
BAMBOO AND SHALLOW TUBEWELLS IN PURNIA DISTRICT-BIHAR

**AN EX-POST
EVALUATION STUDY**



**NATIONAL BANK FOR
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The National Bank for Agriculture and Rural Development (NABARD) was established on July 12, 1982. The Agricultural Refinance & Development Corporation (ARDC) ceased to exist from that day and its functions were taken over by the NABARD. The subject-schemes were sanctioned by the erstwhile ARDC. For the sake of convenience, the report refers to ARDC although it does not exist any more.

FOREWORD

This study report brings out the results of a comparative evaluation of investments in shallow tubewells and bamboo tubewells financed under a group of schemes in Purnia district of Bihar.

The study shows that the investments in both types of tubewells under the schemes have brought about improvements in cropping pattern, cropping intensity, crop yields and beneficiaries' income. The financial rate of return was also satisfactory in respect of these investments.

An important finding of the study is that in regions where good aquifers are available within reasonable depths, the investment in bamboo tubewells is better suited to the needs of small farmers than shallow tubewells. However, the productivity levels were found to be sub-optimal on small farms with bamboo tubewells on account of slow adoption of improved farm practices, under-utilisation of irrigation potential and inadequate input use arising from difficulties in obtaining short-term credit. Hence, the emphasis must be on improving productivity levels of small farms through better support services like extension, input supply and crop loans. In addition, the study draws attention to the need for institutional reforms like consolidation of holdings to further improve the viability of the composite investment in a bamboo tubewell and pumpset.

A disturbing finding of the study is the poor recovery of investment loans notwithstanding the adequate incremental income realised by the beneficiaries.

The usual disclaimer regarding the National Bank's responsibility for the facts and views in the report is intended.

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ABBREVIATIONS

ARDC	:	Agricultural Refinance and Development Corporation
BSLDB	:	Bihar State Land Development Bank Ltd.
BTW	:	Bamboo Tubewell
FRR	:	Financial Rate of Return
GDP	:	Gross Domestic Product
PACS	:	Primary Agricultural Credit Society
PS	:	Pumpset
RRB	:	Regional Rural Bank
STW	:	Shallow Tubewell
VLW	:	Village Level Worker

CONTENTS

	Page No.
Foreword	ii
Basic Data Sheet	vii - viii
Summary and Conclusions	1 - 6
The Main Report	
I Introduction	7 - 10
II Implementation of the Selected Schemes	11 - 19
III Economics of Investment in Tubewells	20 - 35
IV Financial Viability	36 - 39
V Repayment Performance	40 - 42
VI Macro Impact of Tubewells	43 - 44
ANNEXURE - I Objectives, Sample Design and Methodology of the Study	45 - 47
ANNEXURE - II Per Acre Average Yield and Cost of Cultivation of Different Crops (Survey Data)	48
List of reports published under the Evaluation Study Series	49 - 50

BASIC DATA SHEET

Names of the implementing banks	:	Bihar State Land Development Bank (BSLDB) and Kosi Regional Rural Bank (RRB)
Number of schemes evaluated	:	Three
Implementation period of the selected schemes	:	1969-1979
Reference year of the study	:	1981-82

Particulars	STW with PS	BTW with PS	BTW alone
1	2	3	4
1. Number of beneficiaries financed under the selected schemes	1,926	1,182	942
2. Study sample	40	40	33
3. Average unit cost at historical prices (Rs. per unit) :			
i) Anticipated	9,000	5,450	600
ii) Actual	7,694	5,450	600
4. Actual cost of investment at reference year's prices (Rs.)	10,400	6,606	720
5. Average operational holding (Acres)	16.51	7.80	2.87
6. Of which, average area benefited from the investment (Acres)	7.97	4.15	2.60
7. Increase in cropping intensity over 'control' (In percentage points)	57	51	48
8. Incremental income (Rs.)			
i) Per acre of benefited area	541	388	449
ii) Per unit of investment*	4,403	1,704	1,167
9. FRR (%)	36	18	More than 50
10. Incremental on-farm employment per unit of investment (Mandays)			
i) Non-recurring	104.88	23.69	20.22
ii) Recurring per annum	215.11	114.58	63.99

* Inclusive of the net income from sale of water, at only Rs. 91 in the case of STW with PS and Rs. 94 in the case of BTW with PS. Such income did not accrue to the beneficiaries of the single purpose BTWs.

Particulars	Unit	STW with PS	BTW with PS	BTW alone	All TWs
1	2	3	4	5	6
II. Macro-level impact^a of the selected schemes :					
i) Additional area brought under irrigation	Acres	15,350	4,905	2,020	22,275
ii) Value of additional production	Rs. lakhs	225.50	65.83	27.65	318.98
iii) Contribution to GDP	Rs. lakhs	84.80	20.14	9.07	114.01
iv) Additional on- farm employment :	Mandays in lakhs				
a) Non-recurring		2.02	0.28	0.16	2.46
b) Recurring per year		4.14	1.35	0.50	5.99

The estimates in respect of the investment in 'BTW alone' have been adjusted for the observed incidence of misutilisation of entire loan and are based on 777 units actually installed by the scheme beneficiaries.

SUMMARY AND CONCLUSIONS

This report presents the results of an evaluation of the economics of shallow tubewells (STWs) and bamboo tubewells (BTWs) in Purnia district, Bihar, which forms part of the alluvial Gangetic plain. Three schemes were evaluated. Two of these schemes were implemented by BSLDB and one by Kosi RRB, covering investments in STWs with pumpsets (PS), BTWs (improved) and PS, and the investments in BTWs (traditional) alone. The study is based on a sample of 40 STWs with PS, 40 BTWs with PS and 33 BTWs without PS.*

2. BTWs provide an excellent example of "intermediate technology" well suited to the needs of regions such as Bihar, where extensive fragmentation of the small sized land holdings has rendered the investment in STWs unviable for small and marginal farmers, despite abundant availability of groundwater. BTWs are essentially tubewells upto 60 ft. to 80 ft. depth with coir strainers, some with a bamboo casing (traditional BTW) and others with the top five metres of the casing replaced by a metal pipe (improved BTW).
3. BTWs have become highly popular in the region, particularly amongst small and marginal farmers, due to their low capital cost (about Rs. 720 as compared to Rs. 4,900 for STWs in 1981-82 prices) and the simple technology involved. BTWs are being drilled and installed by local artisans in a relatively shorter period of time. While implementing banks found it relatively hard to achieve targets for STW under the schemes evaluated, demand was noted to be high for BTWs, particularly of the cheaper traditional type, with the concerned bank (the RRB) over-achieving physical targets in respect of this item. The field survey revealed that demand for BTWs was high amongst small and marginal farmers. Out of the 67 small farmers in the sample, altogether 59 small farmers (88 per cent) opted for BTWs in preference to STWs, whereas as many as 80 per cent of the sample STWs were installed

* The beneficiaries operated these BTWs with hired pumpsets.

- by large farmers. Clearly, the advent of BTWs has enabled small and marginal farmers, who may not have found the investment in STWs to be viable, to benefit from an assured source of irrigation.
4. However, BTWs are technically feasible only in regions where good aquifers are available within a maximum depth of 80 ft. At depths in excess of this, BTWs tend to buckle and collapse. They are also unsuited to underground strata with fine sand particles which seep into the strainers and choke them. This problem has been largely overcome by the improved type of BTWs with iron pipes. However, since such improved BTWs cost more (Rs. 1,100 per unit)* than the traditional BTWs (Rs. 720 per unit),* the preference in the region has been for the traditional BTWs.
 5. Due to the low level of rural electrification, a large number of tubewells (TWs) in the region were operated by diesel pumpsets. In fact, all the sample TWs were operated by diesel pumpsets in spite of the higher operating cost compared to that of electric pumpsets. The primary reason for this was the erratic and unreliable supply of electricity.
 6. During the survey, no instance of failure of TWs was noticed. BTWs even 6-7 years after their installation and STWs after 13 years were found working satisfactorily. Hence, the economic life of STW generally assumed at 15 years and that of BTW (improved) at 7 years need no modification. However, the life of a traditional BTW may be taken as 5 years.
 7. During the survey, instances of misutilisation were detected in respect of the single purpose BTW loans. About 17.5 per cent of the total BTW (without PS) beneficiaries misutilised the entire loan as the implementing bank lacked effective post-loan supervision.
 8. On an average, the benefited area under the investments in STW with PS, BTW with PS and BTW alone was 7.97 acres, 4.15 acres and 2.60

* At the reference year's prices.

acres respectively. It was higher than the scheme appraisal assumption in regard to the minimum irrigated area of 5 acres for STW with PS, 3 acres for BTW with PS, and 0.5 acres for BTW alone.

9. With the switchover to irrigated farming, considerable improvements were recorded in cropping pattern, cropping intensity and crop yields. There was a shift from a cropping pattern dominated by local paddy and jute, to the cultivation of HYV paddy and improved jute varieties, while wheat and oilseeds were also introduced in the rabi season. Thus, there was a significant improvement in cropping intensity from 127 per cent to 184 per cent under STWs with PS, 133 per cent to 184 per cent under BTWs with PS, and from 130 per cent to 177 per cent under BTWs alone. The improvement in the yields of paddy and jute, the two crops grown under both irrigated and unirrigated conditions, was significant in respect of all the three investments. On an average, the per acre yield of paddy improved from 4.5 quintals to 10.2 quintals in the case of STW with PS, from 4.2 quintals to 9.4 quintals in the case of BTW with PS and from 3 quintals to 9.2 quintals in respect of BTW alone. The increase in jute yield varied between 124 per cent under BTW with PS and 178 per cent under STW with PS. The average yield of wheat obtained by the beneficiaries was in the range of 8.6 quintals per acre (BTW with PS) to 9.5 quintals per acre (STW with PS) and compared favourably with the average yield under irrigated conditions in the area.
10. The investment induced changes resulted in net incremental income per net sown acre of the order of Rs. 541, Rs. 388 and Rs. 449 from the benefited area under STW with PS, BTW with PS and BTW alone, respectively. The incremental income per unit of investment was of the order of Rs. 4,403, Rs. 1,704, and Rs. 1,167 under STWs with PS, BTWs with PS and BTWs alone, respectively.
11. The results of the financial analysis show that the investment in STW with PS was viable with FRR at 36 per cent, whereas, that in BTW (improved) with PS and BTW (traditional) alone was viable with FRR

at 18 per cent and more than 50 per cent respectively. The relatively lower value of FRR in respect of the BTW with PS is mainly on account of the capital cost of the diesel pumpset not generating commensurate returns. Field-level enquiries revealed that 3 h.p. pumpsets were more appropriate for lifting water from BTWs. Notwithstanding this fact, bank finance was provided for 5 h.p. diesel pumpsets, (probably due to the non-availability of 3 h.p. pumpsets) which had lowered the viability of the composite BTW investment. The sensitivity analysis showed that under adverse conditions, the composite investment in BTW with PS would be only marginally viable at 15% FRR. On the other hand, the FRR values in respect of STW with PS and BTW alone would be comfortably higher at about 32 per cent and more than 50 per cent respectively.

12. The branch-level recovery performance under the scheme investments was better in the case of the RRB branches than those of the LDB. At beneficiary level, altogether about 33 per cent, 15 per cent and 76 per cent of the sample beneficiaries respectively under STW with PS, BTW with PS and BTW alone were in default. The default was, by and large, wilful as the defaulters had the necessary repaying capacity from out of the incremental income to service the loans.
13. The macro-level impact of the three schemes under review was assessed in terms of the incremental irrigated area, crop production, farm income and employment in the area. The tubewell investments together resulted into an extension of irrigation over additional area of 22,275 acres, a contribution to GDP of the order of Rs. 114 lakhs (at 1981-82 prices), and about 2.46 lakh mandays of the initial non-recurring and about 6 lakh mandays of additional recurring employment per year.
14. A major area of concern, nevertheless, is the fact that crop yields still remain below feasible levels. For example, yield levels of paddy and wheat in Ludhiana district of Punjab, the foremost ranking district in the country in this respect and one which is comparable in agro-climatic conditions to Purnia, are much higher at 16.71 quintals and 13.70 quintals

per acre* respectively, in comparison to the highest realised yields by sample farmers of 10.20 quintals per acre for paddy and 9.50 quintals for wheat. One reason for this is the fact that the investment in the improved bio-chemical technology remains fairly low. As one indicator, only 40 per cent to 50 per cent of the gross cropped area under different investment types was under high yielding varieties of crops.

15. Another factor contributing to low yield levels is the sub-optimal application of irrigation. Levels of actual irrigation fell short of those recommended by agricultural scientists for the soil types of the region by approximately 11 per cent in the case of STWs and as much as 24 per cent in the case of BTWs, despite adequate availability of irrigation water in the TWs. The under-utilisation of irrigation capacity was on account of a two-fold reason. Firstly, the small command of tubewells in relation to their potential, is caused by a structural constraint, viz., small and fragmented land holdings. Secondly, low intensity of irrigation was attributed to the high cost of diesel and problems in its availability, as also to a lack of extension effort in ensuring optimal use of irrigation.

16. Another cause for concern is the lower level of returns achieved by BTW owners relative to that of STW owners, both in terms of net income per net sown acre (Rs. 733 for STW with PS owners in comparison to Rs. 605 for BTW with PS, and Rs. 614 for BTW alone) and in terms of incremental income per net sown acre (Rs. 541 for STW with PS, and Rs. 388 and Rs. 449 for BTW with PS and BTW alone respectively, when net income was computed based on cost of cultivation exclusive of the imputed value of family labour). This could be attributed to the higher yields obtained by beneficiaries investing in STWs, which in turn resulted from their higher level of use of irrigation and that of associated material inputs. Both factors may be ascribed to the relatively better resource position of STW owners, who were mainly large farmers. The per acre incremental income under STWs being higher than that under BTWs is indicative of a worsening of the relative income position of BTW beneficiaries, i.e., small and marginal farmers.

Figures relate to the agricultural year 1981-82. Source : CMIE, **Profiles of Districts**, Part 2, July 1985, p. 482

There are also indications that BTW owners are not getting a level of return commensurate with their level of expenditure on crop production.*

17. The sample beneficiaries reported difficulties in obtaining short-term credit support from the primary agricultural credit societies (PACS), which were working unsatisfactorily. About 37 per cent of the sample beneficiaries did not have any access to institutional short-term credit. Improved availability of production credit needs to be ensured, especially in the case of small farmers.
18. The incremental capital-output ratio works out to 2.36 : 1 for the investment in STW with PS, 3.88 : 1 for BTW with PS and only 0.62 : 1 in the case of BTW alone.
19. As regards the choice of technology appropriate to meet the needs of small farmers, though the single purpose BTW investment is ideal, there is a physical limitation to availability of pumpsets on custom hire. Hence, the composite investment in BTWs appears to be more suitable for small farmers and that in STWs for other farmers. It may, however, be emphasised that the viability of the composite investment in BTW with pumpset needs to be improved through, (i) higher farm productivity via efficient input use, including irrigation, HYV seeds, fertilizers, etc; (ii) sale of excess water; and (iii) custom hiring of pumpsets to those with single purpose BTWs. Consolidation of land holdings will also have a favourable effect on viability of investment in BTW with PS on small farms. If income distributional considerations call for a preference for BTW investments in the region, emphasis must lie on greater extension efforts and land reforms including consolidation of holdings in the state.

For instance, the incremental cost of cultivation per net sown acre was higher in the case of BTW with PS beneficiaries (Rs. 954) than those with STW with PS (Rs.928). However, the relative inefficiency of the former beneficiaries originated from the composition of cultivation cost. They spent relatively less on material inputs, especially fertilisers and realised lower incremental income.