10th WEDC Conference

Water and sanitation in Asia and the Pacific : Singapore : 1984

Benefit-cost analysis of an irrigation tank in the north-east of Thailand

Dr J C S Tang Dr R W A Vokes and M Kunapinun

INTRODUCTION

Thailand is a predominantly agricultural country with rice farming constituting the most important economic activity. Among the four regions of the country, the Northeast is the least developed and much attention and resources have been allocated to the region to help alleviate the problem of widespread poverty. The major economic activity in the Northeast - as in the rest of Thailand - is farming. The farming economy in the Northeast is of a semi-subsistence type, dominated by wet season rice production, although there has, in recent years, been a major expansion in the production of upland crops, notably cassava. The farmers of the Northeast have to depend on irregular and unreliable rainfall as well as suffering from flooding in lowland areas in some years. The scarcity of alternative on-farm and off-farm employment opportunities and a relatively high rate of population growth have combined to make the Northeast a problem area that demands urgent attention and help.

To augment the irregular rainfall during the wet season and to provide new employment opportunities during the dry season, a large number of irrigation tanks have been constructed during the last 25 years. Lam Chamuak, the irrigation tank under study here, was completed in 1963. However, like most of the tanks built in the Northeast, the Lam Chamak irrigation system has suffered considerable damage, primarily as a result of poor maintenance. At the time of the study, only 600 rai (1 rai = 0.4 acre) could be irrigated in the wet season and not more than 1900 rai in the dry season. In the dry season up to 1900 rai received irrigation although most of this area did not receive an adequate supply throughout the dry season, resulting in very low crop yields. It is envisaged that, after the rehabilitation, a total of 10000 rai (7400 rai on the right and 2600 rai on the left of the canal) will be irrigated in the wet season plus up to 4000 rai in the dry season. The purpose of this study is to evaluate the economic and financial viability of rehabilitating the Lam Chamuak Irrigation Tank. The criteria used to judge the viability of the project are internal rate of return (IRR), net present worth (NPW) and benefit-cost ratio (B/C).

PROJECT AREA

The Lam Chamuak reservoir was formed by construction of an earth embankment across the Lam Chamuak stream. The head works (one embankment, one overflow spillway, the head regulators) of this reservoir were found to be in good condition and no remedial work was considered necessary. Water in the reservoir is supplied to the right and left of the main canals by the head regulators and then it is supplied directly to the rice fields adjacent to the canals. At the moment, only 6000 rai of farm land are irrigated and this is mainly due to the fact that the right and left bank distribution systems are damaged with rehabilitation needed for both canals. Most of the damage was caused by concentration of run-off where the canal crosses the drainage channels, erosion of soils, as well as the lack of proper maintenance during the past few years. Out of the 7400 rai served by the right canal, only 4500 rai are currently being irrigated; and 1500 rai out of 2600 rai served by the left canal are also being irrigated. When rehabilitation is completed, it is expected that all the areas on both sides can be irrigated during the wet season.

The land in the project area can be divided into three categories with most of the farmers operating some of each. Category A consists of lowland that is presently irrigated. Category B consists of lowland that will be irrigated once rehabilitation is completed. The final category, type C, consists mainly of upland, both within the boundaries of the canals and surrounding the irrigation system, which will not be affected by the project. Thus, only land in categories A and B is considered in the subsequent analysis. It is worth noting that almost all of the land within the project areas is owned by the farmers. Tenancy is not widespread in the Northeast as a whole. Prior to rehabilitation, the crops being cultivated in the lowland areas were traditional Long Duration Variety (LDV) rice and vegetables in the wet season and small areas of groundnut, mungbean, maize and vegetables in the dry season.

After rehabilitation, cropping patterns are expected to be as follows:

High Yield Variety (HYV) and Long Duration Variety (LDV) paddy during the wet season (w/s); vegetables in both the wet and dry seasons (w/s, d/s); and mungbean and groundnut during the dry season (d/s). In the wet season, it is envisaged that by the time the project reaches full development in the seventh year, approximately 60 per cent of the area planted with paddy will consist of HYV's with the remaining 40 per cent under LDV's. However, significant improvement in the yields of LDV's are expected with the project as a result of the provision of improved irrigation and improved farming practices. For the dry season, groundnuts and mungbeans are the two recommended crops. These are already cultivated by a number of farmers in the project area and their marketing prospects are good. It is envisaged that only very small areas will be planted with vegetables in both seasons. The six year build up to full project development will allow for the gradual change in cropping patterns and improvement in farming practices.

There are 499 households (HHs) in the Lam Chamuak project area with a total population of 3,892

RESULTS OF ANALYSIS

To take into account the risks of underestimating both the investment and operating and maintenance costs, a 15% contingency was also included in the analysis for both the financial and economic analyses. These results are denoted by 'BASE' in the respective Tables. Further, due to uncertainty, the results obtained for both the financial and economic analyses need to be qualified by performing sensitivity analyses. Six scenarios were included in the sensitivity tests. They are:

1. Incremental yield down by 20%.
2. Incremental production cost up by 20%.
3. Project investment cost up by 20%.
4. Use of tank only during wet season.
5. Operating cost up by 20% and incremental yields down by 10% once every 3 years.
6. Operating cost up by 20% and incremental yields down by 20% with no dry season cropping once every 3 years.

Some of these scenarios need further elaboration. Number 4 assumes that, even after the rehabilitation of the tank, farmers still plant only during the wet season as they have done thus far. Numbers 5 and 6 were included because the pattern of rainfall shortage in the tank area seems to follow a three year cycle. When this happened, additional pumping would then be required resulting in higher operating and maintenance costs, while crop yields would be adversely affected.

Results of the analysis are presented in Tables 1 and 2.

Table 1 Results of FINANCIAL ANALYSIS (including 15% contingency on investment and operating & maintenance costs).

	Case	NPW'000 (Baht) at 12%	IRR (%)	B/C Ratio
	BASE	19,179	20.08%	1.420
Sensitivity Analysis	1. Yield down 20%	6,218	18.24%	1.136
	2. Prod. cost up 20%	14,952	25.72%	1.300
	3. Invest. cost up 20%	16,413	24.55%	1.339
	4. Use tank in w/s only	5,629	18.15%	1.161
	5. Oper. cost uo 20% & yield down 10% every 3 yrs.cycle	16,854	27.21%	1.368
	6. Oper. cost up 20% & yield down 20% & no d/s crop every 3 yrs. cycle	11,789	23.29%	1.278

Table 2 Results of ECONOMIC ANALYSIS (including 15% contingency on investment and operating & maintenance costs).

	Case	NPW'000 (Baht) at 12%	IRR (%)	B/C Ratio
	BASE	19,179	20.08%	1.420
Sensitivity Analysis	1. Yield down 20%	6,218	18.24%	1.136
	2. Prod. cost up 20%	14,952	25.72%	1.300
	3. Invest. cost up 20%	16,413	24.55%	1.339
	4. Use tank in w/s only	5,629	18.15%	1.161
	5. Oper. cost up 20% & yield down 10% every 3 yrs.cycle	16,854	27.21%	1.368
	6. Oper. cost up 20% & yield down 20% & no d/s crop every 3 yrs. cycle	11,789	23.29%	1.278

CONCLUSIONS

Results of the analysis indicate that the project of rehabilitating the irrigation tank is feasible from both the financial and economic points of view. The project also remains acceptable on the basis of the assumptions used in sensitivity analyses. The results of the economic appraisal are found to be more favourable compared to those from the financial analysis. This is to be expected because the shadow wage rate of agricultural and unskilled labour for the Northeast is very low and when incorporated into the economic analysis, reduced significantly the cost stream during the life of the project. At the same time, since the domestic price of rice and paddy is kept artificially low by the operation of the Thai Government's rice export tax and premium, the shadow price of paddy is higher than its market value which in turn increased significantly the benefit stream. Both effects combine to explain why the results from economic analysis is better.

In all cases, the project is found to be most sensitive to changes in yield (case number 1), particularly of paddy, and to whether or not there are any dry season crops (case number 4). These two factors seem to have a very strong influence on the viability of similar (agricultural/irrigation) projects introduced to the Northeast of Thailand, and indicate the importance of ensuring that government extension programmes to support the improvement in farming techniques in the Northeast are effective.

REFERENCES

1. ASIAN INSTITUTE OF TECHNOLOGY, "A Feasibility Study of the Rehabilitation of Tank Irrigation Systems in Northeast Thailand", The United States Agency for International Development, Volume I - Main Report, August 1980.

2. ASIAN INSTITUTE OF TECHNOLOGY, "A Feasibility Study of the Rehabilitation of Tank Irrigation Systems in Northeast Thailand", The United States Agency for International Development, Volume X - Appendix IX, Lam Chamuak, August 1980.

3. GITTINGER, J.P., "Economic Analysis of Agricultural Projects", The John Hopkins University Press, Baltimore, 1972.

4. LITTLE, I.M.D.; MIRRLEES, J.A., "Project Appraisal and Planning for Developing Countries", Heinemann Educational Books, London, 1974.

5. KUNAPINUN, M., "Review of the Techniques of Project Appraisal and Their Application to the Irrigation Project in the Northeast of Thailand", AIT Thesis, Bangkok, December, 1982.