



**IRRIGATION MANAGEMENT AND STATUS OF PIM
ON PRODUCTIVITY IMPROVEMENT
A CASE STUDY IN MAHANADI DELTA PROJECT, INDIA**

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ABSTRACT

Irrigation has helped convert rainfed lands into productive cultivable tracts in India but management of water has suffered due to lack of proper operation and maintenance of the system. Even after establishment of Command Area Development Agencies (CADA, since 1974) performance of the system is still poor and resulted in half hearted adoption of Participatory Irrigation Management (PIM). The CADA Programme was taken up in Mahanadi Delta Stage-I Project, at the lower Mahanadi River Basin in 1976-77.

The CADA took up 'On Farm Development' (OFD) works of construction of field channels, field drains, land leveling & shaping, reclamation of waterlogged areas, enforcement of rotational system, realignment of field boundaries and consolidation of holding, supply of crop production inputs, introduction of suitable cropping pattern and services like credit, extension. The programme also covered ground water development through conjunctive use for efficient operation of the irrigation system upto the outlets.

The programme is under implementation for more than 25 years and a sum US \$ 9.0 ml was spent. A study was taken up by MOWR to assess the achievements of OFD and come out with pragmatic suggestions for optimum results. The paper presents the status of PIM in the Mahanadi Delta Project with respect of the irrigation system, CAD activities, agro-climatic and socio-economic parameters, conjunctive use of water, agricultural performance, environmental impact, benefit cost ratio and recommends remedial measures.

The irrigation system comprises of 5 canals taking off from Mahanadi and Birupa Barrages covering 4 districts and 27 community blocks with a culturable command area of 1,67,000 ha (presently revised to 1,83,400 ha). A number of tributaries and drainage channels forms the drainage system (9000 sq.km) comprising of main, secondary and link drains with out fall,. A total of 44,872 ha is waterlogged of which 32,273 and 12599 ha are seasonal and perennial type with 1671 ha as marshy land. The maximum annual yield is assessed to be 89,593 MCM, with minimum and average of 1880 and 51,061 MCM. The designed average irrigation requirement is assessed to be 3315 MCM (331.5 T ham) with dependable irrigation requirement of 2527.5 MCM\ with 21.0 MCM

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as the requirement for industrial and other uses. Seepage loss is assessed to be 36.3 and 22.9% in main canal and distribution system where as the field application and total conveyance losses are 15 and 59.2% respectively. The efficiency of conveyance and irrigation are 40.8 and 34.7% respectively. In pursuance to the National Water Policy (1987) the State Govt. of Orissa adopted the PIM in the "State Water Policy 1987" and provided legal back up, through Pani Panchayat Act 2002. In the beginning 4 pilot projects on PIM were launched in the first phase (1996) and later on 50 Pani Panchayats were formed and registered as legal bodies and 51% of the total irrigation potential created has been covered under PIM and handled more than 153 nos. of Pani Panchayats (WUAs). and remaining 49% would be covered by 2007.

It has humid tropical climate with good monsoon rain of 1400mm (range 902 to 2337.8 mm) The soil is moderately sandy, pH varies from slightly acidic to mildly alkaline. The infiltration rate of soil is 0.40 cm/hr in sandy soil to 0.1 cm/hr in clay loam soil. The ground water fluctuations for the entire delta in rainy season ranges between 2.18 to 3.94 m and in post monsoon from 1.11 and 2.13 m. Out of 38 blocks 12 are reported to be saline, equally shared by 3 districts of Kendrapara Jagatsinghpur and Puri. The extent of moderate and slightly saline areas are 30,291 ha. and 12,318 ha. respectively (1999-2000)

The total area of Mahanadi Delta Project covers 8304.24 sq. km. with a population of 4.8.62 million with a population density of 585 per sq.km(1991). It has 5,532 villages, 787 Gram Panchayats and 6,67,718 of house holds with per village population of around 1000 persons. Cultivators and agricultural labourers in the whole command have been estimated to be 0.551 and 0. 466 million respectively and are mostly marginal farmers followed by small, semi-medium, medium and large farmers. Average land holding ranges from 1.20 ha. to 1.41 ha.

The command area is rich in ground water with annual replenishable resource, discharge and draft of 3,70,758, 34,549 and 71,378 ha m/year respectively, with the net water availability of 3,36,209 ha.m annually. The quality of ground water is quite safe except in 4 Blocks of Kendrapara district with salinity. Till 2002, rotational water supply covered an area of 1,81,600 ha. and reclaimed waterlogging and salinity in 17,950 ha. Consolidation of holding started prior to the CADA covered 1,40,147 ha with field channels 10,7214 ha. Rs. 11.64 crores has been spent on the construction of field channels, field drains with other components like maintenance of irrigation drainage system, agricultural activities, enforcement of warabani, innovation management in irrigation with a total expenditure of about Rs. 40 crores (us \$ 9 mil.).

The main crops in rainy season are paddy (91%) and in summer also paddy (41.5%) with other major crop are pulses (27.0%), groundnut (8.5%), oilseed (0.7%), vegetables (12.5%). 16343 multi crop demonstrations were conducted from 1977- to 2002 for improving irrigation area particularly in important crops of paddy and other high value crop like vegetables etc. Farmers have resorted to high yield varieties of paddy and other crops and have attempted to take up less water requiring crops in general. Rainy season agricultural productivity of paddy 1.6t/ha. during 1994-95 has increased to 2.5 -2.9 t/ha. in 1997-98 showing 88% increase. In summer the productivity level has gone up to 40.6 t/ha with a increasing trend of production by 55.9% from 1994-95 to 1999-2000 in both the seasons.

Since the CAD development works adoption of PIM in this command area is better as it resulted in better utilization of irrigation potential created by improving project efficiency, increasing irrigated area through available surface and ground water, bringing change in better cropping pattern and increasing agricultural production & productivity and made positive socio-economic impact in the command area of the project.

INTRODUCTION

Irrigation has helped convert rainfed lands into productive cultivable tracts in India but management of water has suffered due to lack of proper operation and maintenance of the system. Even after establishment of Command Area Development Agencies (CADA, since 1974) performance of the system is still poor and resulted in half hearted adoption of Participatory Irrigation Management (PIM). The CADA took up 'On Farm Development' (OFD) works of construction of field channels, field drains, land leveling & shaping, reclamation of waterlogged areas, enforcement of rotational system, realignment of field boundaries and consolidation of holding, supply of crop production inputs, introduction of suitable cropping pattern and services like credit, extension. The programme also covered ground water development through conjunctive use for efficient operation of the irrigation system upto the outlets.

The programme is under implementation for more than 25 years and a sum of US\$ 9.0 million was spent. A study was taken up by Ministry of Water Resources, Govt. of India, to assess the achievements of OFD and progress of PIM and come out with pragmatic suggestions for optimum results in the Mahanadi Delta Stage 1 project, under the perview of the impact evaluation study through the Water and Power Consultancy Services India Ltd. (WAPCOS, New Delhi, India).

The paper presents the status of OFD and PIM in the Mahanadi Delta Project with respect of the irrigation system, CAD activities, agro-climatic and socio-economic parameters, conjunctive use of water, agricultural performance, environmental impact, benefit cost ratio and recommends remedial measures.

LOCATION AND BACKGROUND

The command of the project is located in the lower Mahanadi Basin of Orissa State in Eastern India, with its southeastern boundary touching the Bay of Bengal. The Project lies in the latitude between 19° 40' to 20° 35'N and longitude between 85° 40' to 86° 45'E. The Map-1 and Map-2 indicates it's location with reference to the country and the state.

THE RIVER MAHANADI

The river Mahanadi originates from Madhya Pradesh State and enters into Orissa in Sambalpur district and flows through the state along a distance of about 350 km. It has a total catchment of 1.3 lakh sq./km. carrying an average run off 25000 cumecs.

Its lean season flow is around 30 cumecs. The maximum annual yield is assessed to be 89,593 MCM, with minimum and average of 1880 and 51,061 MCM. The designed average irrigation requirement is assessed to be 3315 MCM (331.5 T ham) with dependable irrigation requirement of 2527.5 MCM with 21.0 MCM as the requirement for industrial and other uses. In the past years one anicut had been constructed at Jobra, Cuttack with a rainy season (Kharif) Command of about 1.5 lakh ha. The tail reach water with an average flow rate of 220 cumecs is not only used to augment the lean season (Dalua) supply into the command of the old anicut but also an additional weir has been constructed at Naraj, Cuttack for irrigating an area of about 4.3 lakh ha. The old anicut has been replaced by a modern barrage. The irrigation command of the old anicut has been named as Mahanadi Stage –1 command and irrigation command and after construction of new weir is known as Mahanadi Stage-II command projects (Fig.3)

CLIMATE

The climate of Mahanadi Delta Command Area is tropical with good monsoon and wet climate. It is characterized by the general wetness of the air. There are 3 distinct seasons in the area. The mild winter season is from November to end of February, followed by hot summer season from March to middle of June and the third the high rainfall monsoon season from middle of June to end of October. During the monsoon season the area experiences heavy rainfall by the Southwest Monsoon with an average rainfall of 1432 cm ranging between 2688.5 mm (1995 in Puri) to 784.3 mm (in Cuttack, 1992). The mean wind velocity varies between 2.6 to 9.1 km/hr with annual average of 5.3 km/hr. The annual mean monthly relative humidity ranges between 92 % (at 8.30Hrs) to 61% (at 1730 Hrs) respectively. The Delta area is not only very close to the Bay of Bengal but also faces cyclone storms during hot summer and monsoon season.

TOPOGRAPHY AND SOIL

The Physiography of the delta presents a general topographical view of a very flat land extending over the vast plane areas with mild undulations in its micro relief. The land areas under these sub-deltas being formed by the fertile alluvium deposits carried by the two adjacent rivers are hence being named as 'doabs'. The Mahanadi Delta Irrigation Project area has been developed in two stages. The Stage-1 Project area constitutes the anicut and gross areas under Doab-I to IV. Similarly the Stage-II project area constitutes the area under Doab-V to VIII. The basin and catchment area relevant to the Delta command are 65,580 sq. km and 19,907 sq.km respectively

The highest land is generally located along the riverbanks, which dissect the Delta forming in to 8 doabs. These doabs tend to slope down from the river to the interior and at the coast. Slopes in the doabs interior are generally in the range of 1:5000 or 0.02%.

SOIL TYPES

Soil Survey in the Delta Command has been conducted by computerized Data Base with inputs from Satellite Remote Sensing Technology, wherein aerial photo – mosaics of 1:29,000 has been used as base map over which different land types and their area coverage information has been transferred by delineating their soil boundaries using a

mirror stereoscope. Both aerial photograph and Satellite imagery has been interpreted for the entire Delta extending over 5000 sq./ km. The method adopted by National Bureau of Soil Survey involves a 3-tier approach, viz. Image interpretation, field survey, cartography and printing. As per the survey report the soils of the delta region are moderately sandy along the rivers to sandy clay loams in the low-lying areas. In general the soil texture is heavier and deeper from river edges to lower delta in the interior of the doabs and from the upper portion of the doabs starting at the delta apex to the lower area closer to sea. The soil pH varies from slightly acidic to mildly alkaline along lavies and upper regions of valley areas. Out of 38 blocks 12 are reported to be saline, equally shared by 3 districts of Kenderpara Jagatsinghpur and Puri. The extent of moderate and slightly saline areas is 30,291 ha. and 12,318 ha. respectively (1999-2000). The soil along the sea shore and adjacent low-lying areas are reported to be saline / alkaline.

THE IRRIGATION SYSTEM

THE IRRIGATION HEADWORK

The Irrigation system of the Mahanadi delta stage-I command, Cuttack comprises of the canal network originating from Mahanadi barrage and Birupa barrage. This delta covers 21 community development (C.D) blocks of Cuttack, Jagatsinghpur, Jajpur and Kendrapada districts. The Mundoli weir is located at the apex of the Mahanadi Delta. In down stream of Mundoli weir the main Mahanadi River branches into three rivers viz., Kathjori, Mahanadi and Birupa. Correspondingly, three barrages were constructed namely, Naraj on Kathjori river at Naraj village, Mahanadi on Mahanadi river at Jobra Village, Birupa on Birupa river at Jagatpur village. These works were commenced in 1866 by British Military Engineering Services after the great Bengal famine and completed in 1883.

The irrigation system comprises of 5 canals taking off from Mahanadi and Birupa Barrages covering 4 districts and 27 community blocks with a cultivable command area of 1,67,000 ha (presently revised to 1,83,400 ha). A number of tributaries and drainage channels forms the drainage system (9000 sq.km) comprising of main, secondary and link drains with out fall,. A total of 44,872 ha is waterlogged of which 32,273 and 12599 ha are seasonal and perennial type with 1671 ha as marshy land.

Seepage loss is assessed to be 36.3 and 22.9% in main canal and distribution system where as the field application and total conveyance losses are 15 and 59.2% respectively. The efficiency of conveyance and irrigation are 40.8 and 34.7% respectively

MAIN CANALS

At the primary level the conveyance of water from the three headwork is being carried out by 6 main canal system. The canal systems coming under Delta Stage-I and Delta Stage-II are (I) Taladanda Main Canal, (ii) Machhagaon canal (iii) Kendrapara Main Canal, (iv) Pattamundai Canal and (v) High Level Canal Range and (vi) Puri Main Canal. The pattamundai canal off-takes from Kendrapara canal at R.D. 0.80 km and

receives high discharge. Similarly, Machhagaon Off-takes from Taladanda Main canal at RD 11.78 kilometers and receives a discharge of 43.10 cumecs.

BRANCH CANALS

At the Secondary level there are 7 numbers of branch canals operating in Mahanadi Delta Stage-I Command. The length and design discharge of this individual canal has been given in Table 2.7. Their total length is 361.41 km at the tertiary level both conveyance and distribution of water is being manned through 431 numbers of distributors and over 531 nos. of minors and sub-minors spreading over the entire delta. The total length of these tertiary level canals is 2808.0 Km..

ENVIRONMENTAL CONDITION

CANAL DENSITY

The total length covered by the primary, secondary level canals has been calculated to be 531.71 km. It may be seen that the density of these primary and secondary levels conveyance systems is 3.2 km per 1000 ha. with a CCA. of 1,83,000 ha. After taking in to consideration of all the conveyance system and distribution system total canal length coverage is 3339.8 km. The density of canal is found to be 20.0 km per 1000 ha of the C.C.A. (Mahanadi Delta Stage I).

CONJUNCTIVE USE AND GROUND WATER STATUS

The ground water fluctuations for the entire delta in rainy season ranges between 2.18 to 3.94 m and in post monsoon from 1.11 and 2.13 m. The command area is rich in ground water with annual replenishable resource, discharge and draft of 3,70,758, 34,549 and 71,378 ham/year respectively, with the net water availability of 3,36,209 ham annually. The quality of ground water is quite safe except in 4 Blocks of Kendrapara district with moderate to slight soil salinity. It is seen that there is occurrence of sand castings in the area which are both of aeolian and fluvial origin. The sand-casting on the slip side off the meandering section of the river is of fluvial origin.

SOIL DRAINABILITY

The soil survey report conducted by National Bureau of Soil Survey and Land Use Planning Nagpur classified the soil of Mahanadi Delta in four parts:

- Soils of upland
- Soils of gently slopping coastal plains
- Soils of lower delta
- Box Sand dunes

It is revealed that in general the deltaic alluvium consists of the admixture of soils with well-drained features. Typical characteristics of soil located in micro uplands are

moderate to heavy textured with poor to very poor drainage characteristics. Findings reveal the area under different soils in the delta command as given in Table 1.

Table 1: Area under Different Soils in Mahanadi Delta Stage I Project

S.N	Soil As per Morphology Classification	Delta Stage –I	
		Area in ha.	% OF G.C.A.
1.	Hydromorphic Soils	19387.50	7.32
2.	Sedentary Soils	1218.75	0.46
3.	Laterite Soil	7443.75	2.801
4.	Aeolian (Dry) Soils	4706.30	1.78
5.	Aeolian (Moist) Soils	Nil	-
6.	Saline Soils	57943.75	21.82
7.	Waterlogged Soils	2681.00	1.00
8.	Coarse Clastics Soils	26925.75	9.82
9.	Other Soils including cropland	145719.00	55.00
	Total	265000	100 %

SOIL PERMEABILITY

On an average the soil permeability in terms of its measured coefficient, hydraulic conductivity, works out to be 2.02 cm/hr for the Delta as a whole. According to USDA permeability classification the permeability of Delta is moderate in entire delta.

SOIL INFILTRATION

The soil infiltration has been observed to be 0.40 cm/hr in sandy soil to 0.15 cm/hr in clayey loam soil. It varies between 0.15 cm/hr in saturated condition sandy loam soil to 0.50 cm/hr in dry conditioned similar soil. In case of clay loam soil it varies between 0.15 cm/hr in dry condition to 0.05 cm/hr in saturated condition.

CROP PERFORMANCE

The main crops cultivated in rainy season are paddy (91%) and in summer also paddy (41.5%). The other major crops are pulses (27.0%), groundnut (8.5%), oilseed (0.7%), vegetables (12.5%).

A total of 16343 multi crop demonstrations were conducted from 1977-to 2002 for improving irrigation area particularly in important crops of paddy and other high value crop like vegetables etc. Farmers have resorted to high yielding (HYV) varieties of paddy and other crops and have attempted to take up less water requiring crops in

general. Rainy season agricultural productivity of paddy was 1.6t/ha. during 1994-95. This has increased to 2.5 -2.9 t/ha. in 1997-98 showing about 88% increase. In summer the productivity level has gone up to 40.6 t/ha (1999-2000) with a increasing trend of production by 55.9% from 1994-95.

RESULTS AND DISCUSSION

IMPLEMENTATION OF NATIONAL WATER POLICY

Ministry of Water Resource, Government of India, has given a high priority for farmers' participation in irrigation water management in its National Water Policy (1987). The policy that recognizes the importance of Participation of Farmers and Voluntary Agencies stressed that efforts should be made to involve farmers progressively in various aspects of management of irrigation systems, particularly in water distribution and collection of water rates. Assistance of voluntary agencies should be enlisted in educating the farmers in efficient water use and water management. As per the Ministry of Water Resources New Delhi, a number of actions have been taken in the Mahanadi Delta Stage -1, namely, preparation and circulation of guidelines for making legal provisions in the Orissa State Irrigation Acts, through modifications providing technical and financial help. Holding of seminars, workshops to create awareness among the officials/officers and farmers etc. This has brought a catalytic effect on PIM activity in many states including Orissa.

CAD PROGRAMME IN ORISSA STATE

The CAD programme was taken up in Orissa in 1974-75 for ushering in Participatory Irrigation Management (PIM) itself by inclusion of four of the major irrigation projects, namely Hirakud, Salandi, Mahanadi Delta Stage I (Cuttack) and Mahanadi Delta Stage II (Puri). After experiencing usefulness of the programme, nine more irrigation projects were also included in different years till 1998-99 and some others later on. Six CAD Authorities were constituted under the Societies Registration Act, 1860, as applicable to the State of Orissa to supervise the CAD work in 7.12 lakh ha. of cultivable command area (CCA) representing 10.9 lakh ha gross command area (GCA)

PIM APPROACH AND FARMER'S PARTICIPATION IN IRRIGATION MANAGEMENT

In pursuance to the National Water Policy (1987) the State Government has adopted the PIM policy in the Orissa State Water Policy 1987 with an objective to transform the irrigation management to such farmers. Similarly, the state government has introduced the Pani Panchayat Act 2002 with an objective to give legal states to such farmers' organization for appropriate handling of the operation and maintenance (O&M) affairs of the land systems at the tertiary level. The state government action was based on two important activities i.e. Farmers Organisation and Turnover (FOT) and Participatory Irrigation Management (PIM).

INSTITUTIONALIZATION OF PIM PROGRAMME

The Command Area Development Authority Mahanadi Delta Stage-I, Cuttack was constituted in pursuance of resolution Dated 12th May 1976 of erstwhile Agriculture & Cooperation department as a legal body and was registered as a society under the Societies Registration Act 1860 in the year 1976-77, comprising 21 Community Development blocks. The Command Area Development Authority aims at effective utilization of irrigation potential through execution of different works like, On-Farm Development Works, Rotational Water Supply, Warabandi, Training of Farmers, Multi Crop Demonstration Programme, Topographical Survey etc. For providing irrigation network unto the farmer's field to increase agricultural production and productivity in the field, tangible improvement in the standard of living of the farmers of the command area is the cherished goal of the authority.

FEATURES OF WATER USERS ASSOCIATIONS (PANI PANCHAYATS)

The PIM component attached to the FOT component mainly governs irrigation management at the territory level of the irrigation system i.e. particularly at distributory/Minor/Sub-Minor level.

It envisages the following powers and responsibilities:

- i. It gives a legal right to participate in operation, maintenance and management of irrigation system leading to farmer's empowerment.
- ii. It gives the freedom and flexibility in choice of crops and land use within the stipulated quota of water allocated as per agreement.
- iii. It assigns equability in getting irrigation water as per agreement on a long term basis from the irrigation agency.
- iv. It enables taking joint discussion in irrigation planning design and construction at the micro level.
- v. It gives a broad scope to achieve more irrigation coverage through optimum, water use and thereby to reduce the water fees per ha.

Till 2002, rotational water supply covered an area of 1,81,600 ha. and reclaimed waterlogging and salinity in 17,950 ha. Consolidation of holding started prior to the CADA activities and covered 1,40,147 ha with field channels in 10,7214 ha.. Rupees 11.64 crores (US\$ 2.9 mil.) has been spent on the construction of field channels, field drains with other components like maintenance of irrigation/drainage system, agricultural activities, enforcement of warabandi, innovative management in irrigation with a total expenditure of about Rs. 40 crores (US\$ 9 million).

IMPROVEMENT IN DEMAND AND SUPPLY OF WATER

The demand and supply of Mahanadi Delta as a whole has been assessed. A broad picture has been assessed as indicated below

Table 2: Irrigation requirement and water supply figures over the years 1984-2002

i)	Irrigation Requirement as was initially designed	331.5 Thousand ham (Tham)
ii)	Average water supply for irrigation made during 1984-86	240.075 Tham
iii)	Irrigation Supply made in subsequent year	381.87 Tham
iv)	Present Water Requirement	
	a) for Irrigation	481.10 Tham
	b) for Industrial etc. uses	21.0 Tham

From the above, it is observed that percentage requirement, has been increased to about 50% for irrigation and industrial uses. Efforts are being made to prepare the water supply through modernization and proper maintenance of irrigation system and proper management of irrigation water.

IMPROVEMENT IN IRRIGATION POTENTIAL UTILISATION

The cultivable Command Area, of Mahanadi Delta Stage-I is 1,83,000 considering, 163% irrigation intensity, the ultimate irrigation potential has been assessed as 300,100 ha. The irrigation potential created and utilized in the project so far is given in **Table 3**.

Table 3: Detail showing periodical Irrigation Potential Utilisation in Mahanadi Delta Stage I Orrisa.

S.N.	Period	Irrigation Potential Utilisation				Remarks
		Kharif	Rabi	Rabi (ha.)	% increase over 1976-77	
1.	1976=77	157917	69875	227792	-	Maximum utilisation of irrigation potential utilization in 1989-90
2.	1979-80	167402	89859	257261	12.9	-do-
3.	1984-85	167594	116241	283835	24.6	-do-
4.	1989-90	198633	135335	333968	46.6	-do-
5.	1994-95	184207	69314	253521	11.3	-do-
6.	1996-97	139327	92486	231813	1.8	-do-
7.	1999-2000	139327	63000	202327	-3.0	-do-
8.	2001-02	139327	63000	202327	-3.0	-do-

The Mahanadi Delta Stage-I is more than a century old project and water is available from run-off of the river through different barrages. There has been considerable

improvement in the irrigation potential utilization after the implementation of the PIM/CAD programme (however fluctuation in potential utilisation has been observed in different years due to varying rainfall pattern).

In the inception year the utilization of irrigation potential was in 227,792 ha. which has increased to 257261 ha in 1979-80 i.e. 12.9 percent increase over 1976-77. 2,02,327 ha during 1999-2000 and 1,39,327 ha. during 2001-02 etc. However, the irrigation potential was less in many years due to scanty rainfall, pattern. So far as designed and planned CCA re concerned, it was 1,67,000 ha. and 1,83,400 ha. respectively. However 190% irrigation intensity is expected by the State on the completion of CAD works as against 167% now.

TRAINING OF FARMERS

To educate the farmers in modern scientific technology for proper utilization of irrigation facilities as available in individual farmers' fields this component was brought to change the traditional mind set of the farmers and modernizes their outlook and approach. After completion of OFD works regular one day duration training camps have been/are being organised under the CADA Blocks usually in villages selected for warabandi and demonstration programme in both kharif and rabi season. The year wise organization of farmers training programme and number of farmers trained are given in **Table 4**.

Table 4: Year Wise Organisation of Farmers Training Conducted Under Mahanadi Delta Stage I Project, Orissa From 1980 to 2002

Year	Achievement			
	Delta stage -1		Delta stage -2	
	No. of Training Camps Organised	No. of Farmers trained	Nos. of Training Programme Organised	No.of Farmers Trained
6 th Plan 1980-85	227	9850	2	132
7 th Plan 1985-90	120	8116	35	1920-
8 th Plan 1992-97	-	-	235	23677
9 th Plan 1997-2002	362		172	17400
Upto 9 th Plan, 2002	982		493	46969

BENEFIT COST RATIO

FINANCIAL ACHIEVEMENT/PROGRESS

For success of PIM the CAD programme is carried out for On-Farm Development works like construction of field channels, field drains, reclamation of waterlogged areas

and other related activities like soil survey, topographical survey, land leveling and shaping etc. As per the assessment of the State Government the ratio between capital cost and other activities works out to around 55% and 45%. Thus the cost on OFD works is assessed at Rs.1162.00 lakh and Rs. 971.221 lakh on other items. This expenditure is used for calculation of B: C Ratio as follows:

	(Rs. in Crores)
Net income from agricultural produce and benefit cost ratio	
i) Net benefit at post CAD project stage (1999-2000)	224.20
ii) Net gain at pre CAD project i.e. at inception stage (-)	154.99
iii) Net income in one-year (a)-(b)	69.21
Total expenditure / investment made on the cad programme in the project of from inception to 1999-2000.	
a) Total Expenditure	39.64
b) Expenditure on capital items	11.64
c) Expenditure on other items	28.00
d) Expenditure for calculations of B: C RATIO	
i) 10 % interest pn capital expenditure	(+) 1.16
ii) 2.5 % interest for maintenance	(+) 0.29
iii) 1% for depreciation	(+) 0.12

Total	1.57
iv) Expenditure are other items	(+) 28.00
v) Total expenditure	29.57
Benefit: Cost Ratio = $\frac{\text{Net Gain (net gain in one year)}}{\text{Total Expenditure}}$	
$= \frac{69.21}{29.57} = 2.34$	

CONCLUSION

Orissa stands out as a under-developed State within the Indian dominion even though it has been endowed with rich natural and mineral resources. The estimate Water Resources of the state is one of the highest in the country, being of the order of 11%

with 4% geographical area. The State is made up of small and marginal farmers, thus the strategy in planning and managing water resources assumes greater importance.

The first step made in this process of reformation was to hand over a part of the network of the canal system/irrigation system for its operation and maintenance (O&M) to the farmers or the beneficiaries through the Pani Panchayats (Water User Associations or WUAs). Four Pilot projects in the first phase namely, Ghodahad project, Rushikulya Distributary No.11 of Ganjam District and Aunli and Derjang Projects in Anugul District were identified for this work during 1996 and related activities of Pani Panchayat (WUAs) started simultaneously in the projects. The farmers were demonstrated about the utility and practicability of Pani Panchayat. Soon after inception, 50 Pani Panchayats were formed in these projects with the help of NGOs and WALMI. Farmers were advised to take up minimum maintenance work by them for ensuring free flow of water up to the tail reaches. They were also helped to organize water distribution in their jurisdiction, resolve disputes, if any, and adopt their own crop-planning etc. The Pani Panchayats were registered as legal bodies to provide the required identify. In pursuance to the National Water Policy (1987) the State Govt. of Orissa adopted the PIM in the "State Water Policy 1987" and provided legal back up, through Pani Panchayat Act 2002. In the beginning 4 pilot projects on PIM were launched in the first phase (1996) and later on 50 Pani Panchayats were formed and registered as legal bodies and 51% of the total irrigation potential created has been covered under PIM and handled more than 153 nos. of Pani Panchayats (WUAs). and remaining 49% would be covered by 2007.

Since the CAD development works, the adoption of PIM in this command area is better than many other Command Area Development Programmes in the country. It resulted in better utilization of irrigation potential created by improving project efficiency, increasing irrigated area through conjunctive use of available surface and ground water, bringing changes in better cropping pattern and increasing agricultural production & productivity. It has made positive socio-economic impact in the command area of the project.