Original Research Article

BENEFITS AVAILED AND CONSTRAINTS FACED BY BENEFICIARIES OF JALASAMRUDHI, PROJECT, THIRUVANANTHAPURAM

Abstract

The study analysed the benefits availed and constraints faced by beneficiaries of Jalasamrudhi Project, Thiruvananthapuram. A systematic sampling technique was adopted for the data collection and information was collected from 80 beneficiaries of the project, thus making the total sample size 80. The farmers responded to the benefits availed and the constraints were ranked using Garrett ranking technique. The respondents benefitted from increase in ground water table level, market and non- market benefits. The major constraints faced by the beneficiaries were crop loss due to high speed wind, pests and climate change, followed by non-availability of inputs and non- availability of subsidy on time, lack of technical guidance. The primary suggestion from beneficiary farmers was to ensure continuity and follow-up, increase the project period from 5 to 10 years and ensure better infrastructure facilities to improve the effectiveness of the project.

Comment [M1]: Need explanation about this project more clearly

Keywords: Constraints, ground water table level, marketbenefits, non-market benefits, watershed development.

Introduction

A watershed refers to a territory drained by a stream or a network of interconnected streams. All surface runoff originating from precipitation converges within this area and is efficiently discharged through various stream outlet, underscoring its significance in water resource management. In the realm of watershed management, the significance of this hydrological unit extends beyond its basic function, evolving into a complex socio-political and ecological entity that profoundly shapes factors such as social dynamics and economic security (Tesfaye *et al*, 2018). The primary goal of watershed development is to optimize the utilization of available water resources while minimizing environmental degradation and maximizing ecological resilience. In 1991, the National Watershed Development Project for Rainfed Area (NWDPRA), which was centrally supported, was launched in the majority of the states and union territories. Through the

application of scientific approaches to land and water management, the initiative seeks to improve the overall production environment, restore ecological balance, and mitigate disparities between irrigated and rainfed areas, ultimately addressing the issue of widespread rural-to-urban migration. The project aims to augment income for rainfed farmers and landless agricultural labourers by diversifying agricultural activities, fostering a surplus for the market, and cultivating cash crops such as vegetables, coriander, cumin, and medicinal plants (Sharma 2001). Large development of the Watershed Development Programme has cost around Rs. 10,000 crores annually so far. The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), which was introduced in 2015 by the Cabinet Committee on Economic Affairs (CCEA) had a major role in improving water use efficiency in agriculture.The PMKSY's tagline is " More crop - Per drop". It is being used to increase the amount of land under cultivation with assured irrigation, decrease water waste, and enhance water-use efficiency (Rajaguru *et al.* 2023).

The Department of Rural Development in Kerala has been leading the state's implementation of the Integrated Watershed Management Programme (IWMP). The ultimate goal of IWMP is enhancing rural livelihoods. The primary objective of the programme is the supply of livestock units and agricultural inputs at a subsidized rate of 5–20 per cent of the total cost. The IWMP is currently being implemented as PMKSY's Watershed Development Component (WDC-PMKSY), under the operating requirements of PMKSY (Silpa and Mercykutty, 2023). The Project Jalasamrudhi was initiated in the Kattakada Legislative Assembly Constituency. The unpredictable climate change which leads to drought and dryness in the area was the main reason for the beginning of "*Vattatha Uravakkay Jalasamrudhi*" (Jalasamrudhi; A perennial ground water spring project). The project embraces innovative ideas such as drawing water from deserted rock quarries and steering the supply to a recharge pit that is situated near the designated wells in a way that works with the gravitational flow of water. Livelihood activities were provided for the residents through subsidies for cattle and cages for poultry. A 6 km stretch of Kollod thodu was restored under MGNREGS by cleaning the stream and building 53 transitory check dams in the stream (Nizamudeen, 2021).

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Material and methods

This studyextensively utilized primary data collection methods. The Jalasamrudhi Watershed Project in Kattakada was intentionally chosen due to its status as one of the two

successful watershed development initiatives implemented in the state of Kerala. The treated watershed selected for the study was Kulathummal thodu micro watershed composed of Kollod micro watershed (2K27b1) and Kuzhaykadu micro watershed (2K27b2). 80 beneficiaries from the treated watershed were selected. An untreated micro watershed (Manappuram micro watershed-2K27b3) under Jalasamrudhi project was selected to compare the ground water table level in treated watershed area. The participants in the fully implemented watershed (treated) were designated as beneficiaries whereas participants of the unimplemented watershed (untreated) as non-beneficiaries. The reference wells were selected from six localities in both treated and untreated watershed area.

Percentages and Averages

The market and non-market benefits within the treated watershed were analysed using percentages and averages.

Two-sample unpaired t-test

A two-sample unpaired t-test was performed to compare the groundwater level of beneficiaries and non-beneficiaries of the project using Grapes software**.**

Null hypothesis (H_o) = There is no significant difference in ground water table level of beneficiaries and non-beneficiaries.

Alternate hypothesis (H_1) = There is significant difference in ground water table level of beneficiaries and non- beneficiaries.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$\bar{x}_1$= mean value of the beneficiaries

$\bar{x}_2$= mean value of the non-beneficiaries

S_1 = standard deviation of the beneficiaries

S_2 = standard deviation of the non-beneficiaries

n_1= size of the beneficiaries

n_2 = size of the non-beneficiaries

If the p-value < 0.05, we reject the null hypothesis. *i.e.,* we accept that there is a significant difference in ground water table level of beneficiaries and non-beneficiaries.

If the p-value > 0.05, we accept the null hypothesis. *i.e.,* there is no significant difference in ground water table level of beneficiaries and non-beneficiaries.

Garrett ranking technique

Garrett ranking approach was used to rank the constraints that farmers faced in the watershed development programme. The respondents were asked to rate the various constraints, and their rankings were transformed into percentage positions using the formula:

Per cent Position = $100\ (R_{ij}-0.5)/N_j$

Where,

R_{ij} is the rank assigned to the i^{th} constraint by the j^{th} farmer is the subject of analysis. The number of constraints ranked by the j^{th} farmer is denoted by N_j. The conversion of the percentage position of each rank to the Garrett score is performed. The summation of the scores for each constraint by the individual respondent is computed. The total score value and the mean score values are evaluated. The constraints are then arranged in descending order according to the mean score value, and the constraint with the highest mean score value is considered to be the most significant constraint (Garett, 1969).

Results and discussion

To assess groundwater table levels between beneficiaries and non-beneficiaries, data regarding the ground water level was obtained from the Water Resource Information System (WRIS) website, managed by the Ministry of Jal Shakti. The selection of data points was based on achieving an even distribution, ensuring comprehensive coverage of all locations within the study area (Harinath, 2022). The study collected groundwater level data, measured in meters, for various locations within the study area that included both treated and untreated watersheds. This comprehensive dataset spans six years from 2017 to 2022, focusing on the post-initiation period of the Jalasamrudhi project. The data underwent analysis using the two-sample t-test with Grapes software.

Table 1. Ground water table level of reference wells during 2017-22

Sl. No	Particular	Minimum (m)	Maximum (m)	Mean (m)	Standard deviation
1.	Beneficiaries	8.970	6.720	7.773	0.786
2.	Non-beneficiaries	8.200	5.100	6.439	1.141
t value		2.357			
p value		0.040*			

*Significant at 5 per cent level

Source: Water Resource Information System, 2023

The mean ground water level in the reference wells of beneficiaries (7.773 m) was more than that in the reference wells of non-beneficiaries (6.439 m). As the p–value was less than 0.05, the null hypothesis was rejected and concluded that there was a significant difference in the ground water table level in the reference wells of beneficiaries and non-beneficiaries. The groundwater table level has shown a 17 per cent increase among beneficiaries when compared to non-beneficiaries. The water level in the wells where artificial recharging was done has increased and the wells have become perennial. The water level in the nearby wells had risen in areas where new farm ponds were dug. The water table can fluctuate over time due to seasonal changes, weather patterns and ground water pumping. The study conducted by Thomas *et al* (2009) found that the average height of the water column in the wells of recipient farmers increased by 21.78 per cent after the initiative was implemented in the Elanad watershed. They also observed that water harvesting techniques like rain pitting, digging, and well rehabilitation helped increase the depth of the water table in the watershed by roughly 20 per cent. They also found a considerable increase in the recipient's water levels, indicating a good influence on the moisture regime and groundwater recharge.

Market and non-market benefits in the treated watershed

Market benefits enjoyed by the beneficiaries in the watershed are tabulated in table 2. The beneficiaries in the treated watershed responded that due to watershed development programme, there was an improved availability of irrigation water (100 %). All the beneficiaries responded that due to the implementation of watershed development programme, they enjoyed improved crop sales (85 %) and improved livestock sales (33.75 %). The study conducted by Gray and Srinidhi (2013) in the Kumbharwadi watershed of Maharashtra tabulated that different watershed development activities had generated several

market benefits such as improvements in the depth of water table, area of different crops under irrigation, cropping pattern which resulted in improved crop sales, livestock sales, reduction in travelling cost for drinking water and irrigation water.

Market benefits received by the farmers due to watershed development programme

Table 2. Market benefits received by farmers due to watershed development programme

Sl. No	**Particular**	**Beneficiaries (No.)**
1	Improved crop sales	68 (85)
2	Improved livestock sales	27 (33.75)
3	Improved availability of irrigation water	80 (100)

Note: Figures in parentheses indicate percent to total

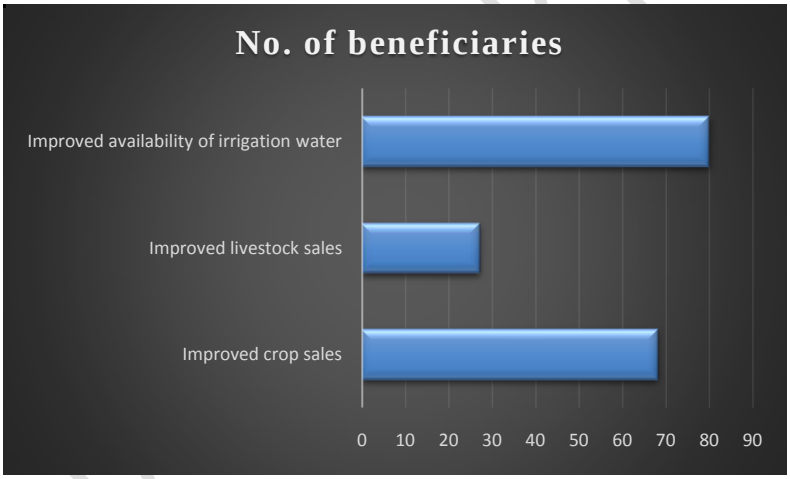

Figure 1. Market benefits received by beneficiaries due to watershed development programme

Non-market benefits of the watershed development programme

Non–market benefits enjoyed by the beneficiaries in the watershed are tabulated in table 3. All the respondents among beneficiaries reported that the watershed development programme has improved scenic beauty, pollination, water filtration, women empowerment, community development and biodiversity or habitat improvement. The study conducted by Grigalunas *et al* (2004) concluded that the non-market benefits derived from the watershed in New York were onsite recreational use for wildlife viewing, swimming benefits associated with protected water quality in Flanders Bay and open space provided to the adjacent property owners near the watershed area.

Table 3. Non-market benefits received by farmers due to watershed development programme

Sl. No.	**Non-market benefits**	**Beneficiaries (No.)**
1	Improved scenic beauty	80 (100)
2	Habitat improvement or biodiversity	80 (100)
3	Improved air quality	75 (93.75)
4	Improved nutrition	76 (95)
5	Improved diversity in diet	80 (100)
6	Increased female empowerment	80 (100)
7	Increased community development	80 (100)
8	Improved resilience to drought	75 (93.75)
9	Increased water filtration	75 (93.75)
10	Improved health	75

Comment [M4]: Its a percentage?

		(93.75)

Note: Figures in parentheses indicate percent to total

CONSTRAINTS FACED BY THE BENEFICIARIES AND SUGGESTIONS FOR IMPROVEMENT

The major constraints perceived by the beneficiaries are evaluated and given in table 4. The major problem faced by the beneficiaries is crop loss due to high speed wind, pests and climate change with a Garett score of 67.98, followed by non-availability of inputs and subsidy on time (61.01), lack of technical guidance (59.77), inappropriate construction works at inappropriate places (57.86), lack of supervision and follow-up of watershed development programme (57.37), lack of awareness about the beneficial programme (52.95), insufficient credit availability (43.06), political interference (34.83), lack of marketing facilities (32.81), non-availability of irrigation water (26.25).

Table 4. Constraints faced by the beneficiaries in the treated watershed

Sl. No	**Constraint**	**Garett's Score**	**Rank**
1	Crop loss due to high speed wind, pests and climate change	67.98	1
2	Non-availability of inputs and subsidy on time	61.01	2
3	Lack of technical guidance	59.77	3
4	Inappropriate constructions work at inappropriate place	57.86	4
5	Lack of supervision and follow-up of watershed development programme	57.37	5
6	Lack of awareness about the beneficial programme	52.95	6
7	Insufficient credit availability	43.06	7
8	Political interference	34.83	8
9	Lack of marketing facilities	32.81	9
10	Non-availability of irrigation water	26.25	10

Suggestions for improvement of watershed development programme

The respondents from the watershed were asked about the suggestions to improve the watershed development programme and they were tabulated in table 5. The table reveals that the most imprtant suggestion from beneficiary farmers was to ensure continuity and follow-up (67.50 %) followed by increase the project period from 5 to 10 years (60 %), ensure better infrastructure facilities (56.25 %), ensure coordination between authorities and farmer (45 %), ensure better marketing facilities (42.50 %), efficientutilizationoffunds (35 %), create more awareness among people towards watershed management and their benefits (32.50 %), ensure diversified farming activities (27.50 %), ensure more thrust on rainwater harvesting (25 %), ensure biodiversity conservation (22.50 %) to improve the effectiveness of the project. The study by Patel and Chauhan (2015) has evaluated the constraints faced and suggestions offered by tribal farmers of the Navsari district of South Gujarat in watershed management through low-cost technology. They reported the common suggestions that loans and subsidies should be easily available, remunerative market prices of the agricultural products should be provided to farmers, farmers should be protected by crop insurance in case of failure of season and more training should be imparted to the farmers.

Table 5. Suggestions given by the beneficiary farmers for improvement

Sl. No	Suggestion	Number	Percentage
1	Ensure continuity and follow-up	54	67.50
2	Increase the project period from 5 to 10 years	48	60
3	Ensure better infrastructure facilities	45	56.25
4	Ensure coordination between authorities and farmer	36	45
5	Ensure better marketing facilities	34	42.50
6	Efficientutilizationoffunds	28	35
7	Create more awareness among people towards watershed management and their benefits	26	32.50
8	Ensure diversified farming activities	22	27.50
9	Ensure more thrust on rain water harvesting	20	25
10	Ensure biodiversity conservation	18	22.50

Note: Figures in parentheses indicate percent to total

Conclusion

The watershed development programme has brought about a positive transformation, as reflected in the increased adoption of water conservation measures by beneficiaries when compared to non-beneficiaries. The impact is particularly pronounced in the treated watershed, where careful monitoring through strategically placed wells has demonstrated a significant boost in ground water levels. After the analysis, there was a significant difference in the ground water table level in the reference wells of beneficiaries and non-beneficiaries. Notably, wells undergoing artificial recharging have proven to be reliable and to be consistent water sources, while the creation of new farm ponds has contributed to elevated water levels in nearby wells. It is crucial to acknowledge the intricate relationship between the undulating water table and seasonal variations, diverse weather patterns, and the dynamic impact of groundwater extraction practices over time. These tangible improvements underscore the effectiveness of the watershed treatment in fortifying and replenishing groundwater reservoirs, thereby promoting sustainability within the local ecosystem. The positive changes extend beyond environmental benefits, with both market and non-market advantages contributing to increased income through enhanced agricultural yield, livestock rearing, and improved aesthetic value of the watershed. The application of Garrett's ranking technique revealed significant constraints faced by beneficiary farmers, including crop loss due to high speed wind, pests and climate change, delays in input and subsidy availability, lack of technical guidance, and issues related to supervision, awareness, credit availability, political interference, marketing facilities, construction placement, and irrigation water availability. In response to these challenges, beneficiaries have provided valuable suggestions for project improvement, emphasizing the need for continuity and follow-up, an extension of the project period from 5 to 10 years, better infrastructure facilities, and improved coordination between authorities and farmers. The multifaceted success of the watershed development programme stands as a testament to its positive impact on both the environment and the livelihoods of the local community.

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