

# Economic Evaluation of Mudimadagu Sub- Watershed project in Kolar District of Karnataka, India

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## ABSTRACTS

The study was undertaken in Srinivaspura taluk, Kolar district of Karnataka to analyse the economic benefits derived by watershed beneficiaries of Mudimadagu sub-watershed project implemented under Credit Institute for Reconstruction-watershed area project (KfW). Primary data of the study was collected from randomly selected 60 farmers from the project area which includes 30 watershed beneficiaries and 30 non-beneficiaries. Data Collected were examined using Simpson's index, cost and returns analysis and Garrett's ranking. Higher crop diversity was found among watershed beneficiaries than the non-beneficiaries with Simpson's index values of 0.84 and 0.79 respectively. Production, productivity and net returns of the major crops cultivated was found higher in watershed area compared to Non-watershed area. Average Annual income for unit farm was found higher in watershed area with Rs. 2,98,855 compared to Non-watershed area with Rs1,73,189. Lack of awareness about benefits of watershed technology among the beneficiary farmers and poor participation by the farmers during training programmes conducted by the implementing agencies were the major constraints faced during the watershed project implementation. From the results it was clear that the watershed activities benefited farmers by enhancing their yield, net returns and overall income. It was also found that formation of watershed area farmers' associations is necessary for the maintenance of soil and water conservation structures by watershed area development department.

**Key words:** Watershed, Farm pond, Field bund, Cattle pond

## Introduction

Agriculture is backbone of Indian economy and is highly dependent on natural resources like soil, watershed and vegetation. Nearly three fourths of the cultivated land in India is depending on monsoon, which is contributing nearly 42 per cent to the agriculture production in India (Anonymous, 2012). India receives annual precipitation of an average of 4,000 billion cubic meters (approximately 1183 mm rainfall) of which, only 48 per cent is available in surface and ground water entities of India (Anonymous, 2017). The scarcity and volatility of water

availability has created pre and post production risk in Indian agriculture. The conservation, up gradation and utilization of these two natural resources on scientific principles is essential for the sustainability of rainfed agriculture. This can be achieved by two alternative solutions, one is to bring all the rainfed areas under irrigation, which could not cover even 50 per cent of cultivated area. Second is improving crop production in rainfed area by promoting improved watershed technology.

A watershed is a hydrologically referred as any area from where runoff resulting from rainfall is gathered and drained through a common point. In

India the Watershed Development Programmes (WDPs) concept was evolved in early 1980's with the aim of improving and sustaining productivity and the production potential of the dry and semiarid regions of the country through the adoption of appropriate production and conservation techniques.

Karnataka State has the higher proportion (79 per cent) of drought affected area among all states in the country and is the second state with largest dry land area in the country after Rajasthan in absolute terms. State also has the second lowest replenishable ground water (154 M ha/yr) after Rajasthan among the states in India (Anonymous, 2016). Out of 19-million-hectares cultivable land of Karnataka 15 million hectares is dependent on rainfall. Hence, strategy to improve the rainfed agriculture is necessary for agriculture development in the state. Kolar district is under rainfed zone with erratic and uneven rainfall, stands fourth in Rainfed Area Prioritization Index (RAPI index). Of the total cultivated area 74 to 85 per cent of the cultivated area was under rainfed farming. The average annual rainfall was around 776 mm (Anonymous, 2018). With this background, many watershed projects were implemented in the district. Among them Mudimadagu watershed project implemented by NABARD under KfW watershed project in the Srinivasapur taluk of Kolar district was considered for the study.

The Indo-German Watershed a Development Programme (IGWDP) is an integrated programme for rehabilitation of watershed areas for the regeneration of natural resources. The IGWDP implemented under the National Bank for Agriculture and Rural Development (NABARD) and leading Indian NGOs supported by the German Government from KfW ((The KfW, formerly KfW Bankengruppe (banking group)), is a German state-owned development bank, located in Frankfurt. This name originally comes from Kreditanstalt für Wiederaufbau ("Credit Institute for Reconstruction) which was initiated on a small scale in 1992 and works among sectors like health, education, agriculture, forestry, and solid waste management. Some of the objectives of the project was to create adequate and sustainable livelihood opportunities and sustainable economic development of farmers through watershed activities.

This study would give us some idea on, how the selected watershed project is designed to develop and harmonize the use of water, soil, forest and pas-

ture resources in a participative manner by involving the local communication that help in conserving these resources. How these projects help in situ soil and water conservation and rain watershed area harvesting to augment ground water resources, forest cover, livestock, fodder management and income-generation activities. What are steps that can be taken to reduce the poverty level and improve the rainfed agriculture?

With this background, the present study "Economic Evaluation of Mudimadagu sub - Watershed project in Kolar District of Karnataka" undertook with the following specific objectives:

1. To document the activities taken up under Mudimadagu sub - Watershed project in the study area.
2. To analyse the economic benefits derived from Mudimadagu sub - Watershed project in the study area.
3. To identify the major constraints faced by the implementing agency and beneficiaries during implementation of the watershed project in the study area.

## Methodology

### The study area

The present research was conducted in Srinivasapur taluk of Kolar district of Karnataka state. The district comes under 'eastern dry zone (zone 5)' of the agro-climatic zones. Srinivaspura taluk is one among the five taluks of Kolar district which is 24 km away from the district and was reported in having a wide variation in distribution and pattern of rainfall over the years.

### The study method

A purposive sampling method was employed for choosing the study area. At the first level Kolar district was selected based on Rainfed Area Prioritization Index (RAPI). In consonance with the objectives of the study and consultation with NABARD (National Bank for Agriculture and Rural Development) watershed officials from regional office, Bangalore, the Mudimadagu sub - Watershed project under KfW watershed project in Srinivaspura taluk of Kolar district was purposively selected for this study, as most of the watershed activities were completed in that area. A total of 60 respondent farmers were selected for the study. Of

which 30 beneficiaries of Mudimadagu sub-Watershed project and 30 non-beneficiaries were randomly selected from Paturagudda, Yarlampalli, Bhonapalli, Anepalli, and M thumanapalli villages in the study area. Primary data on socio-economic features, cropping pattern, allied activities, economic impact of the major interventions undertaken through Mudimadagu sub-watershed project was collected from the sample farmers through pre-tested schedule.

### Statistical tools

Tabular analysis was adopted to analyze the cost and returns of major cultivated crops by using standard cost concepts- Cost A, Cost B and Cost C. Crop diversification Index was used to find out the cropping intensity and Garrett's ranking method was used to rank the constraints faced by beneficiaries and implementers in implementing watershed project in study area.

### Results

Watershed activities extended to sample farmers under Mudimadagu sub - watershed project in the study area.

To conserve the soil and water in the field, some of the structures were constructed in sample

farmer's field, of the total sample farmers ten farmers were benefited by farm pond whereas field bund and boulder bund each were constructed in two sample farmers land and trench cum bund was observed in seven farmers field out of which only four farmers maintained the trench cum bund.

Farm ponds constructed under watershed projects were efficiently maintained by farmers compared to other watershed harvesting structures, as the farm pond holds more rain water and benefits farmers more compared to trench cum bund and field bund, farmers also reported about difficulty in managing trench cum bund and field bund as weed growth on these bunds was a major problem (Table 1).

Some allied activities were also taken under project like mango seedlings provided to farmers (33.33 per cent of sample farmers) under dry land horticulture watershed activity, fodder production programme covered 96.67 per cent of sample farmers, 36.67 per cent farmers were benefitted from tank silt application in their field, 66.67 per cent of farmers were provided with Backyard poultry activity and 26.67 per cent of sample farmers were benefited by sheep distribution. Improved high yielding drought tolerant seeds of ragi were also provided to 93.33 per cent of samples farmers (Table 2).

**Table 1.** Soil and water conservation activities undertaken in the sample farmer's fields (number)

Sl. No.	Structures	Mudimadagu sub- Watershed project		
		Beneficiaries	Managed asset	Not managed asset
1	Farm ponds	10	9	1
2	Field bunds	2	0	2
3	Trench cum bund	7	4	3
4	Boulder bund	2	1	1

**Table 2.** Watershed intervention activities extended to sample farmers in the study area (number)

Sl.No.	Activities	Number of beneficiaries
1	Dry land horticulture (Mango seedling)	10 (33.33)
2	Fodder production promotion	29 (96.67)
3	Tank slit application	11 (36.67)
4	Vermi compost pits	2 (6.67)
5	Compost pit	3 (10.00)
6	Jeevamrutha and Panchagavya	6 (20.00)
7	Sheep rearing	8 (26.67)
8	Backyard poultry	20 (66.67)
9	Backyard poultry shed	10 (33.33)
10	Ragi seeds distribution	28 (93.33)

Note: Figures in the parenthesis indicates per cent to total sample

### Cropping pattern of sample farmers

Ragi, tomato and groundnut were the major sole crops taken with 14, 11 and 14 per cent of Gross Cropped Area (GCA) respectively and mango cultivated as perennial crop with 15 per cent of GCA. Pigeon pea and field bean intercropped with ragi covers 25 per cent of GCA. In non-watershed area ragi was the main field crop with 12 per cent of GCA and ragi intercropped with field bean and pigeon pea covered 40 per cent of GCA. Mango cultivated as perennial crop with 5 per cent of GCA. Cropping Intensity was observed higher in watershed area with 171 per cent compared to non-watershed area with 134 per cent, indicating more crop cultivation in watershed area (Table 3). Simpson's index was also observed higher in watershed area (0.84) than Non - watershed area (0.79), which shows more crop diversification in watershed area compared to Non - watershed area Table 3.

### Production and productivity of crops cultivated under Mudimadagu sub-watershed area project

Production and productivity of major crops cultivated

was found higher in the watershed area than Non - Watershed area. Difference in productivity between watershed and non watershed area was higher in Mango with 16.38 quintals/ac followed by tomato (11.27 quintals/ac). The percentage difference in productivity of major crops was seen in mango and ragi with 34 and 32 per cent respectively, clearly indicating higher production and productivity in watershed area (Table 4).

### Cost and returns of major crops per acre under Mudimadagu sub-watershed project

Table 5 depicts the total cost of cultivation per acre in watershed and non-watershed area, where it was found that cost of cultivation was higher in tomato crop with ₹78341 and ₹70612 respectively under watershed and non-watershed area, followed by groundnut (₹35607 and ₹30778 respectively) and lower cost of cultivation was seen in ragi with ₹28214 and ₹26488 respectively. The net returns of major crops cultivated in study area was reported higher in watershed area compared to non - Watershed area and it was observed higher in tomato with ₹113123 and ₹71011 respectively under watershed

**Table 3.** Cropping pattern of sample farmers under Mudimadagu sub-watershed project. (2018-19)

Sl. No.	Crops	Beneficiaries		Non-Beneficiaries	
		Area (acre)	Percentage to GCA (%)	Area (acre)	Percentage to GCA (%)
I	<b>SOLE CROP</b>				
1	Ragi	14.50	14.22	4.75	12.67
2	Pigeon pea	1.51	1.40	0.00	0.00
3	Horse gram	2.00	1.96	1.00	2.67
4	Paddy	2.00	1.96	1.50	4.00
5	Ground nut	12.25	14.01	2.00	5.33
6	Tomato	11.50	11.27	7.50	20.00
7	Capsicum	1.25	1.20	0.00	0.00
8	Onion	1.25	1.23	0.00	0.00
9	Mulberry	0.00	0.00	0.00	0.00
10	Chilli	0.00	0.00	0.00	0.00
11	Knol-khol	1.50	1.47	0.00	0.00
II	<b>INTERCROP</b>				
1	Ragi + field bean	8.50	9.33	3.50	9.33
2	Ragi + pigeon pea + Field bean	25.75	25.25	15.25	40.67
III	<b>PERENNIALS</b>				
1	Mango	16.25	15.93	2.00	5.33
2	Silver oak	0.00	0.00	0.00	0.00
IV	GCA (acres)	102.00	100.00	37.50	100.00
V	NCA (acres)	60.00		28.00	
VI	CI (%)	171.03		133.92	
VI	Simpson's Index	0.84		0.79	

**Note:** GCA- Gross Cropped Area, NCA-Net Cropped Area, CI- Cropping Intensity.

and non-watershed area and similarly net returns per rupee of expenditure was also found higher in tomato with ₹ 2.44 for watershed beneficiaries and ₹ 2.01 for non watershed beneficiary (Table 5). The results clearly shows that farmers under watershed area benefited with more returns compared to non watershed area Table 5.

#### Annual income of sample farmers of Mudimadagu sub-watershed area project

Annual income of sample farmers of was shown in Table 6 it was observed that net returns for all crops was higher in watershed area (₹266499) compared to non-watershed area (₹149204), the difference in income between both the areas was ₹117294 which is 44 per cent higher than non – watershed area. Annual income from Livestock per farm was 42.64 per cent higher in watershed area (₹28781.46) than the non-watershed area (₹16521.43). The off-farm and non-farm income of non-watershed area was higher with ₹7463.27 which was 52 per cent higher than watershed area this was because non-watershed beneficiaries' farm income was lower than watershed beneficiaries and people tending to do other work for their source of income. The total income of watershed area (₹298855) was 42 per cent higher than non-watershed area (₹173189), indicating more income earned by farmers covered by watershed project. Table 6

#### Constraints faced by beneficiaries in project implementation

From the responses reported by sample farmers in the study area, it was observed that, obstruction for cultural operation by watershed harvesting structure was the major constraint with garret score 73 followed by lack of awareness about benefits of watershed area technology with score 64. High Maintenance cost of struc-

**Table 4.** Production and productivity of major crops cultivated by beneficiary and non-beneficiary sample farmers under Mudimadagu sub-watershed project.

Sl. No.	Crops	Watershed area		Non-watershed area		Difference in productivity (quintals/ac)	Difference in productivity percentage (%)
		Total area (acre)	Production (quintals)	Productivity (quintals/acre)	Total area (acre)	Production (quintals)	
1	Ragi	14.50	149.93	10.34	4.75	33.25	32.33
2	Tomato	11.50	1383.75	120.32	7.50	817.87	9.36
3	Paddy	2.00	35.00	17.50	1.50	15.43	41.22
4	Ground nut	12.25	140.88	11.50	2.00	17.14	25.47
5	Horse gram	2.00	15.00	7.50	1.00	5.00	33.33
6	Mango	16.25	777.40	47.84	2.00	62.92	34.24

**Table 5.** Cost and returns of major crops cultivated by beneficiary and non-beneficiary sample farmers in KfW-WP

Sl. No.	Crop	Ragi+ Field bean		Ragi+ Field pigeon pea		Ragi		Tomato		Ground nut		Paddy	
		B	N-B	B	N-B	B	N-B	B	N-B	B	N-B	B	N-B
1	TVC	20722	18487	20227	19920	19665	18261	60449	54945	26247	22461	21913	19563
2	TFC	7310	6906	7310	6906	7310	6906	7310	6906	7310	6906	7310	6906
3	marketing cost	1415	1329	1422	1388	1565	1320	10582	8760	2050	1411	1916	1109
4	TC	29448	26722	29959	28214	28551	26488	78341	70612	35607	30778	31140	27579
5	GR	45395	34805	46154	38726	42036	34125	191465	141622	51500	42444	45387	38013
6	NR	15947	8083	17195	10512	13485	7638	113123	71011	15892	11666	14247	10436
7	Returns per rupee of expenditure	1.54	1.30	1.59	1.37	1.37	1.29	2.44	2.01	1.45	1.38	1.46	1.38

**Note:** B- Beneficiary, N-B – Non-beneficiary, TVC –Total variable cost, TFC- Total fixed cost, TC- Total cost, GR- Gross returns, NR- Net returns.



tures and Uncertain rainfall were ranked third (60) and fourth (54) constraints by farmers respectively. Small and fragmented nature of holdings and Groupism and village politics ranked least constraints by the farmers with score 42 and 25 score respectively (Table 7).

### Constraints faced by implementing agency in project implementation

Project implementers were also faced some constraints of which Political interference by local leaders was the major constraint, followed by Poor participation by the farmers during training programmes. Failure to recognize advantages of watershed area activities by farmers and Small and fragmented nature of holdings were some more constraints reported and delay in releasing the sanctioned amount ranked least by implementing agencies (Table 8).

### Discussion

When we compare watershed and non-watershed area crop cultivation, cropping intensity was higher in watershed area compared to non-watershed area due to increased water availability by the watershed intervention favoured higher area under cultivation. The study conducted by Nirankusha (2015) and Palinisami *et al.* (2011) also revealed similar results where cropping pattern and cropping intensity were

influenced by watershed interventions which resulted in improved soil health and moisture holding capacity of soils. Similarly, considering Production and productivity of commonly cultivating major crops, it was observed that considerable percentage increase in productivity of crops like paddy, mango and horse gram observed in watershed area, due to watershed activities such as tank-silt, Vermi-compost, Compost, Jeevamrutha and Panchagavya application, which further improved soil fertility and contributed for higher crop yield (Table 5). The results were similar to study taken by Gaurav Chaudhary (2013) where the production and productivity of major crops was higher in beneficiaries compared to non-beneficiaries' farm because of various treatments taken under the watershed development programme enhance the soil moisture and fertility which ultimately increased productivity of major crops.

Total cost of all corresponding crops was low in watershed area compared to non watershed area because of watershed activities reduced the use of chemical fertilizer and plant protection chemicals. Annual income of watershed beneficiaries was higher compared to non-beneficiaries due to promotion of fodder production programme by supplying of fodder seeds, construction of cattle pond, promoting Sheep rearing, Backyard Poultry by supply of sheep's and poultry birds and distribution of Backyard Poultry sheds under watershed program. Simi-

**Table 6.** Average annual income of beneficiary and non-beneficiary under Mudimadagu sub-watershed project. (₹/farm)

Sl. No.	Income source	Mudimadagu sub-watershed project		Difference in income	Percentage change in income (%)
		Beneficiaries income	Non-beneficiaries income		
I	Income from crops	266499.46	149204.6	117294.86	44.01
II	Livestock income	28781.46	16521.43	12260.03	42.64
III	Off-farm and Non-farm income	3574.43	7463.27	-3888.84	52.11
IV	Total income	298855.35	173189.3	125666.05	42.05

**Table 7.** Constraints faced by beneficiaries during implementation of the Mudimadagu sub-watershed projects.

Sl. No.	Constraints faced by farmers	Score	Rank
1	Lack of awareness about benefits of watershed technology	63.93	II
2	Obstruction for cultural operation by water harvesting structure	73.37	I
3	High Maintenance cost of water harvesting structures	60.03	III
4	Uncertain rainfall	54.43	IV
5	Small and fragmented nature of holdings	42.07	V
6	Groupism and village politics	25.33	VI

**Table 8.** Constraints faced by implementing agencies in implementing watershed project

Sl. No.	Implementers	Rank
1	Poor participation by the farmers during training programmes	I
2	Political interference	II
3	Failure to recognize advantages of watershed activities by farmers	III
4	Small and fragmented nature of holdings	V
5	Limited availability of labour	IV
6	Delay in releasing the sanctioned amount	VI

lar findings were observed in the studies by Nirankush (2015) and Gourav (2013).

The main purpose of this study was to assess the farmer's economic benefits in the watershed and compare the same with non-watershed area. Based on the results and grass root reality, this study recommends formation of watershed farmer's association to help farmers in maintaining watershed structures and watershed development programs should include improved practices which should overcome obstruction to farming by watershed structures.

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