Original Research Article

Deciphering Farm Pond Adoption Dynamics and Operational Efficiency in Drought-Prone Regions of Maharashtra, India

ABSTRACT

The study delves the dynamics of farm pond adoption and operational efficiency in the Vidarbha and Marathwada regions of Maharashtra during 2022-23. Through a combination of quantitative and qualitative methods, data were collected from 160 beneficiaries and 160 non-beneficiaries, employing focus group discussions and structured interviews. Agricultural risks were examined, revealing a significant impact on farm income. Challenges such as low ground water table (MS 0.978), high temperatures(MS 0.966), and least evapotranspiration (MS 0.759)affected farmers' livelihoods, underscoring the need for a multidisciplinary approach to address these issues. The study highlights factors influencing farm pond adoption, with high awareness (96.56%) contrasting with lower adoption rates(51.56%). Adopters cited increased water access (22.81%), and relief from water scarcity (20%) as motives. Non-adopters faced barriers like financial constraints (21.88%) and land shortage (18.75%). Farm pond characteristics were comprehensively explored, revealing variations in size, structure, year of adoption, and irrigation sources. Maintenance activities were examined, showcasing key areas for pond health. Regular inspection (31.88%), vegetation management (17.50%), sediment removal(25.63%), and erosion prevention(19.38 %) emerged as crucial tasks, with variations between the regions. Financial aspects of pond construction and maintenance were elucidated, indicating a need of subsidies. Despite widespread awareness of farm pond benefits, adoption rates remained constrained by financial limitations, land availability, and awareness gaps. The study underscores the importance of targeted interventions, including financial aid, technical guidance, and capacity-building. These efforts are essential for promoting widespread adoption, enhancing agricultural productivity, water management, and the resilience of farming communities in both regions.

Keywords: Adoption, Drought, Farm Pond, Kendal's tau rank, Sustainability, Vidarbha, Marathwada.

INTRODUCTION

Despite employing more than half of the country's workers, the agriculture industry in India only makes up 18.8% of the GDP (PIB, 2022); this contradiction is partly attributable to issues with water scarcity (Dhawan, 2017). Maharashtra, a state with a large population and a substantial agricultural sector, struggles with recurrent droughts, unpredictable rainfall patterns, and increased sensitivity to the effects of climate change (Roy *et al.,* 2022 and Sha *et al.,* 2021). In Maharashtra, the construction and evaluation of farm ponds have become a crucial intervention in response to these challenging problems, strengthening agricultural resilience and reducing the negative effects of water scarcity (Shivakumarappa*et al.,* 2023). These agricultural ponds, also known as water harvesting structures or reservoirs, have developed into pillars of support for the farmers of Maharashtra (Gireesh *et al.,* 2023). Situated within or adjacent to agricultural plots, they play a pivotal role in capturing and preserving rainwater during monsoons (Rao *et al.*,2016). By providing a dependable water source for irrigation, livestock, and agricultural operations during arid spells, farm ponds enable farmers to sustain their livelihoods even in protracted droughts or erratic rainfall periods (Rao *et al.,* 2019 and Sagar,2020).

A meticulous evaluation of the necessity and status of farm ponds in Maharashtra is imperative to comprehend the prevailing availability, condition, and utilization of these water reservoirs throughout the state (Udmale*et al.*,2014 &Kale, 2017). The impact studies empower policymakers, researchers, and stakeholders to pinpoint gaps, assess the efficacy of existing farm ponds, and formulate targeted strategies for their enhancement. Scrutinizing the requisites and circumstances surrounding farm ponds yields invaluable insights for promoting wider adoption, optimizing functionality, and surmounting potential barriers obstructing their implementation (Wens *et al.,* 2021). This assessment seeks to probe the current state of farm ponds in Maharashtra, encompassing facets like their dispersion, design, storage capabilities, maintenance or management, and extension interventions. The endeavor seeks to illuminate the geographical regions and farming communities poised to reap the greatest benefits from heightened farm pond access and suggest the recommendations for ameliorating the efficiency, sustainability, and resilience of these water-retention structures, while factoring in socio-economic, environmental, and institutional dimensions.

By bolstering agricultural resilience through extensive farm pond integration, drought region can fortify its agricultural sector, enhance food security, and empower farmers to grapple with the vagaries induced by climate change (Prasad, 2016). Acknowledging the pivotal role of farm ponds, the Maharashtra government introduced the '***Magel Tyala Shet Tale'*** (farm ponds on demand) initiative in 2016, extending partial subsidies to farmers for farm pond construction. This study endeavors to unearth farmers' perceived agricultural risks associated with farming and farm pond practices, with the intent of formulating sustainable extension interventions to surmount challenges faced by farmers within the study locale. The insights garnered from study will enrich our holistic comprehension of the exigency and status of farm ponds in Maharashtra, facilitating well-informed decision-making, targeted investments, and the formulation of robust policies conducive to sustainable agricultural practices in the state. By accentuating the enhancement of agricultural resilience through farm ponds, Maharashtra charts a course toward a more secure and prosperous future for its agrarian communities.

MATERIAL AND METHODS

For this study, *ex post facto* research design was used. The Marathwada and Vidarbha regions of Maharashtra were chosen for the current study as they are highly to their drought-affected state. Two districts were selected from each region, and two blocks from each district were selected purposively due to having the highest number of farm ponds. Two villages were selected randomly from every block for the study. For the study, a total of 16 villages were drawn randomly. Twenty respondents from each village, including farm pond beneficiaries and non-beneficiaries, were selected randomly. Around 80 respondents from one district were selected, making a total of 320 respondents from four selected districts constitute the sample. A structured schedule for data collection was used to assess the profile and farm risk. The responses of the sources of agriculture risk with respect to potential effect on farm income of farm pond respondents were recorded in three-point-continuum in the schedule i.e. Most Severe, Severe and Not Severe, and scores were assigned as 3, 2 and 1 respectively and assessed through Kendal's tau rank as given below:

Kendall (τ) rank correlation coefficient statistic was used to measure the ordinal association between two measured quantities. A τ-test is a non-parametric hypothesis test for statistical dependence based on the τ coefficient. It is a measure of rank correlation: the similarity of the orderings of the data when ranked by each of the quantities. Intuitively, the Kendall correlation between two variables will be high when observations have a similar (or identical for a correlation of 1) rank (i.e. relative position label of the observations within the variable: 1st, 2nd, 3rd, etc.) between the two variables, and low when observations have a dissimilar (or fully different for a correlation of −1) rank between the two variables.

The Kendall τ coefficient is defined as = $\frac{C - D}{C + D}$

Where,

C = number of concordant pairs

D = number of discordant pairs

The tau correlation coefficient returns a value of 0 to 1

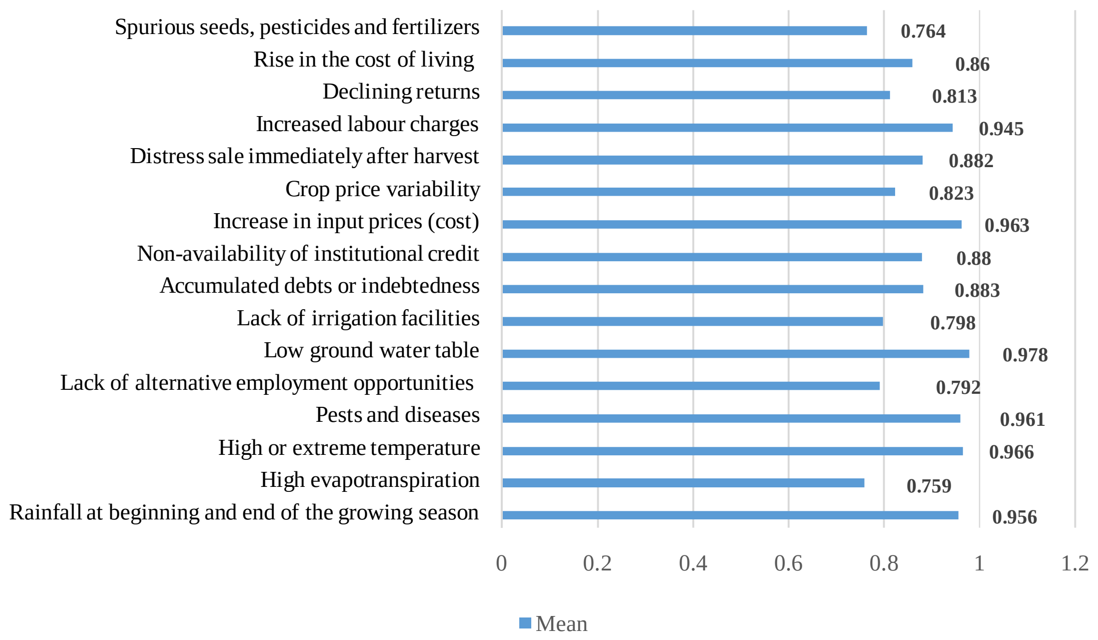
Where,

0 is no relationship, 1 is a perfect relationship

RESULTS AND DISCUSSIONS

Agricultural Risk Factors in Drought-Prone of Marathwada and Vidarbha regions

Fig 1: Percieved Sources of Farm Risk of Farmers



The data pertaining to the sources of farm risk is eloquently depicted in Figure 1. The outcomes underscore that a low groundwater table, with a mean score(MS) of 0.978, stands out as the most formidable form of farm risk. Conversely, the risk of high evapotranspiration, with a mean score of 0.759, emerges as the least significant farm risk.

Furthermore, the majority of respondents (MS 0.966) confront the risk of high or extreme temperatures as their foremost challenge. This is closely followed by an escalation in input prices or costs (MS 0.963), the incidence of pests and diseases (MS 0.961), untimely rainfall at the beginning and end of the growing season (MS 0.956), heightened labour charges (MS 0.945), accrued debts or indebtedness (MS 0.883), distressing post-harvest sales (MS 0.882), the unavailability of institutional credit (MS 0.880), an upsurge in the cost of living (MS 0.860), variability in crop prices (MS 0.823), diminishing returns (MS 0.813), inadequate irrigation facilities (MS 0.798), a lack of alternative employment opportunities (MS 0.792), and the prevalence of counterfeit seeds, pesticides, and fertilizers (MS 0.764). These findings harmonize with the research conducted by Venkateswarlu in 2011.

Consequently, all the enumerated perceived risks exhibit a Tau rank Mean score exceeding 0.3. This unequivocally underscores the substantial impact on farmers' income and underscores the imperative for a multidisciplinary approach to withstand the aforementioned agricultural farm risks faced by the respondents.

Table 1:Factors Influencing Adoption of Farm Pond

SN	Particular	Marathwada (n=160)		Vidarbha (n=160)		Total (N=320)	
		f	%	*f*	%	*f*	%
1	Awareness of farm ponds scheme	154	96.88	154	96.25	309	96.56
2	Adoption rate	86	53.75	79	49.38	165	51.56
3	**Reasons for adoption of farm pond (n=160)**						
a	Increased water availability	35	21.88	38	23.75	73	22.81
b	Mitigating water scarcity	35	21.88	29	18.13	64	20.00
c	Sustainable agriculture	7	4.38	6	3.75	13	4.06
d	Soil conservation	9	5.63	6	3.75	15	4.69
4	**Reasons for non-adoption of farm pond(n=160)**						
a	Lack of financial resources	36	22.50	34	21.25	70	21.88
b	Insufficient land availability	31	19.38	29	18.13	60	18.75
c	Lack of awareness	4	2.50	6	3.75	10	3.13
d	Inadequate technical support	8	5.00	11	6.88	19	5.94
5	**Perceived benefits of farm pond(N=320)**						
a	Improved crop yield	59	36.88	54	33.75	113	35.31
b	Enhanced income diversification	21	13.13	25	15.63	46	14.38
c	Reduced dependence on rainfed	38	23.75	30	18.75	68	21.25
d	Improved livestock rearing	44	27.50	51	31.88	95	29.69
6	**Challenges for adoption of farm pond(N=320)**						
a	Lack of technical knowledge	10	6.25	17	10.63	27	8.44
b	Inadequate financial support	100	62.50	84	52.50	184	57.50
c	Limited access to	23	14.38	29	18.13	52	16.25

	equipment						
d	High maintenance costs	25	15.63	30	18.75	55	17.19

The findings in Table 1 shed light on the factors influencing farmers' decisions regarding the adoption of farm ponds, along with the associated benefits and challenges of this practice. The study reveals a high level of awareness of the farm pond scheme in both the Marathwada and Vidarbha regions, with 96.88 Per cent and 96.25 Per cent of respondents being aware of the farm pond scheme, respectively. However, the adoption rates are relatively lower, with 53.75 Per cent of farmers in Marathwada and 49.38 Per cent in Vidarbha having adopted farm ponds. This indicates that while the concept of farm ponds is widely recognized, there is still room for increased adoption, possibly due to various barriers and challenges faced by farmers.Among the farmers who have adopted farm ponds, the primary reasons include increased water availability (22.81%), mitigation of water scarcity (20.00%), and the promotion of sustainable agriculture (4.06%). Similarly, the reasons for non-adoption are attributed to factors such as a lack of financial resources (21.88%), insufficient land availability (18.75%), and inadequate awareness (3.13%). These findings emphasize the importance of addressing financial and resource-related constraints to encourage higher adoption rates.

Farmers who have adopted farm ponds perceive various benefits from this practice. Improved crop yield (35.31%) is recognized as a significant advantage, followed by enhanced income diversification (14.38%), reduced dependence on rainfed agriculture (21.25%), and improved livestock rearing (29.69%). These benefits align with the aims of sustainable and resilient agricultural systems, highlighting the positive impact of farm ponds on both crop and livestock sectors.

While farm ponds offer numerous benefits, they also come with challenges that hinder adoption. Lack of technical knowledge (8.44%), inadequate financial support (57.50%), limited access to equipment (16.25%), and high maintenance costs (17.19%) are identified as key challenges. The substantial percentage of respondents citing inadequate financial support underscores the need for targeted interventions, including financial assistance and capacity-building programs, to facilitate wider adoption of farm ponds.Comparing the two regions, Marathwada and Vidarbha, it is evident that both regions share similar awareness levels but exhibit differences in adoption rates, reasons for adoption and non-adoption, perceived benefits, and challenges. These results in line with Halagundegowda*et al.* (2023), Shivakumarappa*et al.* (2023), and Kumar *et al.* (2021).These disparities could be attributed to varying socio-economic conditions, agro-climatic factors, and resource availability in the respective regions. The findings underscore the importance of targeted financial support, technical training, and improved resource availability to promote wider adoption of farm ponds, thereby contributing to more resilient and sustainable agricultural systems in both the Marathwada and Vidarbha regions.

Table 2: Farm Pond characteristics

S. No.	Size of farm pond	Marathwada(n=80)		Vidarbha (n=80)		Total (N=160)	
		f	%	*f*	%	*f*	%
1.	**Size of farm pond**						
a.	Small	0	0	0	0	0	0
b.	Large	80	100	80	100	160	100.00
c.	Inlet & outlet	3	3.75	5	6.25	8	5.00
d.	Plastic lining	72	90.00	64	80.00	136	85.00
2.	**Source of irrigation**						
a.	Farm pond / Tank	80	100	80	100	160	100
b.	Well	78	97.50	52	65.00	130	81.25
c.	Bore well	32	40.00	28	35.00	60	37.50
3.	**Irrigation potential**						
a.	Through out the year	56	70.00	57	71.25	113	70.63
b.	Only during seasons	17	21.25	31	38.75	48	30.00
c.	Un- Assured & irregular	7	8.75	49	61.25	56	35.00
4.	**Structure of farm pond**						
a.	As per recommended	3	3.75	5	6.25	8	5.00
b.	Not as per recommended	77	96.25	75	93.75	152	95.00
5.	**Irrigated area under farm pond**						

a.	1-2 ha	36	45.00	54	67.50	90	56.26
b.	2-3 ha	20	25.00	17	21.25	37	23.13
c.	> 3 ha	24	30.00	9	11.25	33	20.63
5.	**Year of adoption**						
a.	3 to 5 year old	54	67.50	62	77.50	116	72.50
b.	> 5 year old	26	32.50	18	22.50	44	27.50
6.	**Source of water harvest**						
a.	Only from rain	2	2.50	6	7.50	8	5.00
b.	Well/bore well	0	0	0	0	0	0
c.	Both	78	97.50	74	92.50	152	95.00
7.	**Distance of farm pond**						
a.	< 1 km	40	50.00	22	27.50	62	38.75
b.	1 - 2 km	21	26.25	26	32.50	47	29.38
c.	2 – 3 km	12	15.00	18	22.50	30	18.75
d.	> 3 km	7	8.77	14	17.50	21	13.13

Table 2 reveals essential aspects of farm pond utilization and construction in the context of agricultural water management in Marathwada and Vidarbha. Both regions predominantly favor large farm ponds (100%) for ample water storage. A minority employ inlet and outlet structures (5%) to manage water flow. Farm ponds/tanks serve as the primary irrigation source for all respondents (100%), highlighting their crucial role in securing agricultural water supply. In Marathwada, most respondents also rely on wells (97.5%), while in Vidarbha, a substantial proportion (65%) still use well water, store water in farm pond. Both regions demonstrate substantial year-round farm pond usage (Marathwada: 70%, Vidarbha: 71.25%) for consistent irrigation. Vidarbha stands out with a significant portion (38.75%) relying on farm ponds exclusively during seasons, potentially due to climate fluctuations and water scarcity. Regrettably, most respondents in both regions (Marathwada: 96.25%, Vidarbha: 93.75%) do not adhere to recommended farm pond construction standards, necessitating the promotion of best practices. There's variation in the size of the irrigated area under farm pond, with Vidarbha having more smaller plots (1-2 ha) and Marathwada having more extensive areas (>3 ha), likely tied to regional landholding patterns. Vidarbha showcases a higher percentage of respondents (77.5%) with farm ponds older than five years, indicating sustained benefits and accrued experience. While rainfall and farm ponds remain primary water sources for both regions, Vidarbha exhibits slightly lower reliance on these sources (92.5%) compared to Marathwada (97.5%). Notable distance of farm pond in Marathwada within 1 km (50%) compared to Vidarbha (27.5%), possibly influenced by land distribution and topography. This study in line with Mahandrakumar(2020) and Meena *et al*. (2023), despite consistent trends like favoring large ponds and using plastic lining, disparities exist in source diversification, construction adherence, irrigation potential, and adoption duration between Marathwada and Vidarbha. These distinctions arise from regional climatic, geographical, and socio-economic factors, underscoring the need for tailored interventions to optimize farm pond usage and enhance water resource management in both regions.

Table 3: Maintenance of farm pond (post construction)

S N	Components	Marathwada (n=80)		Vidarbha (n=80)		Total (N=160)	
		f	%	*f*	%	%	*f*
1.	Regular inspection: identifying signs of wear, erosion, or damage to the pond structure, inlet, outlet, and surrounding areas.	28	35.00	23	28.75	51	31.88
2.	Vegetation management: checking the growth of aquatic vegetation	17	21.25	11	13.75	28	17.50
3.	Sediment Removal: periodically removing sediment	15	18.75	26	32.5	41	25.63
4.	Trash and debris removal: regularly clearing debris, litter, and fallen leaves	25	31.25	31	38.75	56	35.00
5.	Structural integrity: maintaining inlet and outlet structures, spillways, embankments, and the pond liner	9	11.25	11	13.75	20	12.50
6.	Erosion control: maintain rocks lines or appropriate vegetation	18	22.5	13	16.25	31	19.38
7.	Water level management: checking overflows and ensuring water availability during dry periods	67	83.75	53	66.25	120	75.00
8.	Algae and water quality: monitoring water quality and checking excessive algae growth	25	31.25	13	16.25	38	23.75
9.	Wildlife management: ling & fencing	52	65	37	46.25	89	55.63
10.	Dredging: maintain and restoring the pond's capacity	7	8.75	13	16.25	20	12.50
11.	Repairs and upgrades: checking the leaks and cracks or damaged components	23	28.75	19	23.75	42	26.25
12.	Drainage management: maintaining outlet	11	13.75	7	8.75	18	11.25

	structure & clearing of debris						
13.	Expert consultation: issues or complex maintenance tasks	5	6.25	9	11.25	14	8.75

Maintaining a farm pond is crucial to ensure its effectiveness, longevity, and optimal functionality. Proper maintenance practices help prevent deterioration, water loss, and potential environmental issues. The results of table 3, provide insights into the prioritization and execution of different maintenance activities, shedding light on the key areas of focus for sustaining the health and functionality of water ponds. The data revealed that 31.88 per cent of all respondents consider regular inspection crucial. Interestingly, a slightly higher percentage of respondents from Marathwada (35.00 %) prioritize this aspect compared to Vidarbha (28.75%). Monitoring and managing aquatic vegetation is critical for maintaining pond health. Around 17.50 per cent of respondents emphasize vegetation management, with a marginal difference between the two regions. Also 25.63 per cent of respondents acknowledge the importance of sediment removal. Vidarbha has a notably higher emphasis on this aspect (32.50 %) compared to Marathwada (18.75%). Regular clearing of debris, litter, and fallen leaves is recognized as vital by 35.00 per cent of respondents. Both regions demonstrate a similar focus on this aspect. Ensuring the integrity of inlet and outlet structures, spillways, embankments, and the pond liner is highlighted by 12.50 per cent of respondents. The two regions show comparable priorities in this regard. Maintaining rock lines or appropriate vegetation to prevent erosion is noted by 19.38 per cent of respondents, with a slightly higher percentage from Marathwada. Managing water levels and availability during dry periods is a central concern, with 75.00 per cent of all respondents highlighting its significance. Notably, a higher proportion of respondents from Marathwada (83.75%) stress the importance of water level management compared to Vidarbha (66.25%). Monitoring water quality and controlling excessive algae growth is a priority for 23.75 per cent of respondents. Vidarbha places greater emphasis on this aspect compared to Marathwada. Wildlife Management: Managing wildlife through fencing and other means is considered important by 55.63 per cent of respondents. Marathwada shows a higher focus on this aspect. Maintaining and restoring pond capacity through dredging is highlighted by 12.5 per cent of respondents, with a higher emphasis from Vidarbha. Addressing leaks, cracks, and damaged components is crucial for 26.25 per cent of respondents. Also, both regions show similar priorities. Maintaining outlet structures and clearing debris for effective drainage is noted by 11.25 per cent of respondents, with a slightly higher emphasis from Marathwada. Seeking expert advice for complex maintenance tasks is recognized by 8.75 per cent of respondents. This study in line with Shivakumarappa*et al.* (2023), Geetha & Loganathan (2019), Dupdal*et al.* (2023) and Basu et al. (2021), Vidarbha places a higher emphasis on expert consultation. The results indicate that certain maintenance components have varying levels of importance across the Marathwada and Vidarbha regions. Water level management and wildlife management emerge as major concerns in both regions.

Table 4: Cost of Construction and Annual Maintenance Cost of Farm Pond

S N	**Cost of Construction**	**Marathwada(n=80)**		**Vidarbha (n=80)**		**Total (N=160)**	
		f	***%***	***f***	%	***f***	**%**
1.	Sufficient of Subsidy	2	2.5	3	3.75	5	3.13
2.	Subsidy + up to 50000/-	3	3.75	5	6.25	8	5.00
3.	Subsidy + up to 100000/-	4	5	5	6.25	9	5.63
4.	Subsidy + up to 200000/-	7	8.75	8	10	15	9.38
5.	Subsidy + up to 300000/-	11	13.75	14	17.5	25	15.63
6.	Subsidy + >300000/-	53	66.25	45	56.25	98	61.25
7.	**Maintenance (per year)**						
8.	Up to 5000/-	21	26.25	37	46.25	58	36.25
9.	5000 to 15000/-	28	35	12	15	40	25.00
10.	15000 to 25000/-	18	22.5	16	20	34	21.25
11.	>25000/-	13	16.25	15	18.75	28	17.50

The result of table 4 shed light on the financial considerations associated with pond construction and upkeep, highlighting variations in subsidy preferences and maintenance expenditures between the two regions. A minimal percentage of respondents in both regions (3.13% overall) believed that a sufficient subsidy should be provided for pond construction. This approach may be indicative of a desire for comprehensive financial support. A slightly higher percentage of respondents (5% overall) suggested that a subsidy, combined with a cap of up to 50,000 rupees, would be appropriate for pond construction. About 5.63 per cent of respondents favored a subsidy along with a limit of up to 100,000 rupees for construction, indicating a willingness to contribute a higher amount toward the cost. The preference for a higher subsidy amount with a limit of up to 200,000 rupees was voiced by 9.38 per cent of respondents. A notable proportion (15.63%) of respondents leaned toward a subsidy with an upper cap of up to 300,000 rupees for construction, suggesting an understanding of the associated expenses. The majority of respondents (61.25%) indicated a preference for a subsidy exceeding 300,000 rupees, underscoring the need for substantial financial assistance in pond construction.

The data regarding annual maintenance costs reflects varying financial considerations among respondents in the two regions. A higher percentage of respondents from Vidarbha (46.25%) favored maintenance costs within the range of up to 5,000 rupees, compared to Marathwada (26.25%). A significant proportion of Marathwada respondents (35.00 %) spending maintenance costs within the range of 5,000 to 15,000 rupees, while in Vidarbha, this spending was lower (15.00 %). Respondents from both regions expressed a similar preference for maintenance costs in the range of 15,000 to 25,000 rupees, with slightly more respondents from Marathwada (22.50 %). A comparable percentage of respondents from both regions (around 18.75%) indicated that spending more than 25,000 rupees annually for pond maintenance. The results indicate that respondents in both Marathwada and Vidarbha regions recognize the importance of subsidies in facilitating pond construction. The majority of respondents, particularly from Marathwada, favored a subsidy exceeding 300,000 rupees. Annual maintenance costs varied, with a higher proportion of respondents from Vidarbha expressing willingness to allocate higher funds for upkeep. This study in line with Bendapudi*et al* (2020) and Reddy *et al* (2020).

Unveiling Key Factors Contributing to Inefficiency of Farm Ponds in Maharashtra's Drought-Prone Zones

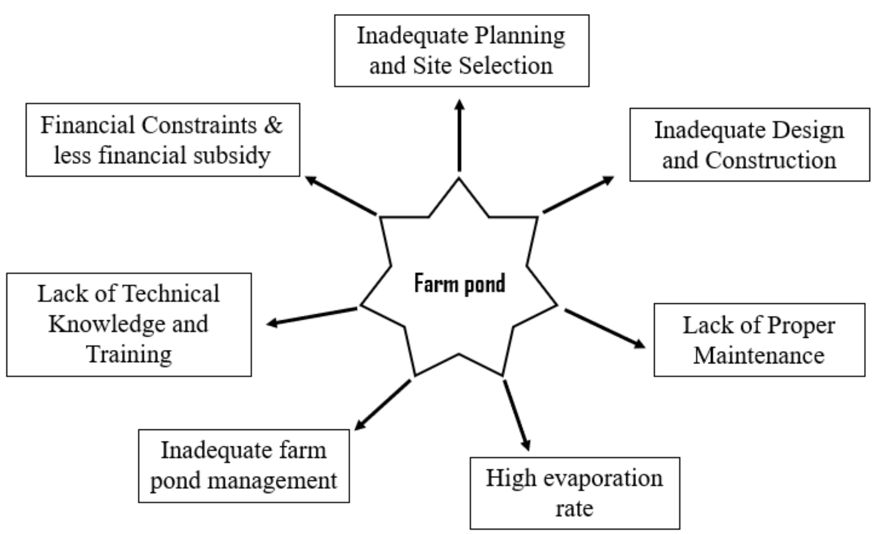


Figure 2: Factors Contributing to Inefficiency of Farm Ponds Maharashtra

- Inadequate Design and Construction: Poor design or construction techniques can lead to structural weaknesses in farm ponds, such as inadequate slope, weak embankments, or improper lining. This can result in leakage or pond failure.
- Lack of Proper Maintenance: Neglecting regular maintenance tasks, such as cleaning, desilting, and repairing, can lead to sediment accumulation, reduced storage capacity, and deterioration of the pond structure over time. Inadequate maintenance can weaken the pond's effectiveness and resilience.
- High evaporation: due to prolonged drought periods or inadequate rainfall, the ponds may not have enough water to sustain agricultural activities. Insufficient water availability can render the ponds ineffective.
- Inadequate farm Management: Farm ponds are often designed to capture and store rainwater runoff from the surrounding farm pond. If there is poor farm pond, such as deforestation, excessive soil erosion, or improper land-use practices, the inflow of water into the ponds may be limited, reducing their effectiveness.
- Lack of Technical Knowledge and Training: Farmers may lack the necessary technical knowledge and training regarding the proper design, construction, and maintenance of farm ponds. This can lead to suboptimal implementation practices and increase the likelihood of pond failure.
- Financial Constraints& less financial subsidy: Limited financial resources can hinder farmers from constructing and maintaining farm ponds properly. Insufficient funds may result in the use of substandard materials or inadequate maintenance, compromising the longevity and effectiveness of the ponds.
- Inadequate Planning and Site Selection: Poor planning and site selection can contribute to the failure of farm ponds. Factors such as unsuitable soil conditions, improper location, or inadequate hydrological assessment may result in ineffective water storage and utilization.

Extension model for Enhancing Farm Pond Performance in Drought-Prone Regions

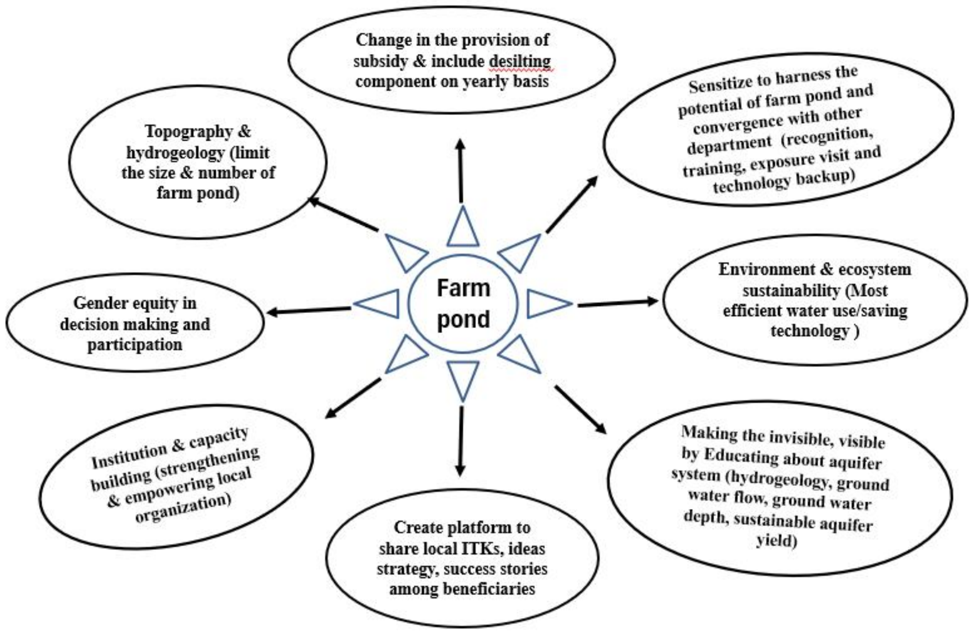


Figure 3: Extension model for Enhancing Farm Pond Performance

A good number of extension interventions have emerged in construction, utility and management of farm ponds. The details are depicted (Result: Figures 1, 2 & 3, and Tables 1, 2, 3 & 4) However, the crucial once are given below which may be addressed by the extension services to make the pond technology widely adopted and profitable.

- Given the benefits of the farm pond technology, the state may promote it to cover non-beneficiary farmers in order to maximize the irrigation potential for more crops per drop.
- Given the positive economic and social impact of farm ponds on the farmers, State may prioritize the continuation of the programme covering small and marginal farmers.
- The programme may collaborate with local institutions or non-governmental organizations to create ecologically viable and sustainable natural cementing or other natural techniques for adopting replacements for plastic linings in agricultural ponds, to be promoted by state extension agencies.
- The State may make it essential for farm pond beneficiaries to use effective irrigation methods such as drip and sprinkler to acquire more crops per drop and enhance subsidy provision for such practices.

- There is a need to create a platform in each village for the community to share traditional knowledge, experience, mobilize local resources and efficient use of location specific technologies.
- Make geo-tagging and monitoring of farm ponds necessary after 3 to 5 years of construction of farm ponds to verify the progress of improved irrigation potential at the micro level.
- In programme adopted village, a farm pond users association, farmer's field school and awareness campaigns involving stakeholders may be organized to enable beneficiaries exchange knowledge and experiences to utilize farm pond water judiciously.
- The state may learn from the success stories of farm pond in drought-prone villages and incorporate learnings in ongoing programmes. The farm pond programme should incorporate a continual feedback system for programme improvement.
- A holistic supportive package of technology transfer in connection to farm ponds may be promoted in a farmer participatory manner with active participation of related scientists.

CONCLUSION:

The study delves into the challenges and opportunities faced by farmers in these drought-prone areas, shedding light on the factors that influence their decisions and actions. The findings highlight the critical role of farm ponds in mitigating agricultural risks, particularly the impact of low groundwater levels and extreme weather conditions. The multidimensional risks faced by farmers, including input costs, pests, rainfall variability, and more, emphasize the need for holistic strategies to enhance resilience and income stability. The study underscores the significance of tailored approaches to pond construction and maintenance. It reveals varying preferences in subsidy allocation and annual maintenance costs between the two regions. The majority of respondents recognize the importance of substantial financial assistance in pond construction, while maintenance priorities differ based on local conditions. Moreover, the research reveals that while there is high awareness about the benefits of farm ponds, adoption rates remain relatively lower due to challenges such as financial constraints, land availability, and limited awareness. The motivations and benefits for adopting farm ponds are diverse, ranging from improved water access to increased crop yield and income diversification. Overall, the study provides valuable insights into the complex dynamics of farm pond adoption and operational efficiency in drought-prone regions. It emphasizes the need for targeted interventions, including financial support, technical assistance, and capacity-building, to facilitate widespread adoption and ensure the sustainable management of farm ponds. Such efforts are vital for enhancing agricultural productivity, water management, and the overall resilience of farming communities in Marathwada and Vidarbha.

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