village**

### **1. The region**

Radhaballavpur belongs to Medinipur district. The district of Medinipur lies between 21°36' and 22°57' North latitude and between 86°33' and 88°11' East longitude. The district is bounded on the north by Bankura district, on the north and north-east by Hugli, Hawrah and 24-parganas district, on the south by the Bay of Bengal, on the west and south-west by Bihar and Orissa state, respectively.

The river Rupnarayan which rises from Chotanagpur plateau is the eastern boundary of the district. It joins the Hugli before falling into the Bay of Bengal. The nature of the Rupnarayan is tidal through its entire course. Therefore, it is difficult to utilize its water for irrigation. This region is below 3 meters above sea level. The region has suffered heavily on account of floods of the river, in spite of the fact that

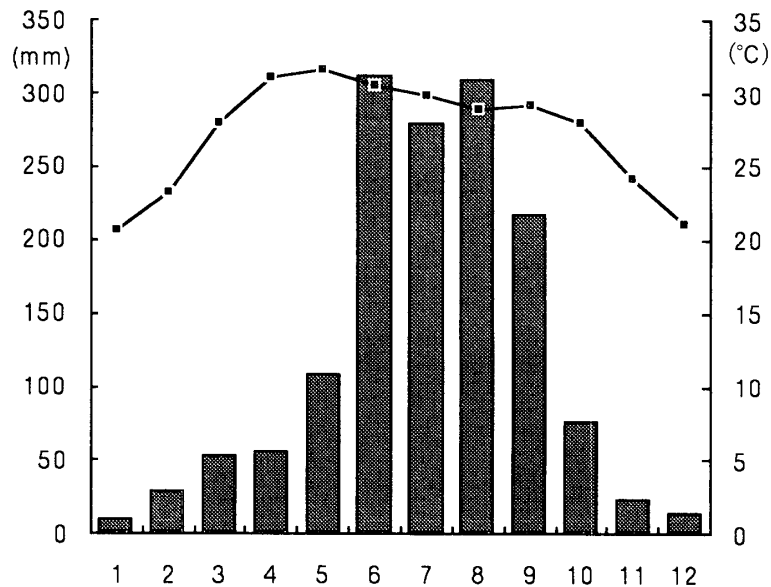


Fig. 1 Rainfall and temperature at Medinipur

the side of river are protected with high embankments.

The region experiences a hot and humid monsoonal climate. The coldest month in the region is January (20.5°C) and the hottest is May (31.7°C). The rainfall is widespread with uneven distribution. The average of annual rainfall at Medinipur is 1472.6mm. About three fourths of annual rainfall is brought during monsoon season(June to September)(see Fig.1)

The region has rich natural water resources. For efficient utilization of these natural water resources suitable management is needed. The absence of such management will contribute to be in disasters-drought and flood, and to create problems for rural and agricultural development.

## 2. The village

Radhaballavpur is located in Tamulk police station in the east part of Medinipur district, facing the eastern boundary of the district. The Ganga *khari*, a tributary of the Rupnarayan, flows on the north edge of the village. Radhaballavpur has 59.76 hectare of geographical area. The land of the village is roughly divided into two categories, namely high land and low land. The difference between high and low land is 1 to 1.5 m. High land is utilized for settlement, field and tank. On the other hand

low land is mainly utilized as paddy field. According to the Census(1981), there was no forest. The area of irrigated land, un-irrigated land, culturable waste and area not available for cultivation was 26.30, 21.04, 2.020 and 14.40 acres, respectively.

According to the our census survey(1992), there were 202 households in total. 108 workers, both male and female, were engaged in agriculture (28.1 per cent of total worker)

### III. Water facility

We shall describe here on the water facilities in the village such as tank, canal and drainage, tube well and pump-set.

#### 1. Tank

The number of tanks in this village had increased after 1968. In the first survey(1967), 124 tanks were reported. In the return survey(1992), the number of tanks constructed before 1967 is recounted. It is 132. There is no tank disappeared after 1968. There are 155 tanks in the village in 1992, thus 23 new tanks were constructed during the period. The location of tanks in the village is mainly in high land (see Fig.2). Some new tanks locate in low land, which are mainly used for fish cultivation and irrigation for betel-vine. These are new patterns of tank utilization. More detail will be discussed later.

Most of the tanks are not so deep. According to our measurement(1992), it is at most about 3m with a limited capacity. Tanks are not connected with the canal and drainage. The impounded water in tanks is only rain water. In the case of no or less rainfall, tanks have little and limited water. The new tanks are relatively small with only 2 to 3 *khata*(133.78 to 200.67 m<sup>2</sup>).

#### 2. Canal and drainage

The Ganga *khari* flows on the edge of the village with a sluice, located about 2 km downstream of the village, controls tidal water. There are two channel systems in the village. One is connected with the Ganga *khari*, and the other is not (see Fig. 2). The Ganga *khari* is under tidal influence and therefore the ebb and flow affect its water level. In addition to that, the village is quite flat. Hence, the former channel

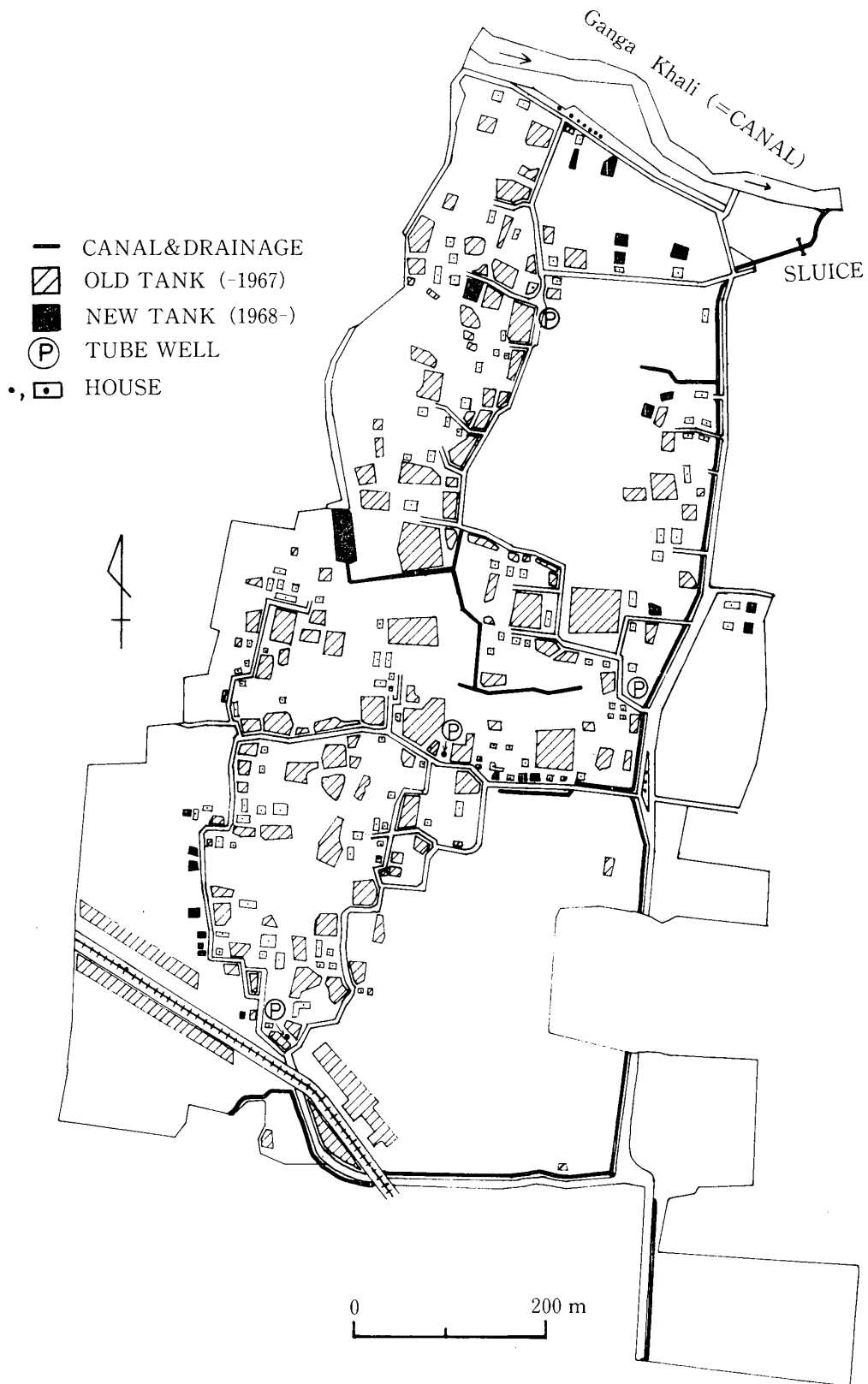


Fig. 2 Water facilities in Radhaballavpur

system plays a role for drainage and distribution of water. The river water is controlled by a wooden sluice at the takeoff point of the Ganga *khari*. The sluice is owned by the state Government but operated by the villagers.

### 3. Tube well

Four tube well are working to acquire drinking water in 1992(see Fig. 2). There is no irrigation well in the village. The first tube well of the village was introduced about 40 years ago. This tube well has already dried up. *Panchayat Raj* which is a newly institutional system was introduced to the village in 1977. At that time a *Gram Panchayat* which is the lowest level of *Panchayat Raj* system was set up. The *Gram Panchayat* has 13 revenue villages including Radhaballavpur. One of the important tasks of *Gram Panchayat* is to improve water supply system. Two tube wells were constructed in 1978 and 1979. One of them was dried up in 1988 and was replaced by a new tube well in the same year. Two more tube wells were made in 1984 and 1986. The depth of tube well ranges 650 to 800 feet. The concentration of salt, potential of hydrogen and electric conductivity of the water is 0.02 – 0.03%, 7.6 – 7.8 pH and 977 – 1040  $\mu$ s/cm, respectively. It is strictly prohibited to use the water for bathing and washing.

Table 1 Pump-Sits in Radhaballavpur

Owner Type (H.H.NO.)	Type	Power (H.P.)	Year Introducd	Remark Price
1-3	Kerosene	1.5	1966	
1-4	Diesel	5.0	1990	RS. 7,000
3-2	Kerosene	3.5	1990	RS. 6,000
4	Kerosene	1.5	1984	
37-3	Kerosene	1.5	1985	
	Diesel	11.95	1991	RS. 7,300
37-4	Diesel	9.5	1991	RS. 13,500
	Kerosene	5.0	1991	RS. 5,000
86	Kerosene	3.5	1986	RS. 3,500
90	Kerosene	3.5	1985	
108-3	Kerosene	3.5	1990	RS. 6,000
109-6	Kerosene	3.5	1990	

Source ; Field Survey in 1992

#### **4. Pump-set**

Pump-set is a necessary device to have water control. Table 1 shows the pump-sets in the village. The first pump-sets was introduced in 1966. Most of the pump-sets in early time were low power kerosene pump-set with around 1.5 H.P. . After 1985, high power kerosene pump-set with above 3.5 H.P. was introduced. Diesel pump was introduced in 1990. The power of diesel pump-set is higher than that of kerosene pump-set. There were 9 kerosene pump-sets and 3 diesel pump-sets in 1992.

### **IV. Water utilization**

There are numerous tanks in the village. Tanks are used in various ways, namely for drinking , washing, bathing, fish cultivation and irrigation. Canal and tube wells play significant roles in irrigation and sanitation systems. In this section, the focus is placed on utilization of the water facilities in the village.

#### **1. Drinking and cooking water**

The main source of drinking and cooking water is through the tube wells in all season. Before the introduction of tube wells, the villagers used the tank water for drinking purpose. They got water from their own tanks with a bucket and brought it to their house. Each house had a traditional water treatment system. They piled three or four pots which were un-glassed pot, called *kalsi*, and kept some sand these in. The villager poured the water into the top pot. The water went down, percolating from the top to the bottom through sand in the pot. Finally the villager got fine water from the bottom pot.

Nowadays we can not find such traditional treatment system. Only a few villagers use two stories' plastic or metal bucket water treatment system. But they do not use tank water. Most of the villagers use the water from tube well for drinking and cooking. During the first survey there was only one tube well in the village. Thanks to the *Gram Panchayat*, there are four tube wells. All houses are located within a radius of 100 m of tube wells. In each house collecting water is mainly done by women and children. A specific timing is not fixed as tube well water is available for the whole day.

There is no restriction for the use of tube well except for particular people. It is observed that the villagers generally use the tube well which is situated near their houses. The villagers who live at the north edge of the village use river water for drinking purpose. In fact the water in the river does not suit for drinking, but other villagers prohibited them to use tube well because they are migrants and got their land in the village owing to the government policy. From this fact, we can understand that they are not recognized as the member of Radhaballavpur by local villagers.

## **2. Washing and bathing water**

Washing and bathing water is taken from tanks. Most of the tanks in the village have steps for washing and bathing purpose. These steps are made of wood and/or stone. A few rich families have *pacca ghat* with bench as made of big stone board or concrete by their own tank. This indicates affluence of well-endowed families.

When the villagers wash their clothes, they beat their clothes on the surface of a step or washing board which is set near steps and is about 60 by 130 cm. To wash utensils, pans and pots, the villagers use only sand. On the other hand, they use soap and detergent for washing clothes, which leads to pollution. The tank in the village is unopened. The problem of water pollution is gradually becoming more serious.

According to our census survey, only 16.8 per cent of the total households have lavatory. Children and men usually take a bath in tank. Even women, we could see taking a bath in a thin sari at tank. The use of soap is becoming popular. They usually take a bath in morning. It is strictly prohibited to use tube well water for washing and bathing purpose.

## **3. Fish cultivation**

There are various water spaces in the village, namely tanks, river, and channel. In addition, some plots of the low land are turned into paddy fields. In these water spaces, there are various kind of aquatic life such as fish, shell, crab etc. They form important source of food and protein for the people of the Bengal delta.

The villagers use fishing rod and fishing net, called *chakuni jal*, to catch fish in tank, and a traditional instrument for catching fish, called *munguri*, in flowing water



at channel and outlet of paddy field. Some villagers catch shells and crab in tank with their own hand. These products are mainly consumed by themselves.

Some villagers are devoted to pisciculture. Some rent out their own tanks to other people who do pisciculture for the purpose of earning money. But such a commercial fish cultivation has been appreciated neither the borrowers nor the lenders of tank.

There are new tanks which are dug to get soil for betel-vine cultivation. Most of such tanks are used only for fish cultivation.

Recently the villagers use medicine to increase fish productivity. It seems that some medicines and feed are thrown into the water without much care for water quality for health, in spite of the fact that the water on tank is utilized for washing and bathing purpose.

#### **4 . Irrigation**

In the village, the crops which need irrigation are rice, betel-vine and vegetables. Betel-vine and vegetables require timely and optimum irrigation rather than the quantity of water. The villagers irrigate them with tank water by using bucket and low power kerosene pump-set since 1967. But its command area is limited, because capacity of tank water is quite small and it is mainly used for washing and bathing purpose.

On the other hand, rice requires large amount of water. There is much rainfall in monsoon season. That is why rice is rain-fed cultivation in *kharif* season. In *rabi* season, there is less rainfall. Then, rice is irrigated by the water from the Ganga *khari*. The water is pumped up by 3 H. P. diesel pump-set which are temporally set at the outlet of channel in the village, and the water is put into field through the channel. This irrigation system was introduced in 1990.

#### **5 . Sanitation and other uses**

Sanitation in the village is quite slow in progress. There are only 28 families which have lavatory. Most of the villagers, both male and female, go outside for nature's call. The channel system in the central settlement is used as open toilet. There are some boards as step on the drainage. But this channel system does not work as drainage because of lack of maintenance. Another channel system which is used for water

distribution and drainage was improved in 1977. At that time, the channel was made wider and deeper to increase the discharge capacity and was kept in good condition by the *Gram Panchayat*. Now, the *Gram Panchayat* tried to introduce Central Rural Sanitation programme to improve the situation of sanitation system.

Water spaces, especially tanks, give the villagers spiritual repose. Children enjoy swimming in the tank. Steps around tank function as communication place. Women enjoy chatting as they wash clothes and eating-utensils, and bathing themselves. Both men and women enjoy fishing as well. We can safely state that tank plays a significant recreational role for the villagers.

## V. Discussion

In the previous sections, we described water facilities and its utilization in Radhaballavpur. We shall here discuss the relations between living and rural development in connection with relation to water in the Bengal delta, especially focusing on its changes for the last quarter of a century. In this section we shall take the southern part of the village as study area, because it is recognized as a unit in the village where many new tanks are located

### 1. Living and tank

First, we shall discuss tanks in the village in terms of ownership. There are broadly two types of ownership. One is private, and the other is government. There is no public tank which is owned by village community. Most of the tanks in the village are private tanks. Only three big tanks which locate along with railway are government tanks. They were made for construction of embankment of railway. The construction work started in 1962 and this route has opened in 1974. The government allows the villagers to use them for pisciculture. Fig.3 shows the relation between owner and tank in the southern part of the village. Each household has one or more tanks near his house. However, it is rare to see tanks which locate apart from its owner's house. Some tanks are commonly owned by several households. In this case, each group is formed with a relative family called *para*. There is no case that a tank is possessed by different *paras*. As mentioned above, the place around tank is communication place for the villagers. The villagers own some common tanks

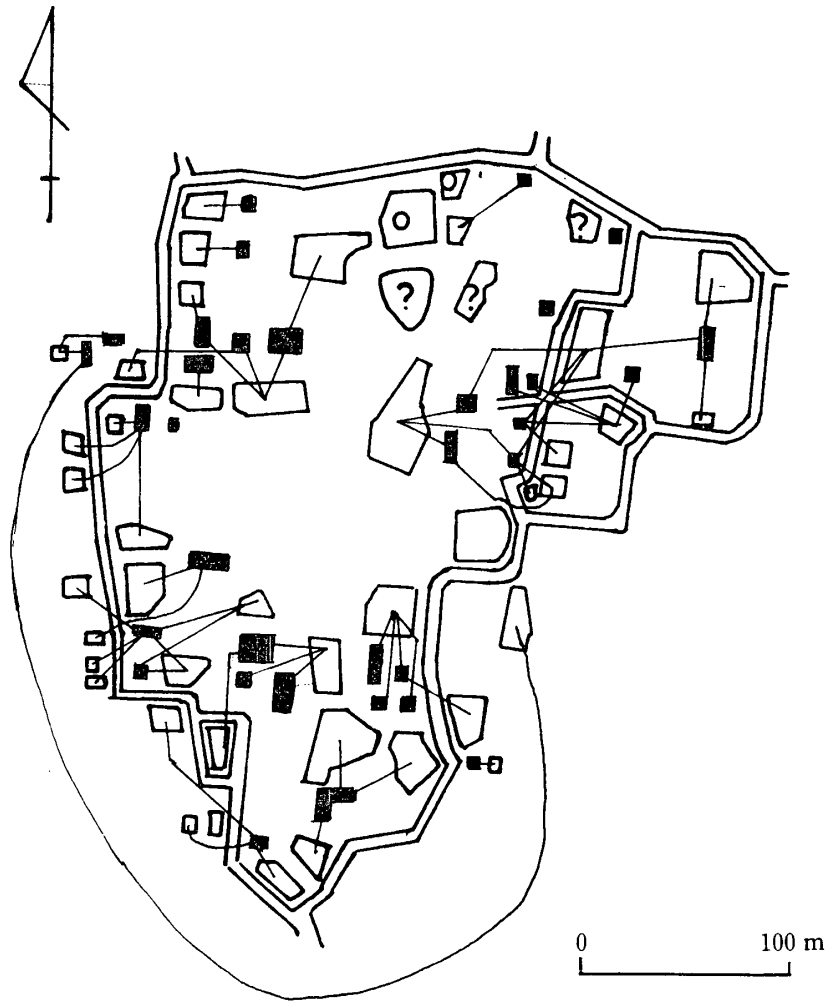


Fig. 3 Relation of Tank and its owner

Table 2 Patterns of Tank Utilization

Single Purpose		Multi-Purpose	
Purpose		Purposes	
D	1	D + F	2
F	9	D + F	1
I	1	I + F	7
		D + I + F	22
(N. U	11 4)		32

D: Domestic purpose (Washing + bathing)

F: Fish cultivation I: Irrigation

N.U: No Use

Source : Field Survey in 1992

within their relatives and strengthen their unity through the communication at tanks.

Next we shall see the using pattern of tank in the same area. As Table 2 shows, most of tanks are utilized in multiple ways. The tanks utilized for a single purpose is only 23.4 per cent of the total of using tanks. Nine tanks are utilized only for fish cultivation. The owner dug these tanks for the sake of irrigation of betel-vine but also of selling out soil. Such owners have other old tanks near their houses. Therefore there is no need to use a new tank for domestic purposes (Drinking and cooking, washing and bathing). They use for fish cultivation only. In case of a new tank, it was made for domestic purpose as an owner constructed a new house. He used the soil for site of his new house. 76.6 per cent of tanks in the village is utilized multi-purpose. 68.6 per cent of the multi-purpose one, furthermore, is utilized for all purpose, namely domestic purpose and production purpose (fish cultivation and irrigation). Tanks are indispensable to the life of the villagers. Irrigation by tank is only for betel-vine cultivation. There was no case for irrigating rice. There are four non-utilized tanks in the northern part. They are located apart from the owners' house and rounded by bamboo tree which interrupt sun shine. Thus it is difficult to use both for domestic and production purpose. These tanks must have been made by the villagers for getting soil to build a house site at the time of settlement establishment.

The above facts reveals that tank has significant role not only for domestic purpose but also for production purpose in the Bengal delta. The added use is for social purpose, namely drainage and recreation. However proper affection is needed to take care of increasing water-pollution

## **2. Progress of irrigation**

Although they have enough rainfall for rice cultivation during monsoon season, the rice cultivation during non-monsoon season needs artificial irrigation. Since the Ganga *Khari* which flows on the northern edge of the village is entire tidal river, the utilization of the water is necessarily controlled tidal water. Furthermore, the dimension to this effect one further added on account of the land being flat and tanks occupying village hollows. The water lifting instruments like pump-sets are needed.

Since 1967 pump-set as water lifting instrument was introduced in the village. In the beginning, the power of pump-set was too low and its command area was

limited so it was used only for vegetables. Because there was not enough water for irrigation, and the capacity of tanks limited and the water in tank being indispensable for the life of villagers in a variety of uses. In the middle of 1970's betel-vine cultivation was introduced, for betel-vine cultivation needs much soil and not much irrigation water. Then villagers dug low land for getting both soil and capacity for storing irrigation water. During 1980's, lot of new tanks were made due to the same reasons.

It was said in the first report that *Taichung* which is H.Y.V. was introduced into the village in 1967. In those days the villagers tried to irrigate *Taichung* in rabi season with tank water using swing-bucket. Later, *Taichung* went out of cultivation and the villagers cultivated no crop in rabi season because of lack of irrigation water.

At present, *Taichung* have come back, due to the improvement of water facilities. The Ganga *khari* was dredged 25 years ago. The channel system which is connected with the Ganga *khari* was improved in 1977 owing to "Food for Work Programme" which aimed to augment the funds of the state government for maintenance of public work on which large investigation had been made in the past, but which are suffering for want of proper care. This work focused on irrigation and, more importantly, on improvement of drainage. The channel was made wide and deep. It is important for not only drainage but also water distribution. In 1988 a sluice was constructed at Chandramer about 2km downstream of the village in the Ganga *khari*. The purpose of it was to control tidal water from downstream and to store fresh water from upper stream. Then the stable water supply for irrigation with optimum amount of water is being expected. Afterward, *Taichung* cultivation in rabi was rapidly developed. The Green Revolution requires a new agro-technology like H.Y.V. as well as optimum irrigation.

For *Taichung*, a new irrigation system is used which is to bring the water of the Ganga *khari* into the channel system by using a high power diesel pump-set, then into fields. The system is completely private and depends upon individual cultivators. The owners of diesel pump-sets charge 380 Rs./Bigha/Crop season a water fee. The state government is discussing water rate for the Ganga *khari*. If the government water charge is introduced, the total water rate will be high. For the optimum water management, the *Panchayat* is specially charged with duty for management of water.

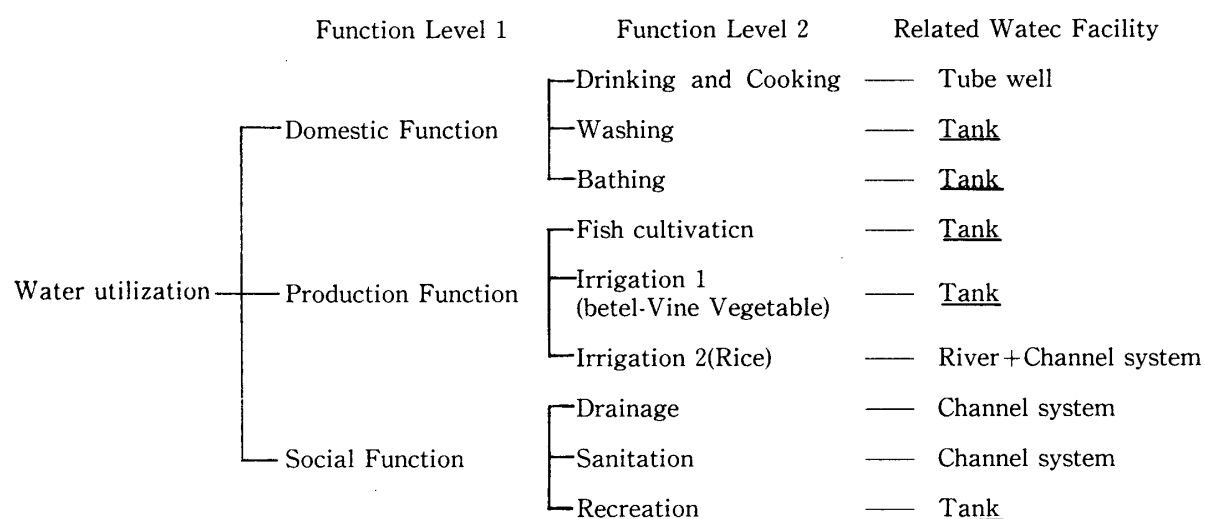


Fig. 4 Relation between Water facilities and Water utilization

Table 3 Changes on water facilities in Radhallavpur

Year	Tank	River (Ganga Khari)	Channel system	Tube well	Pumpset	RematK
1950'S				• First Tubewell introduced		
1966					• Kerosene pwmp unroduced	
1967	Tank(132)	• Drainagemont		• Tube well(1)		• Taichung introduced
1977				• Tube well dry up		
1978			• Improvement work "Food tou work Programme"	• Tube well(1)		• Gram Panchayat set up
1979				• Tube well(2)		
1984				• Tube well(3)		• Betel-Vine introduced
1986				• Tube well(4)		
1988		• Sluice constructed				
1990					• Diesel pump introduced	• Taichung
1992	Tank(155)			• Tube well(4)	• Diesel pump(3)	• Kerosene pump(9)

## VI. Conclusion

This study reveals a few important points regarding the living and water utilization in the Bengal delta.

- 1) The water facility in the village has been improved for last quarter of a century (see Table 3). The Gram Panchayat has contributed for improvement of

drinking water supply system and drainage system. Tanks have increased from 132 to 155 on account of introduction of betel-vine cultivation and construction of new houses. Although the Ganga *khari* is tidal river, the tidal water is controlled by a sluice from 1988 onwards, resulting from availability of irrigation water. The impact on agriculture is significant in the case of Radhaballavpur.

- 2) Tank still has a significant role on the life of people in the Bengal delta (see Fig. 4). Though the water in tank has not been utilized for drinking purpose because of introduction of tube well, it contributes to all patterns of water utilization-domestic, production and social function. The social function is unique.
- 3) Due to the new irrigation system, *Taichung* cultivation is developing. But its water rate is quite high. It is suggested for optimum management of water to establish irrigation *Panchayat* in the villages of the Bengal delta region.
- 4) There are some new problems. Water pollution has increased on account of use of soap and detergent for washing and bathing, and also of medicine and feed for pisciculture. It is necessary to pay more attention to these problems because the tank in the village is a closed system.

## **Acknowledgement**

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