Post Project Performance Evaluation Study of Itiadoh Irrigation Project

Executive Summary

Introduction

Maharashtra stands first amongst the major states in India in income and growth rate. The eastern region of Maharashtra State is consisting of Wainganga Basin. Itiadoh Irrigation Project is located at the Eastern side of Wainganga Basin. The annual weighted mean monsoon rainfall in the catchment of Itiadoh Project is 1362 mm. The main crop grown in the command area is Low Land Paddy. The irrigable command area (ICA) is 17980 ha out of 22751 ha. CCA.

The project is located in the Arjuni Mor Taluka of Gondia District of Maharashtra State. Earthen Dam is constructed across the river Gadvi at Gothangaon. Tq. Arjuni Mor, Dist: Gondia. The Project is planned to irrigate in Bhandara, Gondia & Gadchiroli District.

Evaluation studies

The Irrigation system performance is to be evaluated with reference to set objectives and targeted benefits as envisaged in the detailed project report. The status of infrastructure, organizational and water distribution network, overall project efficiency, irrigation management practices, agro-economic, socio economic and environmental impacts are to be evaluated with respect to pre project situation with similar nearby areas without irrigation and with irrigation facilities.

Objectives

The objectives of the post project evaluation studies were:

(A) System Performance

(i) Project Infrastructure and canal network

(ii) Hydrology

(iii) Irrigation Potential:

(iv) Conjunctive use of ground and surface water:\

(v) Managerial Issues

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(B) Agro-Economic Impacts

(C) Socio-Economic Impacts

(i) Farm Employment

(ii) Non-farm employment

(iii) Infrastructural and Institutional Facilities

(iv) Demographic Impacts

(v) Literacy

(vi) Health Care and Family Planning

(D) Environmental Impacts

Methodology

The post project evaluation of Itiadoh project is taken up with an interdisciplinary approach. The primary and secondary data of the project is collected from the various Government Organizations involved in the activities proposed under evaluation studies. Field observations on the irrigation project are also taken for the collection of field data pertaining to irrigation and allied sectors, which directly or indirectly affect the performance of irrigation project.

Field observations on the distribution network is taken up by selecting three distributaries or minors each in the initial reach of 0 to 40 Kms. of main canal, Wainganga branch canal and 40 to 72 Kms. length of main canal.

Field observations and measurements have been carried out in the field during the Irrigation period of project. The Project officials, farmers, WUA officials etc. are interviewed with structured questionnaires.

The procedure, nature and the type of the data to be collected in the formats was developed by WALMI, Aurangabad which in turn was utilized by the field staff for collecting the data. All the data collected from the field observations, primary and secondary sources is compiled by WALMI, Aurangabad and analyzed. The services of external consultants wherever necessary for the collection of primary, secondary or field data has been takien as per requirement.

Irrigation System Performance

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The 77.25 km. long main right bank canal has a Wainganga branch canal off taking from Km. 40. It is 40.23 km in length. The discharge carrying capacity of the main canal is 39.64 cumecs and that of Wainganga branch canal is 14.86 cumecs.

The Itiadoh is a composite dam consisting of earthen and masonry portions. Earthen dam length is 471 m. The length of masonry dam is 70.89 m. The height of dam is 29.85 m. 30 years are lapsed after completion of the project. The canal system is satisfactorily delivering water, but in few patches it needs maintenance or restoration.

Present Status

The stratified sampling technique was adopted for selecting nine minors in the Itiadoh Irrigation Project. Three minors viz: 2-A, 7 and Arjuni in the Head reach 0 to 40 km of main canal; three minors viz: Asoli, Tulsi and Kosa are selected in Head, middle and tail reach of Wainganga Branch Canal; three minors viz: Phuyar, Pimpalgaon and Borgaon in head, middle and tail reach 40 to 72 km of main canal were selected for evaluation study.

The detailed evaluation studies were conducted for all the nine minors on the following aspects:

- Walk thru survey indicating the present status of minors
- Details of condition of structures on the minors
- Discharge carrying capacity
- Priorities are listed for repairs and maintenance
- Photographs indicating the present status of minor condition
- Evaluation of S.R. outlets and measuring devices
- Recommendations

The detailed studies depicting all the above items on sample basis of Borgaon Minor are given here. However, the technical data of all the 9 minors have been taken for preparing the evaluation report of Itiadoh Irrigation Project

Evaluation of Flow Measuring Devices and Self Regulated Outlets installed on main canal and minors of Itiadoh Project were carried out to study their adequacy. Similarly, study was also carried out to check the adequacy of discharge from head regulators of minors considering the effect of afflux caused due to newly installed cut-throat flumes on the existing minors.

Standing Wave Flume located at ch. 42.150 Km on main canal was evaluated with respect to the design and the existing dimensions.

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At present the flume functions under the submerged conditions with the submergence of 96.25%. The flume can be brought under free flow condition by increasing the present hump height of 0.45 m to 0.70 m.

To deliver measured quantity of water and Cutthroat flumes (CTF) are installed recently at the head of the minors.

Evaluation of these cutthroat flumes installed at head of the selected minors were carried out. All CTFs are found to be working under free flow conditions except CTF of Asoli Minor. Similarly, the discharge measuring capacity of all these CTFs is found to be adequate except in case of the CTF installed on Kosa Minor.

The evaluation of 2 self-regulated outlets was carried out by installing the CTF on the D/s of SR outlet to check the adequacy of the discharge. The observation shows one outlet gave lower than the design discharge and one gave higher than the design discharge. The variations in the discharge for SR outlets are mainly due to improper setting of sill levels of the outlet.

Design & Present Capacity of Canals

The observation shows that the present capacity of the main canal and branch canal is marginally lower than the design capacity. Whereas the present capacities of the minors are comparatively higher than the design capacity. The service road of main canal needs to be repaired. At few location in main canal over topping was observed, the bank work needs to be restored. The leakages are observed at the U/s and D/s side of the structures on the main canal. Measuring devices needs to be installed at the head of distributaries. The control gates are to be provided for 11 minors on the main canal.

The calibration of S.W.F. at 1380 m. needs to be done. The length of syphon on main canal is more than 100 m making it difficult for maintenance.

Irrigation Efficiencies

The standard norm of water use efficiency decided by Water Resources Department, Government of Maharashtra is 50 ha. per million cubic meter of water delivered at Main Canal Head. The water use efficiency obtained in Itiadoh Irrigation Project is 53 ha. i.e. more than the prescribed norm of WRD, Maharashtra State. The inflow efficiency varies between 89 to 100%. The average storage efficiency of Itiadoh Project is 91%.

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The conveyance losses observed on canal systems of the Itiadoh project are slightly on higher side as compared to the prescribed norms. This is mainly due to the siltation and vegetation in the canal system. The conveyance efficiency of main canal, branch canal and minors are 78.3, 78.84 and 73.84 % respectively.

The field application efficiency is more than 85%, which is considered as ideal for paddy field. Hence, it is said that farmers have leveled land very accurately so as to apply efficient irrigation.

The land forming index (L.F.I.) for 8 minors varied from 2.5 to 5.9 cm. which means the land forming quality is good. In general the surface drainage efficiency in the command of Itiadoh project is also good.

Surface Hydrology

The live storage capacity of the reservoir is 318.85 Mm^3. The reservoir was full for 7 years out of 12 years.

Ground Water

Most of the area of submergence and command of Itiadoh Project is occupied by ancient Igneous and Metamorphic rocks.

There are 813 wells reported in the command area. However, most of these wells are not reported to be in use for irrigation. The prevailing condition shows that farmers are reluctant to use the ground water and indicates the remote possibility of conjunctive use of surface and ground water in near future.

Usages

The usable water storage in the reservoir is 317.874 millian cubic meters. Deducting dead storage and evaporation losses the utilizable water is 288.569 Mm^3. There are six water supply schemes lifting 3.072 Mm^3 of water for domestic purpose. Three lift irrigation schemes draw 55.87 Mm^3 of water from the reservoir for irrigation 358 farmers have been given permission to lift water for irrigating 616.72 ha. The total non-irrigation use is 3.072 Mm^3 for domestic purposes. Thus non-irrigation water use is 1.06 % of the usable water available in the reservoir.

Irrigation Potential

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The project was commissioned in the year 1971-72 and was designed to irrigate 17,980 ha. ICA. The average area irrigated in the last 10 years is 17948 ha. ICA. Kharif season utilization is 100% while utilization in Hot weather is 62%.

Command Area Development

Initially CADA have taken work of on farm development works in the Project. However, hardly any field channels are seen in command as only Paddy is grown. The farmers take water from field to field. As the low land paddy is the predominant crop, the fields are almost leveled by farmers themselves. The bench terracing is done for field-to-field irrigation. There are roads and canal bridges constructed so as to facilitate farmers to take out their farm products out of field. There are 4 major market yards at Taluka places i.e. Arjuni (Mor), Lakhandur, Wadsa and Armori all of which are in the command.

Participatory Irrigation Management

The Itiadoh Major Irrigation Project is under Maharashtra Water Sector Improvement Project (MWSIP) since one year. On the Itiadoh Project, a total of 55 Water Users Associations are registered and the elections are already completed. Yet the irrigation management is not handed over to the Water Users Associations till now.

Competing Demands

The gross storage of the Itiadoh Irrigation Project is 381.587 Mm^3. The live storage of the Itiadoh Irrigation Project is 317.874 Mm^3. The competing demand other than irrigation is only 1% i.e. small.

The total annual evaporation losses are computed as 67.57 Mm^3, which is 17.7% of the gross storage. However the total annual water utilization is 75.62% of the gross storage.

Floods & Drought

The estimated flood of the project is 3256.48 cumecs. However, the observed maximum flood was 6824.48 cumecs in the last 25 years. Since the project was spilling over almost every year the spillway height was raised by 1.70 m. as per the guidance given by Central Designs Organization, Nasik.

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During the evaluation study local inquiries at the project site and with the officials of WRD were made and it was concluded that there were no severe floods or droughts occurred in the Gadhavi River Basin.

Periodicity and Frequency of Drought

The command area falls in the assured rainfall zone. There were no incidences of droughts observed in last few decades.

Drainage

The land slope in the Itiadoh irrigation project command varies from 3 to 4 % and 1 to 2% in head reach and the tail reach respectively.

The natural drainage conditions in the entire command are very good. The water from paddy fields is efficiently drained out at the grain maturity period of paddy crop.

Management

Prescribed unit water use entitlement for Itiadoh Irrigation Project is calculated for the Normal year. Completed Irrigation Programme is prepared after the season: Based on the experience gained, the improvements in the next year PIP are suggested. This also helps in detecting un-authorized irrigation. The water charges are prepared based on the type of crop and area irrigated. The water will be charged on volumetric basis after the irrigation system is handed over to WUA. The maintenance of Irrigation System is being done by the Water Resources Department. It will be done by the WUA after the handing over procedure is completed.

Benchmarking

The Benchmarking Indicators for the Project are:

1) Annual irrigation water supply per unit irrigated area varied from 8736 to 11533 m^3/ha.
2) The ratio potential utilized to created irrigation varied from 0.65 to 1.1.
3) The output per unit of irrigated area varies from Rs.14000 to 24000/ha.
4) Output per unit irrigated supply is Rs. 1.3 to 2.65/m^3 of water
5) Cost recovery ratio varied from 0.032 to 0.16
6) The total O & M cost per unit area is Rs. 1374 to 2474/ha.
7) The revenue per unit vol. of water supplied is 0.005 to 0.0684
8) Total O & M cost per unit vol. of water supplied is 0.1339 to 0.2667.

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9) Mandays for O & M per unit area irrigated is 0.4159 to 3.39

10) Land damage index is zero

11) Equity performance at head, middle and tail is indicated in Table 4.26.

12) Assessment recovery ratio for irrigation use is 0.07 to 0.53.

13) Assessment recovery ratio for non-irrigation is 0.0 to 1.0.

Agro–Economic Impacts

The command area of Itiadoh Irrigation Project falls under high rainfall zone with long term annual average of 1362 mm rainfall, well spread in four months of south - west monsoon (June to Sept.), therefore, the lowland paddy culture in kharif season is the obvious choice by the farmers throughout the commands (100 % ICA). Because of irrigation facility created through Itiadoh Irrigation Project with comparatively reliable water availability, the stability of kharif cropping with paddy is enhanced due to 2-3 rotations of protective irrigations with area irrigated as 100% ICA i.e. 17980 ha. Due to favourable climate, assured water supply, comparatively good physical system for water distribution, farmer's know – how regarding paddy culture i.e. crop production technology, the average yield of kharif paddy as revealed through farmers interviews in this command was 33 q/ha which is almost double the state average and is about 80% of the maximum which is obtained at the nearby research station. This is primarily due to somewhat lower extent of area under HYV's, and inadequate organic and inorganic manuring. However, the positive aspects of lowland kharif paddy cultivation in this command is that the farmers very well know about planting right age of seedlings with right technique to maintain adequate plant population, interculture operations to keep paddy fields free from weeds, adequate plant protection measures against pests & diseases, and above all, shallow submergence of properly leveled paddy basins avoiding excess irrigation. The 100% cropping intensity is observed in kharif season and there is a good utilization of water during kharif. However, when water is available for R-H.W. season (Dec. to May), farmers again prefer lowland paddy because of bunded fields, field to field irrigation and lack of knowledge regarding cultivation of other non – paddy crops viz. wheat, gram, mustard, groundnut etc. which leads to mono culture i.e. kharif paddy followed by R – H.W. paddy. The average yield of R – H.W. paddy is 37 q/ha slightly higher than kharif paddy and is about 70% of maximum at research station. The area irrigated with R- H.W. paddy is limited to 7600 ha as against 17980 ha of ICA (i.e. 42%). This is because of high crop water requirement of R-H.W. paddy i.e. 1675 mm at root zone as against on an average 350 mm at root zone for non–paddy Rabi crops such as wheat, gram mustard and on an average 700 mm at root zone for H.W. Groundnut and

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chillies etc. indicating thereby crop diversification need with benefits of 2 to 3 fold increase in irrigated area, dispersal of irrigation benefits to large farmers population and avoidance of demerits of monoculture. Therefore, the diversified crop pattern with 151% cropping intensity and consisting Rabi (wheat, gram, mustard) and R- H.W. crops (Groundnut, chillies) is proposed. The soil – climatic and water availability conditions are highly favourable for this change of diversified cropping pattern for better use of land & water resources with increased economy of farmers from present Rs. 21,123/ha to Rs. 38,797/ha due to diversification as well increased water use efficiency from Rs. 1.87/m^3 to Rs.3.65/ m^3 . Presently the total crop production in the command area of 17,980 ha is Rs. 54.03 crores which can be increased to Rs. 105.33 crores with the same water availability for irrigation due to crop diversification as per proposed crop pattern. However, concerted efforts on the part of extension wing of Agriculture Department and Management Division at Gondia are needed to introduce crop diversification on selected minors with extension of complete know-how.

As regards the farm equipments, it is found that 74% farmers are having bullock drawn farm equipments like harrows and bullock carts. The power driving equipments like tractors, threshers, harvesters and oil engines were possessed by 7% sample farmers.

Gramsevek, Talathi and Canal inspector of Water Resources Department were found to be the main sources of information at village level. The utility of neighbors and relatives was found to be more in receiving information about improved agricultural technology.

A majority of the farmers are marginal and small farmers constituting 86% of sample farmers. A majority of farmers are having bullocks, and poultry birds.

The average farm income per family is Rs. 37396 per year. The non farm income contributes near about 16% of total income.

A total of 85% population is living in rural area. The decadal population growth rate for rural area is 15.45% and for urban area it is near about 10% The density of population in Itiadoh command is 183 persons per sq.km. as against states, 315 persons per sq.km. Thus, density of population for project command is lower as compared to that of the state (i.e. 58.09%).

Socio-Economic Impact

The average land holding of majority beneficiary farmers is 1 to 2 ha. i.e. small farmers. Out of total population, 51 percent are having farm employment and 28 percent had non-farm employment. It indicates that there is vast scope in non-farm employment activities like dairy, poultry, sericulture and bidi business. Literacy percentage of male is 84 percent while in female it is 60%. There is a need to emphasize special awareness and communication campaign for

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farmers in command area on a priority basis as a part of future agricultural development programme. The number of colleges in command area are very less. The efforts for college education facility need to be boosted. The most positive finding of the present study is the significant improvement in standard of living due to Itiadoh Irrigation Project. It envisages from the study that the beneficiary farmers had increased their average annual income four times more than that of before the project i.e. from Rs. 10000/- per year to Rs. 44000/- per year. This was possible because of canal water is available adequately, timely and assured in Kharif & hot-weather season. This was only possible because of Itiadoh Project when the income is compared with non-command area farmers, where the well irrigation is less. As regards the agricultural assets, the number of farm equipments like tractors need to be increased. The financing authorities like Banks & Credit Societies should encourage the farmers to purchase tractors. The infrastructural facilities like Agro-based Industries, Postal Services, Telecommunication, & Health Care System in the Itiadoh Command Area should be strengthened for Socio-Economic Upliftment of the farmers on a priority basis. As a part of Poverty Alleviation programme, it is strongly recommended that the efforts to implement crop diversification programme in the Itiadoh Command Area is to be undertaken. In this regard, the emphasis on vegetable cultivation will be beneficial to farmers for raising their income levels. The experiment of Gournagar Village, 7 km. from Desaiganj (Wadsa) is an ideal example implemented successfully the vegetable cultivation at village level. The farmers rallies at Gournagar need to be organized for large number of farmers of Itiadoh Command Area by the State Water Resources Department and Agricultural Department, on top priority basis for demonstrative effect.

Environment Impact

The Command area of Itiadoh Irrigaton Project falls under Bhandara, Gondia and Gadchiroli Districts of eastern Vidarbha region of Maharashtra state, which is grouped under "Agro Climatic Zone No.9" Charactereized for high rainfall zone with soils derived from mixed parent material. The annual rainfall averaged for nine locations and recorded for the year 1980 to 2000 works out to be 1362 mm. On the basis of average climatic data published by IMD Pune for Gondia Station, the average values of minimum and maximum temperature, minimum and maximum relative humidity, wind run and bright sunshine hours are 13 to 29 ^{oc}, 27 to 42 ^{o} ^{c}, 20 to 59%, 39 to 86%, 2 to 7 km /hr and 3.1 to 9.3 hours, respectively . Thus, the climate of command of Itiadoh Irrigation Project is highly favourable for growing different crops. Besides paddy growing, there is scope for taking diversified crops with increased cropping intensity so as to optimise land and water resources.

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Soils of Itiadoh irrigation project are brown to yellowish brown in colour, dominantly (60%) deep to very deep in nature (0.5 to 1 m & above) and predominantly (95%) coarse to medium textured (SL & Sil) with good available water storage capacity (200 mm/m). The soils are free from any of the problem situations such as waterlogging (G.W.depth > 6 m), soil salinity (EC 1:2 = 0.2 ds/m), soil sodicity and acidity (pH = 6.8). Similarly surface (river / canal) water quality for irrigation is found to be "Excellent" (pH= 7.28,ECw= 0.12 ds/m SAR = 1.58, RSC = 1.1 meq /l). Ground water (dugwells) is also of good quality for irrigation (pH = 7.7, ECw = 0.3 ds/m; SAR = 2.41 and RSC = 1.1 meq /l). Thus, soil and water resources of Itiadoh Irrigation Project are of best quality at present and have high potential for output.

Economic Evaluation

The Benefit-Cost ratio and Internal Reate of Return (IRR) are estimated as per the guidelines of Central Water Commission for the Post Project Economic Evaluation of Itiadoh Irrigation Project. The reference year for the estimation is 2005-2006.

The total annual benefit is estimated considering direct agricultural benefits including that of by-product, non-irrigation benefits viz. water charges through drinking/domestic water supply from reservoir and canal and the net benefits from fisheries and Khas grass. No benefits through water supply for industries is observed.

The Benefit-Cost ratio as envisaged is minimum one for the project in tribal area. The actual benefit cost ratio estimated is 0.86, which does not satisfy the norm of B.C. Ratio for tribal area.

The Internal Rate of Returns is estimated as 8.8%. The minimum value for economic viability is 10% for the project in tribal area.

Considering overall situation of the project, there is still scope for improvement in the economic performance of Itiadoh Project.

Inclusion of cash crops, short duration crops and vegetables with proper modifications in the distribution network under MWSIP project will help improve the agriculture benefits. Higher market price needs to be ensured to farmers. Additional number of aqgro-based industries are required to be setup. Revenue through non-irrigation water supply, especially for industries can be increased.

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