International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 10 Issue: 03 | Mar 2024 www.irjet.net p-ISSN: 2395-0072

CRITICAL ANALYSIS OF LIFT IRRIGATION SCHEME: A CASE STUDY ON WAKURDE LIFT IRRIGATION SCHEME

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Abstract - *Wakurde lift irrigation scheme is under Maharashtra Krishna Valley Development Corporation (MKVDC). A scheme is located in Wakurde of Sangali district, Maharashta State, India. It is major ongoing irrigation project of Krishna basin basically implemented for irrigating areas of Shirala and Valava Tal. in Sangali district also Karad Tal. in Satara district. Techno-economic viability of project is one of the important key factor having significant contribution in success of lift irrigation scheme. The aim of this study is to check economic feasibility of LIS and asses it's social impact, as it is important to know that whether the project is beneficial or not. For this purpose, we calculated the economic feasibility and sanctioning of projects by working out benefit to cost ratio and Internal Rate of Return (IRR). The purpose of this study is to overcome problems is execution and cost-time overruns. We assessed actual facts and problems in implementation of this LIS. We also studied practical irregularities while running this scheme. In this study suggestions are given to improve efficiency of project and to overcome actual on field problems.*

Key Words: **MKVDC, economic feasibility, socio-economic impact, Lift Irrigation System, cropping pattern, benefit to cost ratio.**

1. INTRODUCTION

Wakurde Lift Irrigation Scheme is under Warana Irrigation Project which is located on Warana River in Krishna basin. It is proposed to lift water from (LBC) Left Bank Canal of Warana project. It consists of main 2 parts and again first part divided into 3 stages and second part is divided into 2 stages. As per the original standard approved by the Corporation in 1998, it was planned to irrigate 15775 hectares of irrigated area by pumping water in one area in 3 phases. As per the proposed second RAA of this scheme, a total irrigated area of 28,035 hectares is proposed to be irrigated as 12,275 ha in 3 phases under Part 1 and 15,760 ha in 1 phase under Part 2. Total cultivated command area of Wakurde LIS project is 33,062 ha. running text. The order of reference in the running text should match with the list of references at the end of the paper. Out of that irrigable command area is 28,035 ha. The crop structure proposed in the first RAA approved was 126% and 123% for Sangli East and Sangli West respectively. It had 20% cane crop for both the regions. According to the proposed crop structure, 173.36 gallons of water is required for Modified Penman method for irrigation. An economic feasibility of project is worked out by Benefit to Cost ratio (B/C ratio) and Internal Rate of Return (IRR) methods which are considered as economic analysis methods.

1.1 Necessity

India's ultimate irrigation potential is 140 million hacters but only 87 million hacters is utilized through major, medium, minor irrigation project and ground water. This gap can be reduced by using irrigation system of higher water use efficiency. The conventional method for conveying water for irrigation in India has certain limitations as evaporation losses, seepage losses, land acquisition and thefts. In order to overcome these drawbacks, pipe distribution network system is best alternative. It is necessary to search innovative alternative for modernization of existing water distribution network system.

There are various irrigation methods available but an importance of 'Lift Irrigation Scheme' is unique. The total 8% LIS of Maharashtra irrigates 22000 ha of land which finances Rs. 6462.5 million. Basically, lift irrigation schemes are used to lift water from lower level to higher level mainly consists of water sources (such as dams, K.T.weirs, river canals), lifting medium and conveying medium. Dams and canals are constructed to increase irrigated area at lower level than dam level but scarcity of water remained the problem for higher areas.

India is mainly an agricultural country and water resources plays vital role in irrigation. Now a days, industrialization demands for more water availability which leads to reduce water available for irrigation. Stress due to water scarcity increasing day by day. To reduce this water scarcity and meet rapid water demand of irrigation, adoption of new irrigation methods is essential. Warna and Krishna rivers are two major rivers which flow in Maharashtra state and are linked together by Wakurde LIS in Tal-Shirala, Dist-Sangali.

1.2 Objectives

1. To understand/examine water distribution scenario of Wakurde LIS.
2. To check economic viability of Wakurde LIS.
3. To asses socio-economic impact of scheme.
4. To recommend measures to be taken to increase planned benefits.

1.3 Methodology

1. Study of Wakurde LIS.
2. Data collection from Water Resource Department relevant to objectives.
3. Critical study of collected data with respect to financial aspects.
4. Finding out Benefit to Cost ratio (B/C) and Internal Rate of Return (IRR).
5. Checking economic feasibility of scheme.
6. Results and conclusion.

2. PROJECT DETAILS

2.1 Overview of Scheme

Wakurde lift Irrigation Scheme is located in Tal. Wakurde of Sangali district. It is an ongoing major irrigation project of Krishna basin. Wakurde Lift Irrigation Scheme is in the 'Rest of Maharashtra Krishna Valley Development Corporation'. Wakurde LIS is implemented by pumping 2.77 per unit of water annually in left canal of Warana project. There are three phases of 24 km canal which is in Shirala Tal. Sangali Dist.,Valva tal.Sangali Dist.and Karad of Satara Dist.

State level technical advisory committee's feedback about this project is as follows.

1. Approved Basic Scheme - As per the original standard approved by the Corporation in 1998, it was planned to irrigate 15775 hectares of irrigated area by pumping water in one area in 3 phases. It covers 6380 hectares in Shirala Tal. of Sangli district, 7195 hectares in Valva Tal. and 2200 hectares in Satara district. It was proposed to use 4.60 TMC of water.

2. Approved First RAA - The scheme was approved by the corporation in the year 2004 by incorporating Part 2 as per the first RAA and giving joint approval for Part 1 and Part 2. Accordingly, the total irrigated area under the Part I was 5700 hectares in 3 phases and 13875 hectares under Part 2 in 1958 hectare. It was proposed to use 5.88 TMC water. It covers 3500 hectares in Shirala Tal. of Sangli district, 13275 hectares in Valva Tal. and 2200 hectares-- in Karad Tal. of Satara district.

3. Proposed Second RAA - As per the proposed second RAA of this scheme, a total irrigatedarea of 28,035 hectares is proposed to be irrigated as 12,275 ha in 3 phases under Part 1 and 15,760 ha in 1 phase under Part 2. For this 6.12 TMC water is proposed to be used. It covers 7270hectares in Shirala taluka of Sangli district, 18565 hectares in Valva taluka and 2200 hectares in Karad taluka of Satara district.

   There are three phases of left bank 24 km canal as: 6515 ha.in Tal. Shirala of Dist. Sangali,3560 ha. in Tal. Walva of Dist.Sangali & 2200 ha. in Tal. Karad of Dist. Satara .It is planned to irrigate a total area of 12275 ha. The details are given below:

Table 3.4.1 Area to be irrigated

Sr.No.	Taluka /District	Part-1 Area (ha.)	Part-2 Area (ha.)	Total area (ha.)
1	Shirala Dist. Sangli	6515	755	7270
2	Karad Dist. Satara	2200	--	2200
3	Valva Dist. Sangli	3560	15005	18565
	Total	12275	15760	28035

2.2 Administrative Approval Details

The detail original administrative approval of the project, the first Revised Administrative Approval (RAA) and proposed administrative approval areas are as follows:

Table 3.4.2 Details of Administrative Approval

Sr. no.	RAA	Details of recognition	Year of Tariff	Amount (Rs.Crore)	Irrigation Area (ICA)(Ha)	Water consumption per unit
1)	Administrative approval	M.Lost Vs. M.Decision No.Wakurde/Usinyo/ MP2/Prama298/ (956/98)6991 dated 9/12/1998	1995-96	109.68	15775	4.60
2)	First RAA	DecisionMakrikhoviman /MP3/Wakurdeusinyo/8560 dated 25/10/2004	2003-04	332.31	19575	5.88
3)	Second RAA	As proposed	2018-19	888.07	28035	6.12
At the end of March 2020, Rs.211.67 crore i.e.23.83% of the updated price and 63.70% of the sanctioned RAA amount has been spent.						

3. METHODOLOGY OF THE PROJECT

A critical analysis of Wakurde LIS is to be carried out in two phases as follows:

1. Economic Feasibility Analysis
2. Socio- economic study of Wakurde LIS

3.1 Phase 1: Economic Feasibility Analysis of Project

There are several methods used to check economic viability of project. From these methods two methods are used in this study are as follows:

1. Benefit to Cost (B/C) ratio which is also known as profitability index.
2. Internal Rate of Return (IRR)

Economical feasibility study of the project

The economic feasibility is the analysis of the costs and returns from a project with respect to determine whether project is logical or not and possible to complete it. It is one of the cost-benefit analysis of the considered project, which concludes that whether the project is possible to implement or not. The economic feasibility analysis is the mostly used to decide the efficiency of a new project. It is also known as cost analysis. It helps to identify the expected return against an amount invested in the considered project.

For this, two types of costs are calculated which are known as development cost and operating cost. By considering future value of the project, an approximate time span to receive the returns against the investment is also calculated. Economic feasibility study helps to identify how well or how poorly a project will perform.

3.1.1 Benefit-Cost Ratio (B/C)

The benefit cost ratio is calculated by dividing the present value of benefits by that of costs and investments.

$$BCR = \frac{|PV\ [Benefits]|}{|PV[Cost]|} = \frac{\sum_{t=0}^{N} \frac{|CF_t[Benefits]|}{(1+i_t)^t}}{\sum_{t=0}^{N} \frac{|CF_t[Costs]|}{(1+i_t)^t}}$$

Formula for Benefit to Cost Ratio

Where:
BCR = Benefit Cost Ratio
PV = Present Value
CF = Cash Flow of a period (classified as benefit and cost, respectively)
i = Discount Rate or Interest Rate
N = Total Number of Periods
t = Period in which the Cash Flows occur

Note: In this formula, both present values need to be inserted with their absolute, non-negative amounts. If we consistently used negative cash flows for either the cost or the benefit side, result will be negative, then need to multiply it with (-1).

The benefit-cost ratio (BCR) is also known as Profitability Index. A profitability indicator used in cost-benefit analysis to determine the viability of cash flows generated from an asset or project. The BCR compares the present value of all benefits generated from a project/asset to the present value of all costs. A BCR exceeding one indicates that the asset/project is expected to generate incremental value.

Criteria for Benefit to Cost Ratio

Range of (B/C) Ratio	Profitability Index
BCR < 1	Investment will not be profitable.
BCR= 1	Investment is neither profitable nor loss.
BCR > 1	Investment will be profitable.

3.1.2 Internal Rate of Return (IRR)

The internal rate of return can be defined as the rate which equates the present value of cash inflows with the present value of cash outflows of an investment. Internal rate of return is the rate at which the net present value of the investment is zero. It is called internal rate because it depends only on the outlay.

$$C_0 = \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \cdots + \frac{C_n}{(1+r)^n}$$

$$C_0 = \sum_{t=1}^{n} \frac{C_t}{(1+r)^t}$$

$$= \sum_{t=1}^{n} \frac{C_t}{(1+r)^t} - C_0 = 0$$

Formula for Internal Rate of Return (IRR)

IRR higher than the discount rate signifies that investment is profitable. Internal rate of return (IRR) is the percentage of returns that a project will generate within a time period to cover its initial investment. Internal rate of return (IRR) is the discount rate at which a project's returns become equal to initial. It is the rate when the Net Present Value amounts to zero. It facilitates the comparison of different investment options and projects.

3.2 Phase 2: Socio- Economic Study of Wakurde LIS

In this phase of project, Socio-economic study is carried out with following aspects:

- To asses socio-economic impact of scheme.
- To recommend measures to be taken to increase planned benefits.

1. Assessment of socio-economic impact:

   For an assessment of socio-economic impact of scheme, following points are to be studied:
   - For which factors LIS will be feasible and factors affecting feasibility of LIS
   - How LIS affects on environmental factors and on social factors, also it's economic impact.

2. Measures to be taken to improve planned benefits:
   - Actual problems in implementation of LIS are found out by overall study.
   - Overall analysis is carried out to overcome these drawbacks then suggestions are given to improve benefits from LIS project.
   - In which case, implementation of Wakurde LIS will be economical and efficient.
   - How PDN (Pipe Distribution Network) is beneficial over CDN (Canal Distribution Network)

4. DATA COLLECTION AND CALCULATION

4.1 Method 1. Annual Cost and Benefit Cost Ratio of Project

4.1.1 Cost of the project

The total cost of the scheme consists of the following:

1. Fixed cost or investment cost.
2. Operating cost.
3. Maintenance cost.

Table 4.1.1 Cost of the project

Sr. No.	Particulars	Total Amount Rs. Lakhs
A	**Direct Charges**	
1.	Cost of works-	
	1-Headworks	19745.19
	2-Main canals and branches	61879.00
	Total Cost of the project	**81624.19**
2.	Establishment charges at 10% on cost of the project excluding B-Lands and upto date expense on ETP (03/2020 upto date ETP Expense is Rs. 393.69 Lakhs) (1-Head works B-Land Cost-Rs.666.63Lakhs) (2-Main Canal B- Land cost–Rs.3673.73 Lakhs)	7689.01
3.	Charges of Tools and Plants (Ordinary) At 1% of cost of works except B- Lands	772.84
	Total 1+2+3	**90086.04**
	Deductions:	

	Deduct Salvage value of temporary buildings @15% of Cost of the temporary buildings (Cost of K-Buildings–Rs.111.11Lakhs)	16.67
	Total cost of A Direct Charges	**90069.37**
B	**Indirect Charges**	
	Capitalisation of abatment of land revenue at the rate of 8% (Cost of B Lands *0.5%) *8%	1.74
	Audit and account charges at 1% on cost of works excluding the cost of 'B'lands	772.84
	Total cost of B Indirect Charges	**774.58**
	Total Cost of the Project (A) + (B) =	**90843.95**
	Say	**908.44 Crore**

4.1.2 Revised Cost Of The Project

Table 4.1.2.Revised Cost of the project

	REVISED COST OF THE PROJECT				90844	Lakhs
1.	Interest on the total cost of the project@10% on Rs.90844 lakhs				9084.4	Lakhs
2.	Depreciation on the project@1% on Rs.37152.33 Lakhs (90844-2473.3-3029.8-48188.57) =37152.33				371.52	Lakhs
3	Depreciation of pumping system (Mech, portion)				252.38	Lakhs
	Assuming life of machinery 12 years @8.33% on					
	Rs.	3029.80	0.0833			
4	Depreciation of rising main @3.33 % on				1687.04	Lakh
	Rs.	50661.87	0.0333			
	(Assuming life of rising main and PDN 30 years)					
5	Power charges for lift irrigation as per HTPV II as per Separate statement of piping machinery				3267.25	Lakh
6	Annual maintenance charges as per separate statement Ref. (85.52+85.74)				171.26	Lakhs
7	Operational & Maintenance Charges as GR 27/08/2013				193.09	Lakhs
	Rs.	IP	Amount			
	550*	35107	193.09			
	(282 * 390/200)					
Hence the final revised cost of project is				Total of C	15026.95	Lakhs
				Say	**15026.95**	**Lakhs**

4.1.3 Calculation Of Annual Benefits From Project:

Crop Composition Approved by Department of Agriculture

A. Pre project crop pattern

Existing crop structure approved is first taken as per the following.

Table 4.1.3 A) Existing Crop Structure

Season	Name of the crop	% As approved first RAA	% As proposed second RAA
Annual	Cane	3.65	3.65
	Other annuals	1.45	1.45
	Total	5.10	5.10
Kharif	Rice	4.54	4.54
	Tied	36.70	36.70
	Groundnut	19.40	19.40
	Total	60.64	60.64
Rabbi	Wheat	1.05	1.05
	Hybrid tidal	2.00	2.00
	Gram	3.53	3.53
	Millet	4.03	4.03
	T.S.Cotton	1.80	1.80
	Other	21.85	21.85
	Total	34.26	34.26
Other Overall		**100**	**100**

B. Post Project Crop Pattern

Approval of crop plan for Wakurde project has been approved as per District Superintendent of Agriculture, Sangli.

Table 4.1.3. B) Details of crop plan for the project

Sr. No.	Season	Name of crop	% As Approved first RAA		% As Proposed second RAA	
			East	West	East	West
A	**Perennial/ 8 months**	Sugarcane	20	20	10	10
		Chilli	2	2	2	2
		Gingar/Turmeric	3	2	3	4
		Grass/Lucerne	2	2	2	2
		Total A	**27**	**26**	**20**	**18**

B	**Kharif season**	Kharif Paddy (TP)	0	10	7	10
		Kharif Paddy	0	0	30	25
		Drillled Rice	7	25	0	0
		Pulses	2	0	0	0
		Maize	2	0	2	0
		Sorghum/Hybrid orghum	30	10	0	10
		Groundnut	15	15	15	0
		Vegetables	3	0	2	0
		Tobacco	0	0	2	15
		Total B	**59**	**60**	**58**	**60**
C	**Rabbi season**	Wheat	20	20	17	17
		Sorghum/ Hybrid Sorghum	2	2	6	6
		Maize/Hybrid Maize	2	5	6	6
		Vegetables	5	5	10	10
		Gram	5	5	6	6
		Grass	6	0	6	0
		Total C	**40**	**37**	**51**	**45**
		Total (A+B+C)	**126**	**123**	**126**	**123**

The proposed crop composition of the project has been received as per the letter No.48/2009, dated 03/01/2009 of District Superintendent of Agriculture, Sangli and is being approved by the Commissioner of Agriculture, Pune. According to the proposed crop structure, 173.36 gallons of water is required for Modified Penman method for irrigation.

State level technical advisory committee's feedback

The crop structure proposed in the first RAA approved was 126% and 123% for Sangli East and Sangli West respectively. It had 20% cane crop for both the regions. Approved by letter dated 2009. The area under that crop has been reduced by 10% for both the areas and the percentage of other crops has been changed to 126% and 123% for Sangli East and Sangli West respectively.

4.1.4 Calculation of Net Benefits From Crop: Wakurde Lift Irrigation Scheme Tal: Shirala Dist: Sangali

A. For Sangali (East) – Statement showing the net benefits for 1000 hectare under irrigated condition

Table 4.1.4 A) Net Benefits for1000 hectare for Sangali – East

Sr.No.	Name of crop	%	Area in hectare	Net benefit Per hectare	Net benefits
1	2	3	4	5	6
A 1 2	PERRENIALS Sugarcane Grass	 10 2	 100 20	 250166 1014	 25016550 20280
B 1 2 3 4	KHARIF SEASONALS Kharif Paddy (TP) Kharif Paddy Maize Khari fGroundnut	 7 30 2 15	 70 300 20 150	 79563 108609 69487 77021	 5569428 32582799 1389739 11553210

5	Kharif Vegetables	2	20	213534	4270689
6	Tobaco	2	20	36304	726072
C	RABI SEASONAL (IRRIGATED)				
1	Wheat	17	170	58778	9992330
2	Jawar	6	60	25319	1519147
3	Maize	6	60	39900	2393978
4	Vegetables	10	100	213534	21353445
5	Gram Kharif	6	60	47095	2825725
6	Grass	6	60	910	54600
D	H W Crops				
	Chillies	2	20	142807	2856136
	Ginjar	3	30	311783	9353484
	Total	126	1260		131477612

Net Benefit For 5760 Hectare

=1314.78 × 20765 ÷ 1000 = 27301.33 (Rs. In Lakhs)

B. For Sangali (West) - Statement showing the net benefits for 1000 hectare under irrigated condition

Table 4.1.4. B) Net benefits for 1000 hectare for Sangali – West

Sr. No.	Name of crop	%	Area in hectare	Net benefit Per hectare	Net benefits
1	2	3	4	5	6
A	PERRENIALS				
1	Sugarcane	10	100	250166	25016550
2	Grass	3	30	1014	30240
B	KHARIF SEASONALS				
1	Kharif Paddy (TP)	10	100	79563	7956326
2	Kharif Paddy	25	250	108609	27152333
3	Jawar	10	100	38638	3863754
4	Kharif Groundnut	0	0	77021	0
5	Kharif Vegetables	0	0	213534	0
6	Tobaco	15	150	36304	5445540
C	RABI SEASONAL (IRRIGATED)				
1	Wheat	17	170	58778	9992330
2	Jawar	6	60	25319	1519147
3	Maize	6	60	39900	2393978
4	Vegetables	10	100	213534	21353445
5	Gram Kharif	6	60	47095	2825725
E	H W Crops				
1	Chillies	2	20	142807	2856136
2	Ginjar	3	30	311783	9353484
	Total	123	1230	1644065.70	119759167

Net Benefit For 6515 Hectare

= 1197.59 × 7270 ÷ 1000= 8706.49 (Rs.In lakhs)

Calculation of total net benefit

1. Net benefit for Sangali (East) = 27301.33 (Rs.InLakhs)
2. Net benefit for Sangali (West) = 8706.49 (Rs.In lakhs)
3. Total Net Benefit = (1 + 2) = 36007.82 (Rs.In lakhs)
4. Annual Net Benefits = 36007.82 – 14559.08
   = 21448.74 (Rs.In lakhs)

Total Annual Benefits from project is 21448.74 (Rs.In lakhs)

4.1.5 Benefit Cost Ratio

Total cost of project calculated from 4.1.2 = 15026.95 (Rs.In lakhs)

Total Annual Benefits from project calculated from 4.1.4 = 21448.74 (Rs.In lakhs)

B.C.RATIO = Total Benefits/Total Cost
= 21448.74 ÷ 15026.95
= 1.43

Hence Benefit to Cost (B/C) ratio for the project is 1.43

4.2 Method 2. Internal Rate Of Return

Here, Yearwise Net benefits of the project along with Internal Rate of Return is given :

Table 5.2. Internal Rate of Return

Sr. No.	Year	No.Of Years	Convertion factor for benefit	Project Cost Exp.In Year	ICA developed in %	IP in (Ha)	O & M Cost	Total cost	Benefits	Yearwise Converted benefis	Net Benefits
1	2	3	4	5	6	7	8	9	10	11	12
1	2000-2001	23	0.14	883	0	0	0	883	0	0	-883
2	2001-2002	22	0.15	671	0	0	0	671	0	0	-671
3	2002-2003	21	0.17	510	0	0	0	510	0	0	-510
4	2003-2004	20	0.18	293	0	0	0	293	0	0	-293
5	2004-2005	19	0.2	806	0	0	0	506	0	0	-506
6	2005-2006	18	0.21	1046	0	0	0	1046	0	0	-1046
7	2006-2007	17	0.23	460	0	0	0	460	0	0	-460
8	2007-2008	16	0.25	469	0	0	0	469	0	0	-469
9	2008-2009	15	0.28	95	0	0	0	95	0	0	-95

10	2009-2010	14	0.3	205	0	0	0	205	0	0	-205
11	2010-2011	13	0.33	3769	0	0	0	3769	0	0	-3769
12	2011-2012	12	0.36	1085	7.85	2.755	15.15	1100	1683	602	-498
13	2012-2013	11	0.39	1224	7.85	2.755	15.15	1239	1683	656	-583
14	2013-2014	10	0.42	1514	7.85	2.755	15.15	1529	1683	715	-815
15	2014-2015	9	0.46	1262	7.85	2.755	15.15	1277	1683	779	-499
16	2015-2016	8	0.5	1232	7.85	2.755	15.15	1247	1683	848	-399
17	2016-2017	7	0.55	427	10.22	3.588	19.72	447	2192	1203	757
18	2017-2018	6	0.6	1511	10.81	3.794	20.86	1532	2318	1386	-145
19	2018-2019	5	0.65	1340	10.81	3.794	20.86	1361	2318	1510	150
20	2019-2020	4	0.71	2666	10.81	3.794	20.86	2687	2318	1645	-1041
21	2020-2021	3	0.77	13935	42.02	14,752	81.1	14016	9013	6970	-7046
22	2021-2022	2	0.84	20903	73.23	25,709	141.33	21044	15707	13234	-7811
23	2022-2023	1	0.92	20903	85.61	30,054	165.22	21068	18362	16854	-4214
24	2023-2024	0	1	13935	100	35,107	193	14128	21449	21449	7320
1	2024-2025	1	1	0	100	35107	193	193	21449	21449	21256
2	2025-2026	2	1	0	100	35107	193	193	21449	21449	21256
3	2026-2027	3	1	0	100	35107	193	193	21449	21449	21256
4	2027-2028	4	1	0	100	35107	193	193	21449	21449	21256
5	2028-2029	5	1	0	100	35107	193	193	21449	21449	21256
6	2029-2030	6	1	0	100	35107	193	193	21449	21449	21256
7	2030-2031	7	1	0	100	35107	193	193	21449	21449	21256
8	2031-2032	8	1	0	100	35107	193	193	21449	21449	21256
9	2032-2033	9	1	0	100	35107	193	193	21449	21449	21256
10	2033-2034	10	1	0	100	35107	193	193	21449	21449	21256
11	2034-2035	11	1	0	100	35107	193	193	21449	21449	21256
12	2035-2036	12	1	3030	100	35107	193	193	21449	21449	21256
13	2036-2037	13	1	0	100	35107	193	193	21449	21449	21256

14	2037-2038	14	1	0	100	35107	193	193	21449	21449	21256
15	2038-2039	15	1	0	100	35107	193	193	21449	21449	21256
16	2039-2040	16	1	0	100	35107	193	193	21449	21449	21256
17	2040-2041	17	1	0	100	35107	193	193	21449	21449	21256
18	2041-2042	18	1	0	100	35107	193	193	21449	21449	21256
19	2042-2043	19	1	0	100	35107	193	193	21449	21449	21256
20	2043-2044	20	1	0	100	35107	193	193	21449	21449	21256
21	2044-2045	21	1	0	100	30054	193	193	21449	21449	21256
22	2045-2046	22	1	0	100	35107	193	193	21449	21449	21256
23	2046-2047	23	1	0	100	35107	193	193	21449	21449	21256
24	2047-2048	24	1	3030	100	35107	193	3223	21449	21449	21256
25	2048-2049	25	1	0	100	35107	193	193	21449	21449	21256
26	2049-2050	26	1	0	100	35107	193	193	21449	21449	21256
27	2050-2051	27	1	0	100	35107	193	193	21449	21449	21256
28	2051-2052	28	1	0	100	35107	193	193	21449	21449	21256
29	2052-2053	29	1	0	100	35107	193	193	21449	21449	21256
30	2053-2054	30	1	50622	100	35107	193	50855	21449	21449	21256
31	2054-2055	31	1	0	100	35107	193	193	21449	21449	21256
32	2055-2056	32	1	0	100	35107	193	193	21449	21449	21256
33	2056-2057	33	1	0	100	35107	193	193	21449	21449	21256
34	2057-2058	34	1	0	100	35107	193	193	21449	21449	21256
35	2058-2059	35	1	0	100	35107	193	193	21449	21449	21256
36	2059-2060	36	1	3030	100	35107	193	3223	21449	21449	21256
37	2060-2061	37	1	0	100	35107	193	193	21449	21449	21256
38	2061-2062	38	1	0	100	35107	193	193	21449	21449	21256
39	2062-2063	39	1	0	100	35107	193	193	21449	21449	21256
40	2063-2064	40	1	0	100	35107	193	193	21449	21449	21256
41	2064-2065	41	1	3030	100	35107	193	193	21449	21449	21256

42	2065-2066	42	1	0	100	35107	193	193	21449	21449	21256
43	2066-2067	43	1	0	100	30054	193	193	21449	21449	21256
44	2067-2068	44	1	0	100	35107	193	193	21449	21449	21256
45	2068-2069	45	1	0	100	35107	193	193	21449	21449	21256
46	2069-2070	46	1	0	100	35107	193	193	21449	21449	21256
47	2070-2071	47	1	0	100	35107	193	193	21449	21449	21256
48	2071-2072	48	1	0	100	35107	193	193	21449	21449	21256
49	2072-2073	49	1	0	100	35107	193	193	21449	21449	21256
50	2073-2074	50	1	0	100	35107	193	193	21449	21449	21256
51	2074-2075	51	1	0	100	35107	193	193	21449	21449	21256
52	2075-2076	52	1	0	100	35107	193	193	21449	21449	21256
53	2076-2077	53	1	0	100	35107	193	193	21449	21449	21256
54	2077-2078	54	1	0	100	35107	193	193	21449	21449	21256
55	2078-2079	55	1	0	100	35107	193	193	21449	21449	21256
56	2079-2080	56	1	0	100	35107	193	193	21449	21449	21256
57	2080-2081	57	1	0	100	35107	193	193	21449	21449	21256
58	2081-2082	58	1	0	100	35107	193	193	21449	21449	21256
59	2082-2083	59	1	0	100	35107	193	193	21449	21449	21256
60	2083-2084	60	1	15396	100	35107	193	193	21449	21449	21256
61	2084-2085	61	1	0	100	35107	193	193	21449	21449	21256
62	2085-2086	62	1	0	100	35107	193	193	21449	21449	21256
63	2086-2087	63	1	0	100	35107	193	193	21449	21449	21256
64	2087-2088	64	1	0	100	35107	193	193	21449	21449	21256
65	2088-2089	65	1	0	100	35107	193	193	21449	21449	21256
66	2089-2090	66	1	0	100	35107	193	193	21449	21449	21256
67	2090-2091	67	1	0	100	35107	193	193	21449	21449	21256
68	2091-2092	68	1	0	100	35107	193	193	21449	21449	21256
69	2092-2093	69	1	0	100	35107	193	193	21449	21449	21256

70	2093-2094	70	1	0	100	35107	193	193	21449	21449	21256
71	2094-2095	71	1	0	100	35107	193	193	21449	21449	21256
72	2095-2096	72	1	3030	100	35107	193	193	21449	21449	21256
73	2096-2097	73	1	0	100	35107	193	193	21449	21449	21256
74	2097-2098	74	1	0	100	35107	193	193	21449	21449	21256
75	2098-2099	75	1	0	100	35107	193	193	21449	21449	21256
76	2099-2100	76	1	0	100	35107	193	193	21449	21449	21256
77	2100-2101	77	1	0	100	35107	193	193	21449	21449	21256
78	2101-2102	78	1	0	100	35107	193	193	21449	21449	21256
79	2102-2103	79	1	0	100	35107	193	193	21449	21449	21256
80	2103-2104	80	1	0	100	35107	193	193	21449	21449	21256
81	2104-2105	81	1	0	100	35107	193	193	21449	21449	21256
82	2105-2106	82	1	0	100	35107	193	193	21449	21449	21256
83	2106-2107	83	1	0	100	35107	193	193	21449	21449	21256
84	2107-2108	84	1	0	100	35107	193	193	21449	21449	21256
85	2108-2109	85	1	0	100	35107	193	193	21449	21449	21256
86	2109-2110	86	1	0	100	35107	193	193	21449	21449	21256
87	2110-2111	87	1	0	100	35107	193	193	21449	21449	21256
88	2111-2112	88	1	0	100	35107	193	193	21449	21449	21256
89	2112-2113	89	1	0	100	35107	193	193	21449	21449	21256
90	2113-2114	90	1	0	100	35107	193	193	21449	21449	21256
91	2114-2115	91	1	50662	100	35107	193	193	21449	21449	21256
92	2115-2116	92	1	0	100	35107	193	193	21449	21449	21256
93	2116-2117	93	1	0	100	35107	193	193	21449	21449	21256
94	2117-2118	94	1	0	100	35107	193	193	21449	21449	21256
95	2118-2119	95	1	0	100	35107	193	193	21449	21449	21256
96	2119-2120	96	1	0	100	35107	193	193	21449	21449	21256
97	2120-2121	97	1	3030	100	35107	193	193	21449	21449	21256

98	2121-2122	98	1	0	100	35107	193	193	21449	21449	21256
99	2122-2123	99	1	0	100	35107	193	193	21449	21449	21256
100	2123-2124	100	1	0	100	35107	193	193	21449	21449	21256
										IRR =	15.21%

5. SOCIO-ECONOMIC ANALYSIS:

5.1 Factors Affecting Feasibility of Lift Irrigation/Water Supply Project:

1. Location of the scheme.
2. Availability of water in the river or the stream, with respect to irrigation seasons.
3. Number of existing irrigation and water supply projects on the same river or stream in both upstream and downstream sections of the proposed scheme.
4. Potential for additional pumping from the river without adversely affecting the water requirement of existing schemes/ riparian users.
5. Suitability of water for irrigation/water supply.
6. Proposed cropping pattern/cropping intensity in the command area/water supply demands of the population.
7. The extent of land development work needed in the command area.
8. On-farm water conveyance system proposed (open channels/ underground pipelines). PDN over CDN
   The method of water application proposed (surface/sprinkler/drip).

5.2 Actual problems in practical application of LIS:

1. Crop pattern is not being followed by farmers
2. Operation of valves and pressure in pipes should be properly calculated.
3. Scouring of pipes and its maintenance
4. Distribution of water as per requirement
5. Continuous electricity supply is needed
6. Difficulties in flooding situation
7. Limitation on irrigation potential of particular water source
8. Dependency for land acquisition
9. Illiteracy of farmers may lead to improper operation of lift irrigation system

5.3 Suggestions / Recommendations To Improve Planned Benefits:

1. Crop patterns should be followed by farmers.
2. A technical authority should be appointed for execution and operation of water distribution system.
3. Regular inspection and maintenance should be carried out to check blockage in pipes.
4. Pressure should be checked properly while designing and operating lift irrigation system.
5. Cleaning of canals and sediment removal should be done periodically.
6. Distribution of water should be as per requirement and there should be check on wastage of water.
7. Pipe distribution network should be preferred over canal distribution system.

5.4 Advantages of using PDN (Pipe Distribution Network) over CDN (Canal Distribution Network) in LIS :

Disadvantages of canal system

1. In stagnant and open water, there can be spread of mosquitoes, worms and insects.
2. There is theft of water from open canal, due to which there will be shortage of water as per requirement for genuine farmers.
3. The growth of weeds along canal sides and river bed.
4. If regular maintenance of canal is not done, hydraulic capacity of canal decreases due to sediment deposition.
5. Percentage increases in conveyance efficiency and distribution efficiency which minimizes losses

Advantages of PDN over CDN

1. Water is distributed by pipes to entire area of farm. Hence, no significant amount of productive farm area is lost to crop production.
2. There are no transmission losses while supplying water also there is no leakage in pipeline system as it is water tight. As a result, there are no evaporation and seepage losses which lead to saving of water.
3. Drainage problems are reduced as there is no seepage.
4. Labour saving - 25-50% less labour per unit area of irrigation for pipe distribution for the control of water in compare with open channel.
5. Permanence – In pipe distribution network, a pipe network is properly designed, made of good quality materials and well constructed. It has long life span.
6. Ease of conveyance – Water can be drawn directly from water supply source to outlet points mostly it is possible for undulating land. Water can be transported to areas such as across a depression or boosted uphill, which is not possible with open channels, unless an elaborate structure is built.
7. Low maintenance cost – In case of open canals, earthen structures are to be built and maintained continuously but maintenance costs for pipe distribution structures are low, as the system is buried under ground
8. No channel block problems – There is no obstruction to flow of water, no channels to become choked with weeds to hinder flow.
9. Better control – there is better and easier control on the flow of water in case of pipes which leads to more efficient irrigation.
10. No hindrance to equipment - There are few obstacles to hinder the movement of agricultural equipment and farm transport. This is an important feature where fields are small.
11. Full and effective control of irrigation water resulting into taking up of crop diversification such as horticulture, vegetables and other cash crops such as groundnut etc.

6. RESULT AND DISSCUSION

From Economic Analysis, for Wakurde Lift Irrigation Scheme, the total cost worked out to be Rs. 908.44 Crore that is 181000 Rs. per Hectare. Benefit Cost Ratio of the project is 1.43 which is nearly equal to 1.5 and is approved by corresponding Government authority. Hence project is efficient. Internal Rate of Return (IRR) of the project is 15.21% which is more than 12% which fits the project criteria. Hence the project is efficient and economically feasible.

From socio-economic analysis, the factors which affect feasibility of LIS are location, availability of water sources, proposed cropping pattern, water conveyance systems. Many points were came to notice while actual implementation of LIS such as operation of LIS, un following proposed cropping pattern, pressure in pipes, souring & maintenance of pipe distribution system, distribution of water, electricity supply, limitation on irrigation potential, problems in land acquisition, illiteracy of farmers.

7. CONCLUSION

The study concludes that B/C ratio of project is 1.43 which is nearly equal to 1.5 hence implementation of this project is profitable. Internal Rate of Return (IRR) for this project is worked out as 15.21% which is greater than 12.5% hence project will give profitable returns. From these two methods of economic feasibility study (Phase1), it is concluded that project is feasible.

Second phase of project is to assess socio-economic impact of scheme and recommend measures to increase planned benefits. From socio-economic study of Wakurde LIS, it is concluded that even if there are some problems in actual implementation of LIS, LIS is more efficient by using Pipe Distribution Network (PDN) also planned benefits will increase if implementation is carried out with recommended measures.

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