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Full Length Research Paper

Performance evaluation of an irrigation project with reference to its irrigation objectives

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During the late 1950s in India several river valley projects were started for irrigation and power generation. One such project is the Malampuzha project, the largest irrigation project in Kerala state. The project started functioning in 1956. It was expected to cater the irrigation need of 22554 Ha of rice paddy in Palakkad district. The present study is an attempt to evaluate the project by focussing on its original irrigation objectives. Data from the detailed project report (DPR) and those generated from field surveys using a custom made questionnaire was used for the study. The cost – benefit analysis conducted on Malampuzha irrigation project, with reference to its declared irrigation objectives, shows that the performance of the project is not satisfactory.

Key words: Cost benefit analysis, Malampuzha irrigation project, Kerala, detailed project report, performance evaluation.

INTRODUCTION

Cost benefit analysis (CBA) is one of the tools to explore performance of development works such as hydro/river valley projects. Generally, CBA includes calculating the rate of return of a project, its social profitability and its side effects (Mishan, 1982). Calculating the ratio between the benefits from an activity and the cost incurred towards undertaking the activity is the keynote of CBA. If the ratio exceeds one, it is held that the project offers a positive return on the costs (Dixon and Hufschmidt, 1986). Several studies computing the benefit cost ratio of different types of developmental projects have been conducted to assess their feasibility or success in fulfilling their objectives. Environmental costs and their impact in terms of the net present value of a hydroelectric project in Kerala were done by Chakraborty and Santhakumar (2003), showing that with declining rate of discount the benefit of the project increases. However reducing the discount rate would not be an apt method for evaluating the environmental cost of a project. An economic evaluation of Bhoj wetlands by Verma et al. (2003) pointing out causative factors for wetland degradation. Devi (2003), while evaluating the performance of Peechi irrigation project in Kerala, listed out the externalities influencing the performance of the project and suggested management plans.

Amoah and Gowing (2001) studied Dawhenya irrigation scheme in Ghana and reported doubling of the net income with irrigation. While analyzing the relationship of irrigation, productivity and poverty in Java, Hussain et al. (2006) highlighted the link between lack of irrigation facilities and poverty. The cost benefit analysis of Kanjirappuzha irrigation project in Kerala by Vasudevan et al. (1989) brought out differential performance of the left and the right bank canals. Dharmadhikary et al. (2005) documented how the benefits of the Bhakra project in fulfilling its objectives were incorrectly projected. Immediately after independence, in India a large numbers of dams, reservoirs and canals were conceived and built. In Kerala, currently fifteen irrigation projects are in operation benefiting more than 0.3 million Ha of paddy fields (Devi, 2003). The Malampuzha irrigation project (MIP) is one such early project in the state conceived with the main aim of irrigating a part of the Bharathapuzha basin. The study conducted by Rajasekharan et al. (1976) reported high sedimentation rate in Malampuzha reservoir, while Sudha et al. (2007) highlighted the need for optimizing the operation of the reservoir. Six branch canals of the Malampuzha Irrigation project (MIP) was investigated by Centre for Water Resources Development

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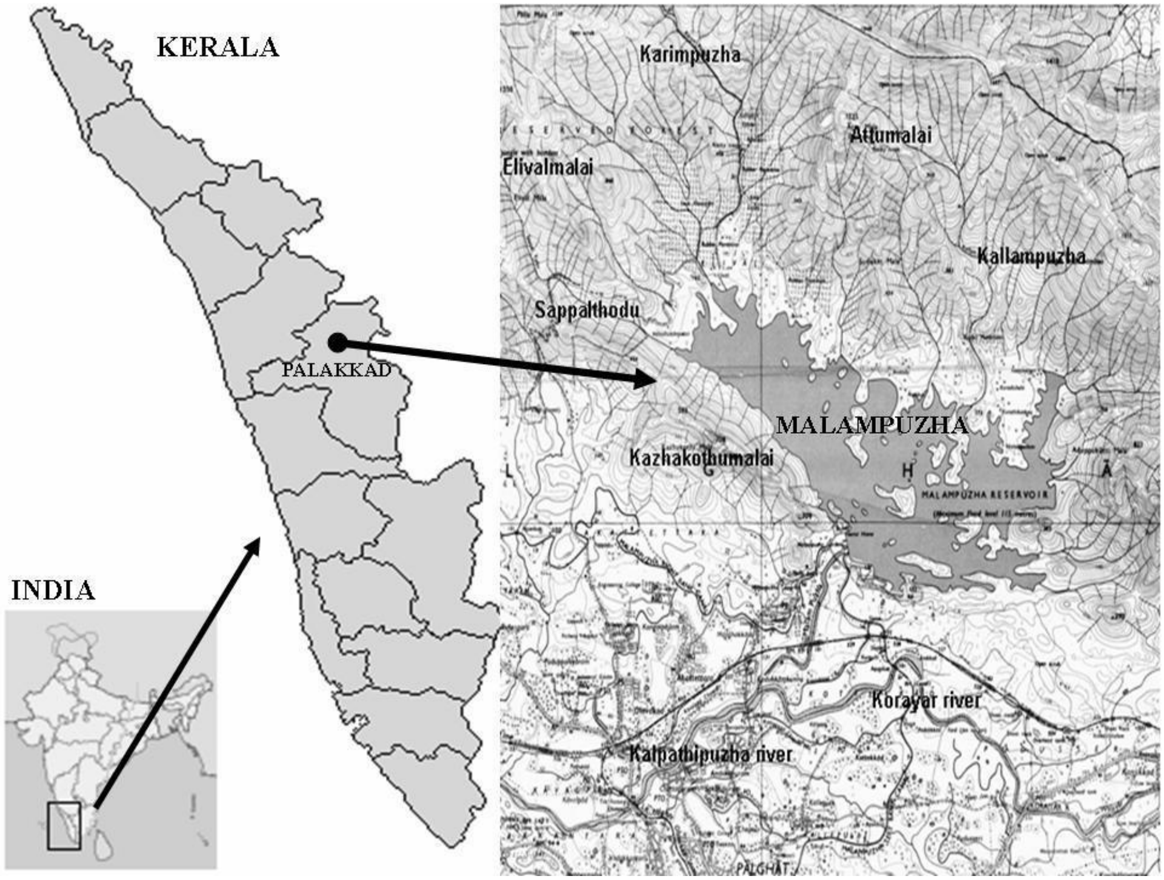

Figure 1. Location of the Malampuzha dam.

and Management (CWRDM, 2004) focussing on water distribution.

The present study explores how the project has been successful in meeting its irrigation objectives.

Study area

The river Malampuzha originates from the hills of north Palakkad bordering the Coimbatore district of the state of Tamil Nadu. The river is one of the tributaries of the river Kalpathipuzha that joins the river Bharathapuzha, the second longest river in the state of Kerala. The major tributaries of the Malampuzha River are: i) Karimpuzha, originating from Karimalai, ii) Kallampuzha, originating from Attumalai and iii) Sappal thodu originating from Elivalmalai. Several other smaller streams such as Vachapurampuzha and Kattupuzha also join directly the Malampuzha River. At Kadukkamkunnu the Malampuzha River merges with the Korayar River. The Korayar River below the falls at Malampuzha is known as Kalpathipuzha (Figure 1). The Malampuzha dam is constructed at about 4.5 km upstream of the falls. An average rainfall of 1800 mm is recorded from the command area of the MIP. About 75% of the annual rainfall is received during south west monsoon that sets in the last week of May and continue up to September. The MIP completed in 1956, is the largest irrigation project in Kerala state. The reservoir covering 2200 Ha is located between 76° 29' and 76° 42' E and 10° 48' and 10° 55' N.

The masonry dam harnessing the Malampuzha River forms a reservoir with a full storage capacity of 236.69 Mm^3. The MIP is designed with 367.54 Cumecs flood discharge capacity, 147 Ha drainage area, and 20553 Ha irrigable command area catered by the left and the right bank canals. The right bank canal (RBC) is 32 km long with a capacity of 4.25 Cumecs, while the left bank canal (LBC) is 27 km long with 21.23 Cumecs capacity (Sudha et al., 2007). The RBC traverses an area of rough undulating terrain and therefore the irrigable land served by it is relatively less (Figures 1 and 2). As per the detailed project report (DPR) of the project, the dam was initially designed for 127.43 Mm^3 capacity with an ayacut area of about 16187 Ha (PWD, 1950). In the study area, traditionally two crops were raised. The first crop, known locally as Kanni crop, is reliant on the south west monsoon. Kanni is the Malayalam month, falling almost in September. Seeds are broadcast in May after two or three showers and the crop harvested in September.

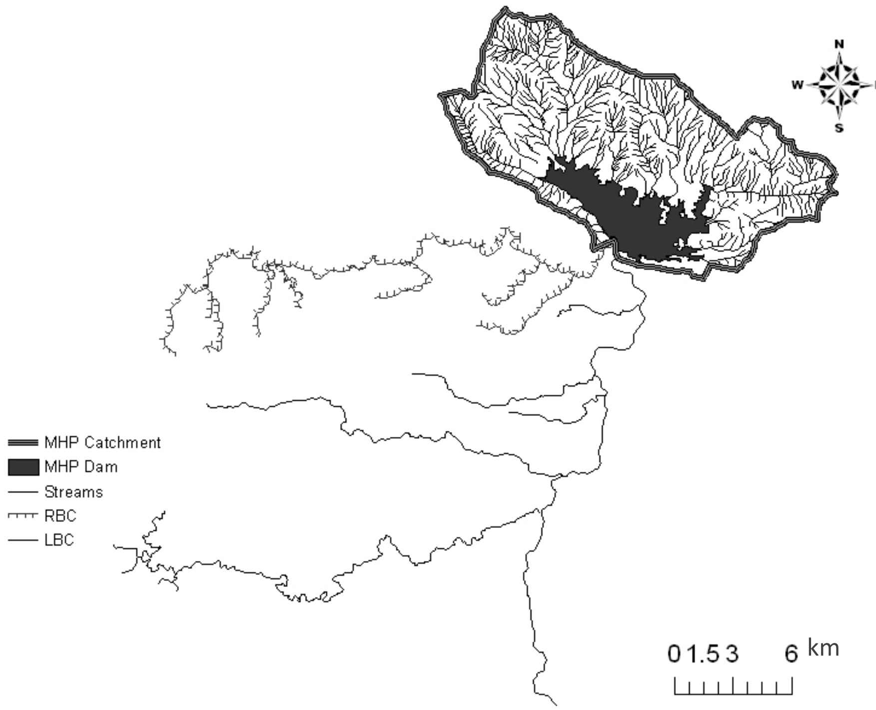

Figure 2. Irrigation canals of the project.

The second crop, locally known as Makaram crop, which depends on the north east monsoon, will be planted immediately after the land is cleared of the first crop. Makaram is the Malayalam month, falling almost in January to February. The second crop is harvested during January to February. Although the area receives rainfall from both south west and north east monsoon, the latter is greatly fluctuating and is scarcer. In fact, the project was intended to free the farmers from vagaries of rains, to support them during the second crop as well as during the dry period between south west monsoon and north east monsoon rains.

According to the DPR, the reservoir can support the traditional two crops and help raise 2023 to 12141 Ha of a third crop. The third crop raised during January to April is locally known as Puncha. The irrigation project is also expected to support a sizable spread of other perennial crops by holding certain amount of surplus water (PWD, 1950). Originally a provision for hydroelectric power generation was made in the scheme as a second objective. However, in later years this was stopped. In due course of time the Palakkad municipality started drawing drinking water from the project; an incidental benefit of the project. The estimated cost for the construction of MIP (PWD, 1974) was equivalent, as per the present day conversion rate, to € 569,000/-, which after the completion of the work reached about € 868,000/-. Estimates of the cost of construction of an irrigation project include expenditures such as that towards land acquisition, buildings, construction of the major structures and other infrastructure, rehabilitation of project effected people, plantations and miscellaneous spending.

MATERIALS AND METHODS

Secondary data including those from grey literature were collected from the District information centre at Palakkad, Divisional and sub divisional offices of the Malampuzha irrigation Project, Information centre at Malampuzha Dam, Kerala Engineering Research Institute (KERI) Peechi, and the centre for water resources development and management (CWRDM), Calicut. The detailed project report (DPR) of the project was consulted to find the major objectives of the project, for details on dam construction, and the project's objectives regarding irrigation. However details such as cropping intensity in percentage, expected farm income per Ha and yield in tons/Ha for major crops of the command area agriculture is not provided in the DPR. A field survey in the project area and its environs using a customized questionnaire was also conducted. The Left Bank Canal (LBC) and Right Bank Canal (RBC) were divided into almost equal stretches in to head, middle and tail ends and field surveys were conducted in the areas falling under each stretch. To collect agricultural and personal details, 107 farmer-households were randomly selected following the method of Suresh and Reddy (2006). Of these farmer-households 54 were from the LBC side and the rest from RBC side.

The data collected for understanding the socio-economic background of each households included family size, annual income, education and profession, area under cultivation, cropping pattern, water requirement, water availability, yield in terms of income and total annual expenditure on agriculture. The questions during the survey were designed to elicit the pre and post dam situations and changes in agriculture that has happened in the

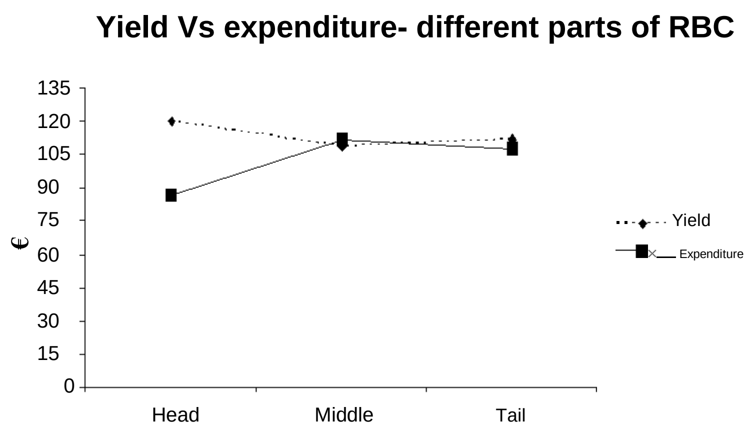

Figure 3. Per hectare annual income and expenditure at different sections (head, middle and tail) of the LBC and RBC.

area. The data on agriculture in the Malampuzha irrigation project's command area obtained from field surveys were compared with the information available with the District Economics and Statistics Department, Palakkad, and the command area development authority (CADA), Thrissur. As noted earlier, the data were examined in view of the DPR to find whether the MIP has fulfilled its avowed irrigation objectives. From the current market value of an agricultural produce, and the yield in terms of product, average annual income per Ha was estimated. Similarly, the total cost and benefit for the whole period of the project since its commissioning was also calculated.

The present value (PV) was calculated taking 7.5% as the discount rate (Agrawal, 2008; Hussen, 2000), the average inflation rate of India during the last few decades. The yield, in terms of income, during the early periods of the project execution was estimated from the present agriculture yield, taking 7.5% as the discount rate.

RESULTS AND DISCUSSION

The present analysis was done giving focussing on the DPR and its objectives relating to irrigation benefits, since covering a larger scope would have been difficult for logistic reasons. Originally, the project was to cater for a total cultivable area of 20553 Ha (PWD, 1950). Later the area was increased to 22554 Ha (CWRDM, 2004). The net productivity of the command area estimated during the present study was equivalent to € 170/- per Ha. Accordingly, the total productivity of the command area for the whole period of dam's existence was € 3,836,000/-. In the command area of the largest irrigation project, the MIP, in the state of Kerala the productivity per hectare is considerably lower than the state average (€ 252/- per Ha, http://kerala.gov.in/economy/agri.htm). Nevertheless, agriculture remains the main source of income for the inhabitants of the area; 80% of the people who responded to our queries have agriculture as their primary source of income. Majority of the public (83%), mostly farmers, have annual income less than € 150/-.

In spite of the apparent low returns from agriculture, most people depend on sustenance agriculture for a living, probably for having no other options. Regions served by the RBC and LBC showed wide difference in the total annual expenditure towards agriculture and the total yield (Figure 3). While the yields in the head region of both the canals were greater than expenditure, in the rest of the command area agriculture was not profitable. Variations in returns between the LBC and RBC supplied areas are likely due to the disparity in release of water in the canal systems. The head regions of the canals comparatively are better effective in terms of irrigation resulting in higher yield. According to the DPR, MIP was designed to irrigate at the rate of 25.4 cm per month for the third crop during February to April and 18.3 cm in May (PWD, 1974). However during the present study third crop cultivation in the project area was reportedly absent due to water scarcity during the period. It suggests that with reference to fulfilling the objective of facilitating the third crop, the project has failed, perhaps chiefly for the lack of realistically designed and executed water release strategy. It is possible that water is released more than required in other season or the storage of the reservoir is considerably lower than what was envisaged limiting the availability of water during the period of crucial requirement.

The calculated PV of the fixed cost of the project, at 7.5% annual rate, is € 24,444,000/- while the cumulative benefit is € 3,836,000/-. It is found that the cost of the project, as its PV and the benefit from the project follow an upward path as expected. However, the trajectory was divergent and the gap increased towards the later years. On the other hand if the original cost, PV at 0% discount rate, is considered the path of the benefit intersects that of the cost in the year 1985 (Figures 4 and 5). The inefficiency of irrigation system management of MIP may be a probable reason for the low output from agriculture

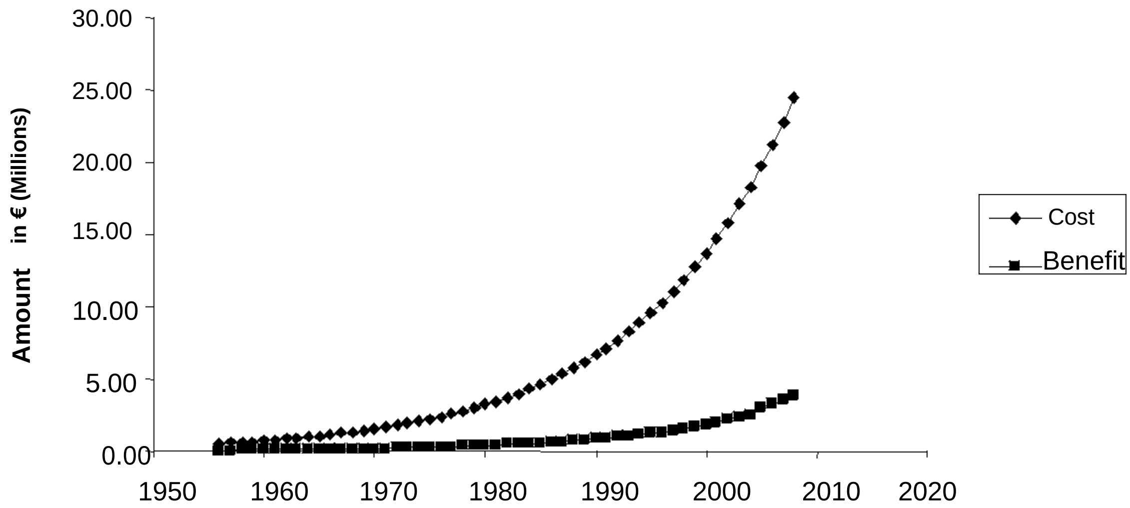

Figure 4. Comparison of the cost- benefit trend line (of cost at 7.5% discount rate) of the Malampuzha irrigation project.

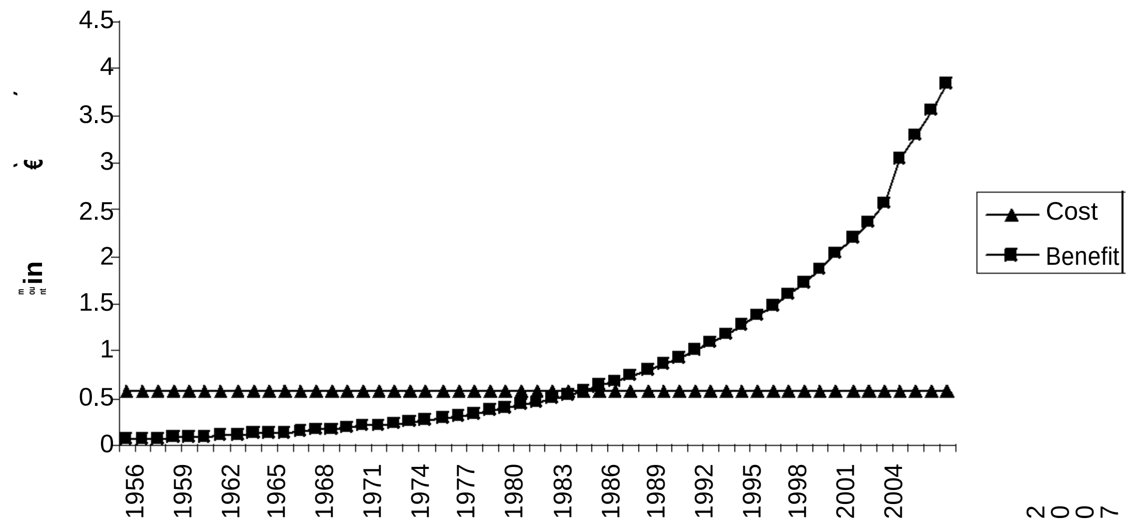

Figure 5. Cost- benefit trend line keeping the cost as the initial cost.

in the area. The total water demand for the second crop in the Malampuzha command area has been estimated as 0.7 mm3/ km^2. However, according to Sudha et al. (2007) MIP could meet only 25% of the total demand during the second crop season. Spillage (Sudha et al., 2007) and lack of proper maintenance of the channels are notable factors reducing the efficiency of the irrigation system. The water released from the reservoir largely gets lost on its way through the channels, perhaps due to percolation and spillage for lack of maintenance, and fails to reach the target areas. The low return from agriculture, high cost of labour and inordinate politicisation of the labour, lack of any incentive from government to cultivate paddy and such food crops, low minimum support price fixed by the government from year to year, seems to add to the low monetary output from agriculture in the area.

The disparity found during the cost-benefit evaluation of MIP may be possibly due to several other reasons. The ongoing changes in land use pattern in the catchment area as well as command area has significant impact on the performance of the irrigation project. The land use changes in the dam catchment are extensive; large stretches of natural forest / vegetation in the catchment have been converted to plantations. Prior to building the dam and formation of the reservoir the catchment area was devoid of any plantations. Twenty years after the construction of MIP the total plantation has spread to 1000 Ha. In the command area also notable changes have happened since the execution of the project. As the years pass the cropped area under rice cultivation is reducing and area under other crops are somewhat increasing (CADA, 2003). Changes in the land use, especially those associated with higher human interference and activity, in the catchment will speed up sedimentation in the reservoir. Studies conducted by Rajasekharan et al. (1976) have concluded that within 24 years the reservoir has lost 11% of its storage capacity. This reduction in storage capacity has significant implication on the area under effective and adequate irrigation. People losing interest in agriculture is a general feature in the state of Kerala, where the land holdings are comparatively of small sizes. The land reforms effected in the state during the sixties and seventies have redistributed land ownership among a large section of the population, the erstwhile tenant farmers. While the land reforms were a significant step towards socio-economic emancipation of a large segment of people in the state it had serious implications on the land use. Although agriculture remained as the major source of income it gradually started losing hold; probably small land holdings offered lesser return on investment (Raj and Azeez, 2009a).

The study by Chandran et al. (2001) observed lacking people's participation in the water users' associations (WUA) as well as the Command Area Development Programmes. On the other hand the command area development agency (CADA), the government agency in charge of promoting agriculture and efficient use of water in the command area also was apathetic in its activities.

The pressure from urbanisation in the command area of MIP also has a commendable influence on the agricultural productivity. Agriculture wetlands in the command area are being converted to built-up areas at a faster pace, particularly those cultivable lands situated on the track of urban sprawl and in the vicinity of roads and highways. The traditional narrow foot paths in Kerala connecting independent households amidst a stretch of cultivated areas, are giving way to black topped roads and this is an important catalyst for conversion of lands especially the inexpensive low lying ones such as paddy fields and wetlands. Although the roads per se have limited direct influence on agriculture, the roads by interfering with the natural hydrologic regime of the area have serious collateral impacts on agriculture. They lead to drastic land-use changes including construction of buildings, fragmentation of cultivable lands and higher demand and market value of the parcel of land that have direct motorable access. The state of Kerala traditionally has distinct pattern of housing; each household occupied by a family is placed distinctly in a parcel of cultivable land.

The village do not have distinct residential areas and agricultural areas as seen in other rural parts of India. This leads to requirement of distinct pathways, in recent years black-top roads, to each of the households. The road density of the state (374.9 km/100 km^2) is far ahead of the National average (74.9 km/100 Km^2). Motorable road opens up a low lying land for filling up and for other construction activities (Raj and Azeez, 2009b), sacrificing the original setup/use of the land.

Conclusion

In this study, as a part of the performance analysis of Malampuzha irrigation project commissioned in mid nineteen fifties, a cost benefit analysis was carried out to see weather the project is fulfilling its proposed objectives in terms of irrigation, primarily promoting agriculture in the command area. The present study, taking 7.5 and 0% as the discount rates, analyzed the cost and benefits. It was found that taking a reasonable discount rate of 7.5%, the cost and benefit never intercept each other. Hence the declared irrigation objectives of the project are not fulfilled and the performance of the project is not satisfactory. Various factors are responsible for this under-performance of the project in terms of the resultant agricultural output. Proper scheduling of the water release, regular maintenance of the channels, and appropriate incentive for paddy and such crops may set the condition for better and effective use of the valuable water resource that would be reflected as improved performance of the MIP.

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