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Unlocking water security: A comparative analysis of constraints in the adoption of Krishi Honda under Karnataka's Krishi Bhagya scheme

¹Nikhil J, ²AK Singh, ³Musani Chennamadhava and ⁴Sarvesh Kumar

^{1,3}Ph.D. Scholar, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

²Senior Professor, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

⁴Associate Professor Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

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Corresponding Author: Nikhil J

Abstract

The Krishi Bhagya Scheme, a flagship program of the Government of Karnataka, aims to mitigate the risks of rain-fed agriculture through the implementation of "Krishi Hondas" (farm ponds). Despite its potential for water security, adoption remains influenced by various socio-technical and economic constraints. This paper utilizes the Garrett Ranking Technique to identify and prioritize the problems faced by 200 farmers (100 beneficiaries and 100 non-beneficiaries) in Karnataka. Results indicate that while cost and administrative hurdles dominate the concerns of beneficiaries, non-beneficiaries are primarily deterred by high input costs and water quality issues. The study suggests targeted policy interventions to improve technical training and financial accessibility.

Keywords: Constraints, Karnataka, Krishi Bhagya scheme, Krishi Hondas, Garrett ranking

Introduction

The global agricultural landscape is currently grappling with the dual challenges of climate change and dwindling freshwater resources. In India, where nearly 54% of the net sown area is rain-fed, the vulnerability of the agricultural sector to monsoon fluctuations is profound (Meena *et al.*, 2023) [6]. Karnataka, the state with the second-largest arid area in India after Rajasthan, presents a critical case study in water-stressed agriculture. Approximately 68% of the state's geographical area is prone to drought, leaving farmers increasingly reliant on innovative in-situ moisture conservation techniques. Climate variability and recurring droughts in the arid and semi-arid regions of Karnataka have necessitated robust water harvesting strategies. The Krishi Bhagya Scheme promotes the adoption of Krishi Hondas to ensure supplemental irrigation during critical crop growth stages (Government of Karnataka, 2024). However, the transition from traditional rain-fed farming to pond-based irrigation involves significant shifts in management and resource allocation. Understanding the bottlenecks in this adoption process is crucial for enhancing the efficiency of the scheme and ensuring sustainable farmer livelihoods. Karnataka's water crisis is multi-dimensional. The state is characterized by highly erratic rainfall patterns and a significant dependence on groundwater, which is being depleted at an alarming rate. According to the Central Ground Water Board (2023), several taluks in the state are categorized as "Over-exploited," with groundwater extraction exceeding recharge levels. This hydrological stress is exacerbated by the "Hard Rock" terrain of the

Deccan Plateau, which offers limited storage capacity and poor recharge rates. Recent research by Ramappa and Lavanya (2021) [7] highlights that the recurrent droughts in the North and South Interior Karnataka have led to a 30% reduction in the productivity of major dryland crops, necessitating state intervention through schemes like Krishi Bhagya. Within Karnataka, the Chikkaballapur district serves as an epicenter of the water crisis. Located in the semi-arid Eastern Dry Zone (Zone-5), the district suffers from a severe lack of perennial river sources. Historically, the region relied on a chain of traditional tanks, but rapid urbanization and siltation have rendered many of these systems defunct. Current estimates suggest that the groundwater level in parts of Chikkaballapur has plummeted to depths exceeding 1,000-1,200 feet.

Recent studies indicate that the fluoride and nitrate contamination in the district's groundwater has also surged, making the remaining water unsuitable for both domestic and agricultural use without significant treatment (Kumar & Singh, 2022) [5]. This "water-poverty" has forced a shift in cropping patterns, yet the adoption of water-saving technologies like Krishi Hondas (farm ponds) remains uneven. While these ponds are designed to act as "water banks" for life-saving irrigation, their success in Chikkaballapur is hampered by high evaporation rates and the economic inability of marginal farmers to invest in pond lining materials.

To mitigate these regional disparities, the Government of Karnataka (2024) implemented the Krishi Bhagya scheme, prioritizing the construction of farm ponds integrated with

micro-irrigation and diesel/solar pump sets. The scheme aims to provide a "critical irrigation" buffer during the dry spells of the Kharif season. However, the transition from subsistence rain-fed farming to managed pond-based irrigation involves a steep learning curve.

Current extension research suggests that "Adoption" is not a binary event but a process influenced by the "Constraint Perception" of the farmer. While some studies focus on the technical efficiency of farm ponds, there is a significant gap in comparing the perceived hurdles between those who have successfully entered the scheme (Beneficiaries) and those who remain on the periphery (Non-beneficiaries). As Srinivasan and Reddy (2021) [8] argue, the "psychological and bureaucratic distance" to a technology often outweighs its physical availability. This study, therefore, employs the Henry Garrett Ranking Technique to critically analyze these constraints, providing a data-driven roadmap for enhancing water security in the drought-prone regions of Karnataka.

Methodology

The study employed an *Ex-post facto* and comparative research design. This design was selected because the researchers had no direct control over the independent variables (adoption status) as the events had already occurred. The comparative element allowed for a critical contrast between the perceived constraints of those who adopted the Krishi Honda (Beneficiaries) and those who did not (Non-beneficiaries).

Locale of the Study

The research was conducted in the Chikkaballapur district of Karnataka. This locale was purposively selected due to its status as a perennially drought-prone region with severe groundwater depletion (Central Ground Water Board, 2023). Chikkaballapur falls under the Eastern Dry Zone (Zone-5), characterized by red sandy loams and a critical dependency on in-situ moisture conservation for Kharif crop survival.

Sampling Procedure

A multistage stratified random sampling technique was adopted for the selection of respondents:

- **Selection of the state & District:** Both Karnataka State and Chikkaballapur District are selected purposively because out of 24 eternally drought prone districts in India 75% of districts are prevailing in Karnataka and Chikkaballapur is also one among them. (KSDMA Report, 2018).
- **Selection of Taluks:** Bagepalli (0.78) and Gudibanda (0.66) blocks are selected purposively based on the drought vulnerability index released by Karnataka State Disaster Management Agency, 2018.
- **Selection of Villages and Respondents:** Krishi Honda beneficiary list is obtained from the Agriculture Offices of respective Taluks and villages with highest no. of beneficiary are selected and equal number of non-beneficiary respondents are selected from same village respectively. Total of 100 beneficiary and 100 non-beneficiary respondents are selected for the study.

Tools for Data Collection

Primary data were collected through a structured interview

schedule, pre-tested for reliability and validity. The schedule included sections on socio-economic profiles, psychological constructs, and a specific section on "Problems Faced," where respondents were asked to rank six identified constraints from 1 to 6.

Statistical Analysis: The Henry Garrett Ranking Technique

To analyze the hierarchy of constraints, the Henry Garrett Ranking Technique was utilized. This method is superior to simple ranking as it converts the ordinal ranks into a standardized numerical score, allowing for more precise comparison between the two groups.

Step 1: Conversion to Percentile Position

The assigned ranks were first converted into percentile positions using the formula:

$$\text{Percentile Position} = \frac{100(R_{ij} - 0.5)}{N}$$

Where:

- R_{ij} = Rank given for the i^{th} factor by the j^{th} individual.
- N = Total number of factors ranked by the individual (In this case, $N=6$)

Step 2: Conversion to Garrett Scores

The calculated percentile positions were then converted into scores by referring to Garrett's Table. For example, a Rank 1 (Position 8.33) corresponds to a score of 81, whereas a Rank 6 (Position 91.67) corresponds to a score of 20.

Step 3: Calculation of Mean Scores

The scores for each constraint were summed and divided by the total number of respondents to arrive at the Garrett Mean Score (GMS):

$$GMS = \frac{\sum \text{Scores}}{\text{Total No. of Respondents}}$$

The constraint with the highest GMS was assigned Rank I, and the lowest was assigned Rank VI.

The study was conducted in Karnataka, focusing on a sample of 200 farmers categorized into beneficiaries of the Krishi Bhagya scheme and non-beneficiaries. Data was collected through structured interviews and ranked based on six identified constraints. The Henry Garrett Ranking Technique was employed to convert these ranks into scores, providing a clear hierarchy of concerns.

Results and Discussion

The results of the Henry Garrett Ranking analysis reveal a significant divergence in the perception of constraints between farmers who have adopted the Krishi Honda (Beneficiaries) and those who have not (Non-beneficiaries). The following sections detail the prioritization of these hurdles and their implications for agricultural water management in Karnataka.

Analysis of Problems Faced by Beneficiary Farmers: For

the 100 beneficiary respondents, the constraints are primarily operational. Since they have already crossed the "adoption threshold," their concerns shift toward the maintenance and utility of the infrastructure.

Based on the Garrett Mean Scores (GMS), the priorities for beneficiary farmers are as follows:

Table 1: Ranking of constraints for beneficiary farmers by using Garrett ranking method (n = 100)

Sl. No	Constraints / Problems	Total Score	Mean Score	Final Rank
1	Cost and Inputs	6065	60.65	I
2	Water Quality	5786	57.86	II
3	Power Supply	5608	56.08	III
4	Bureaucracy	4614	46.14	IV
5	Lack of Training	4081	40.81	V
6	Favouritism	4004	40.04	VI

The data indicates that Cost and Inputs is the foremost challenge (\$GMS = 60.65\$). Beneficiaries reported that while the Krishi Honda construction was subsidized, the recurring expenditure on diesel for pumping, replacement of clogged drip filters, and labor for pond desilting was prohibitive. Water Quality (Rank II) emerged as a critical technical bottleneck. In the Eastern Dry Zone, harvested rainwater often carries high sediment loads and minerals that cause "emitter clogging" in micro-irrigation systems. This finding is supported by Kumar and Singh (2022) ^[5], who observed that without proper filtration units, the efficiency of farm ponds drops by 40% within two years. Furthermore, Power Supply (Rank III) remains a major grievance. In Karnataka, the erratic supply of 3-phase power for agriculture (often restricted to 6-7 hours at night) makes it difficult for farmers to utilize the stored water precisely during critical crop stress periods.



Fig 1: Chart showing constraints and their mean scores for beneficiary farmers

Analysis of Problems Faced by Non-Beneficiary Farmers

For non-beneficiaries, the constraints act as "barriers to entry." Their ranking reflects the reasons for their non-adoption or exclusion from the scheme.

Table 2: Ranking of constraints for non-beneficiary farmers by using Garrett ranking method, (n = 100)

Sl. No	Constraints / Problems	Total Score	Mean Score	Final Rank
1	Cost and Inputs	5987	59.87	I
2	Bureaucracy	5941	59.41	II
3	Power Supply	5069	50.69	III
4	Water Quality	4844	48.44	IV
5	Lack of Training	4255	42.55	V
6	Favouritism	4104	41.04	VI

A striking difference is observed in the perception of Bureaucracy (Rank II) among non-beneficiaries (\$GMS = 59.41\$), which is significantly higher than that of beneficiaries (Rank IV). This suggests that the "red tape"—including complex documentation, multiple office visits, and delays in subsidy release—is a major psychological deterrent. Non-beneficiaries view the administrative process as nearly as difficult as the Cost and Inputs (Rank I). Meena *et al.* (2023) ^[6] similarly argued that for marginal farmers, the "transaction cost" of navigating government schemes often outweighs the perceived value of the subsidy. Interestingly, Lack of Training (Rank V) and Favoritism (Rank VI) were ranked lowest, suggesting that farmers do not necessarily feel that the system is "unfair" or that they lack knowledge, but rather that the economic and administrative thresholds are simply too high to overcome.

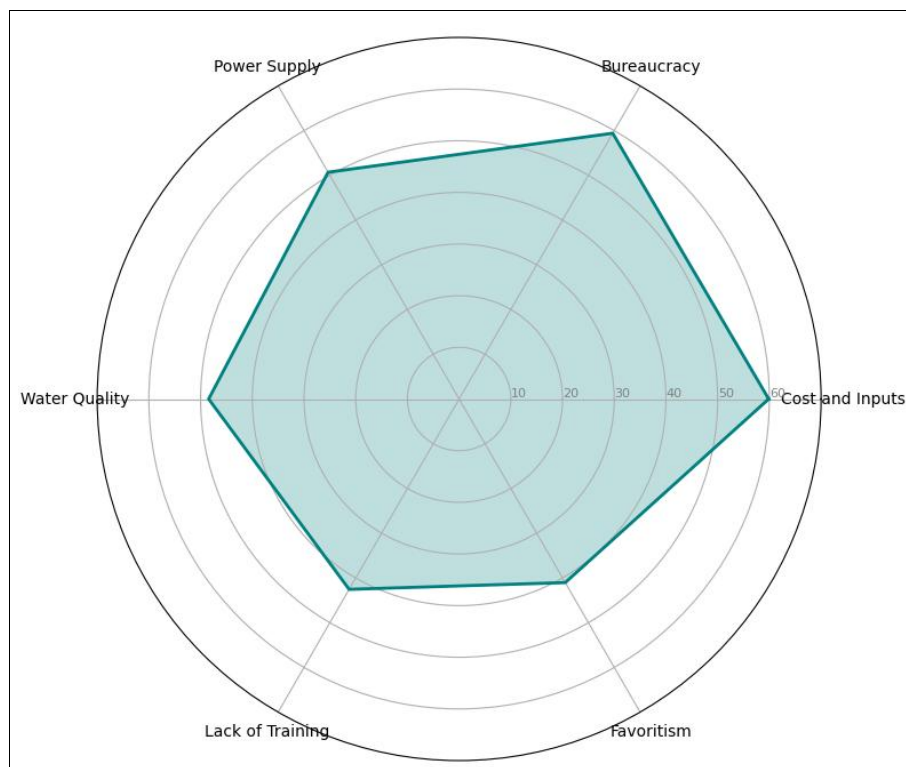


Fig 2: Chart showing constraints and their mean scores for non-beneficiary farmers

The comparative analysis reveals that while economic constraints (Cost and Inputs) are a universal Rank I problem, the secondary bottlenecks vary based on adoption status.

1. **The "Pre-Adoption" Bottleneck:** For those outside the scheme, the hurdle is Administrative. Streamlining the application process is essential to convert non-beneficiaries into participants.
2. **The "Post-Adoption" Bottleneck:** For those inside the scheme, the hurdle is Techno-Physical (Water Quality and Power). Providing a pond without ensuring clean water or reliable energy for pumping results in underutilization of the asset.

Conclusion and Policy Implications

The study concludes that economic barriers are the most significant hindrance to the adoption of water conservation technologies in Karnataka. To improve the adoption rate of Krishi Hondas:

1. **Financial Support:** Subsidies should be extended to cover the operational costs of pumping and maintenance, not just initial construction.
2. **Administrative Reform:** Simplifying the application process for the Krishi Bhagya scheme is essential to bring non-beneficiaries into the fold.
3. **Technical Training:** Enhanced extension services through KVKs (Krishi Vigyan Kendras) should focus on water quality management and energy-efficient pumping (Meena *et al.*, 2023) ^[6].

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