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### A study on constraints faced and suggestions expressed by the farmers on practicing groundwater conservation practices

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#### Abstract

Water is the fundamental and most needed resource to every organism on the earth. Being a community resource as well, water source needs to manage as a shared pool under public trust to achieve food security, extend livelihood and ensure equitable and sustainable development for the long run sustenance of the ecosystem. change in the trend of extraction and usage of borewells is due to an increase in groundwater utilization of the state from 65% to 70% for various purposes. , central and state had put efforts to regulate groundwater use by individual Well owners. Despite these initiatives from the government, there is still availability of efficient groundwater use by farmers showed little success. Hence. In this regard, the research problem to elicit constraints and seek suggestions for improving adoption of groundwater conservation practice was taken up. The results of the study reveal that the constraints faced by the farmers in adopting groundwater conservation practices among that the institutional supply constraints ranked first with a percentage of 76.38 followed by technical (74.44%) constraints second, socio-economic (72.77%) constraints third, situational (69.44%) constraints fourth, and the last financial (63.51%) constraints at fifth place. The majority of marginal farmers have given suggestion that Govt. should come up with initiatives keeping in view of demand side of groundwater (90.00%), Subsidies on electricity need to be cut short and encourage on use of solar pump sets (90.00%), Provision of sufficient financial assistance for taking up water conservation structures (80.00%) and Tank irrigation needs more concentration (76.67%).

**Keywords:** Groundwater conservation practices, constraints, suggestions, eastern dry zone

#### Introduction

Water is the fundamental and most needed resource to every organism on the earth. Being a community resource as well, water source needs to manage as a shared pool under public trust to achieve food security, extend livelihood and ensure equitable and sustainable development for the long run sustenance of the ecosystem. Each drop of water is precious and has to be judiciously used for its optimum output as rightly addressed by then Hon'ble President of India Sri Pranab Kumar Mukharjee during joint sessions of parliament in 2015. The statement is justifiably applicable to a country like India because the significant challenge of any developing country like India is maintaining sustainable development and efficient management of scarce water resource and groundwater falls in the front line. The reason why it is becoming a major challenge to India is, Indian is an agricultural land, and groundwater has steadily become the backbone of agriculture and drinking water security.

Groundwater contribution to irrigation is 62% (Dynamic GW resource of India, 2020), which indicates more than half of agriculture depends on groundwater as a primary source of irrigation, the most significant challenge on the country's hand is to reduce the consumptive use of water in agriculture so that the saved water could be optimally utilized to bring more area under irrigation. (Nagraj, 2020). Providing safe water for drinking, sanitation, and irrigation is the prime importance, and when all the basic needs are

met, it should be allocated in a manner that promotes its conservation and efficient use.

An analysis of the irrigation profile of Karnataka from the 1970s to 2017 indicates that canal irrigation getting stagnant, but bore well is rising rapidly. At the same time, tank and open wells are showing a negative growth rate. This change in the trend of extraction and usage of borewells is due to an increase in groundwater utilization of the state from 65% to 70% for various purposes (Karnataka GW resource Assessment report March, 2020) The main drawbacks in water users and farmers of Karnataka, particularly farmers of the dry zone, are not adopting the irrigation schedule as per the crop water requirement.

There is an urgent need to help the farming community create awareness among them regarding depleting groundwater levels and reasons for depletion. If we focus on efficient use of water resources noted that 10 per cent of water saving in the agriculture sector now, would make available for all the users for the next 50 years. (ToI report, Nov 25th, 2019). These alarming figures show the groundwater's plight that sought an immediate change in the extraction pattern of both groundwater and surface water interventions. Public and water-related associations need to focus and manage more on the demand side rather than on the supply side of the GW resource. The demand side is groundwater users, irrigated farmers, domestic users and industrialists.

Some of the studies were reviewed regarding farmers constraints faced on adopting water conservation practices and suggestions sought to adopt such water management practices in their farm and village. Shortage of water supply were the major problem observed by the rainfed paddy growers of eastern dry zone of Karnataka. (Shivamurthy *et al.* 2008) <sup>[12]</sup>. Mango growers from Srinivaspur region of Karnataka faced lack of technical know-how, and lack of awareness on drip irrigation technology in adopting drip to the mango orchards. The major constraints faced by them were lack of technical knowhow, lack of awareness on drip irrigation technology. (Govinda *et al.* 1997) <sup>[7]</sup>. While adopting water management technology farmers revealed that they faced physical constraints of field channel and unlevelled land and drainage problem were the major along with that also expressed they faced administrative constraints, the constant tapping of water at distributary canal and sub canal. (Anand *et al.* 1998) <sup>[2]</sup>. when there is lack of technical guidance and training on adoption of soil and water conservation practices has changed the interest of farmers on taking up water conservation practices in farms. (Mithun and Bheemappa 2015) <sup>[9]</sup>. deferred maintenance of the system, insufficient revenue to meet O&M cost and noninvolvement of farmers in irrigation management. (Akkamahadevi Naik, 2019) <sup>[1]</sup>. Some common suggestions got from the farmers are they expects that government should undertake corrective measures regarding project planning, extension services, water management by irrigation agencies and initiate policies with respect to water pricing. (Umali, 1993) <sup>[13]</sup>. The performance of irrigation system in Fordwah Irrigation system in Pakistan by Wahaj in 2001 and study revealed that collective action has to take up more at the watercourse or higher level in the irrigation system, whereas individual actions were mainly has to take up at the farm level. In the place called Hagedal as many as 69 per cent of the sample farmers feel that it is the responsibility of the agency to maintain the upkeep of the irrigation infrastructure. In Gundur, 62 per cent of farmers mentioned that financial support from to WUA was most desired for the improvement of physical conditions of sub-distributary. (Mini, 2006) <sup>[8]</sup>. Farmers also indicated adequate funds need to be provided by the government to take up development works on regular basis, coordinated efforts of agriculture irrigation and revenue departments for effective implementation of participatory tank irrigation system (Mohan and Rameshkumar, 2013) <sup>[10]</sup>.

Besides various general characters of groundwater usage problem, direct users, especially farmers of India, are currently feeling helpless in sustainable use of groundwater for agricultural production in the rain fed situation, that might be due to the following reasons:

- groundwater is an invisible resource.
- It is difficult for communities to visualize complex geological aspects.
- Groundwater volume estimation involves complex equations
- There is an inadequate appreciation of the role of farmers in village groundwater management

For this reason, central and state had put efforts to regulate groundwater use by individual Well owners. Despite these initiatives from the government, there is still availability of

efficient groundwater use by farmers showed little success. For this reason, central and state had put efforts to regulate groundwater use by individual Well owners. Despite these initiatives from the government, there is still availability of efficient groundwater use by farmers showed little success. Hence. In this regard, the research problem to elicit constraints and seek suggestions for improving adoption of groundwater conservation practice was taken up to maintain the sustainable groundwater table.

### Methodology

The study was taken up to analyze the constraints faced by the farmers in adopting the groundwater conservation practices in the eastern dry zone districts of Karnataka state, and seeking suggestions by the same farmers on improving the conservation practices. Kolar and Chikkaballapur districts which have highest groundwater extraction for domestic usage, Agriculture and Industrial purpose hence, Kolar and Chikkaballapur district were taken as the study area to study the constraints facing by the farmers of Kolar and Chikkaballapur district. Based on the highest percentage of overuse of Groundwater in each taluk in selected district of Chikkaballapura district, Chintamani and Gowribidanur taluks were selected. Based on highest percent of overuse of groundwater in taluks of Kolar district and also based on researcher convenience, Kolar and Bangarpet taluks were selected in Kolar district for the study. Five villages from each taluka were selected. A total of ten villages from each district were selected. From each village, nine farmers were randomly selected, out of nine farmers three were marginal farmers, three were small farmers and three were large farmers. Thus, making a total sample size of 180 comprising 60 marginal, 60 small and 60 large farmers from 10 villages. The respondents were asked to indicate the constraints they are facing to adopt the recommended farm level water conservation techniques in order to conserve and maintain the existing groundwater levels. The constraints classified, recorded and presented in frequency and percentage. The rank was assigned depending upon the higher percentage obtained for each problem. Suggestion as expressed by the farmers to overcome the constraints in adopting groundwater conservation practices are classified and presented in terms of frequency, percentage and ranks. Data were collected from 180 farmers which includes both bore well drilled farmers and non-bore well farmers during the months of August and September, 2021. The personal interview was conducted under informal atmosphere. The collected data were scored, quantified and analyzed using mean, frequency, Percentage.

### Result and Discussion

#### Constraints faced by the farmers in practicing Groundwater conservation

#### Constraints faced by the farmers in total in adopting groundwater conservation practices

Constraint faced by the farmers in adoption of groundwater conservation practices was operationalized as the factors that restricts the farmers to establish water conservation structure that would help to manage and increase the groundwater level at their farm level. Based on the review of literature constraints faced in adopting any measures in agriculture were classified in to five factors.

They were socio-economic constraints, technological constraints, situational/ environmental constraints, financial constraints, and institutional supply constraints. Respondents asked to indicate the agreement in the constraints in which they faced the difficulties. It was clear from the table 1, that the institutional supply constraints

ranked first with a percentage of 76.38 followed by technical (74.44%) constraints second, socioeconomic (72.77%) constraints third, situational (69.44%) constraints fourth, and the last financial (63.51%) constraints at fifth place.

**Table 1:** Ranking of constraints given by farmers

(n=180)

Sl. No.	Constraints	Percentage	Rank
1.	Socio-economic constraints	72.77	III
2.	Technical constraints	74.44	II
3.	Situational/ environmental constraints	69.44	IV
4.	Financial constraints	63.51	V
5.	Institutional constraints	76.38	I

\*multiple response

**Constraints faced by marginal, small and large farmers in practicing Groundwater conservation.**

Specific constraints faced by three categories of farmers marginal, small and large farmers under each factor with its frequency and percentage were tabulated (Table 2). Out of all constraints under socio-economic constraints, majority of small and large farmers (88.33% and 83.33%) expressed that Family labors are less supportive. Second constraints scarcity of farm labors were expressed by majority of the small farmers (91.67%). Lack of unity and cooperation among groundwater users were expressed more by marginal (83.33%) and small (76.67%) farmers. The fourth constraints Unwillingness of groundwater marketing among the farmers were expressed more by marginal (80.00%) and small (90.00%) farmers. Technical constraints list outs the constraints such as Fear of success of conservation techniques were expressed by all the marginal farmers (100.00%). Second constraints Large widening gap between irrigation potential created and utilized through conservation techniques were expressed almost equally by all marginal (88.33%), small (80.00%) and large (80.00%) farmers. Lack of awareness on the fact that water conservation not only saves water but also enhance productivity were expressed more by marginal farmers (70.00%). Majority of small farmers (80.00%) expressed Lack of trainings and demonstrations of water conservation techniques. Under situational/ environmental constraints first constraints on unprecedented monsoon leads to less scope to collect rainwater were expressed more by marginal farmers (96.67%), small farmers (93.33%) and large farmers (93.33%). Availability of small and fragmented land holdings were expressed more by marginal farmers (86.67%). Small farmers (66.67%) expressed that Adoption of water conservation structure obstruct the regular cultivation activities. Financial constraints include the constraints such as Financially not feasible / financially instable to adopt the conservation techniques were expressed majority by marginal farmers (71.67%). marginal farmers expressed Some conservation techniques are expensive (96.67%), Misuse of money for non-farming purposes were expressed more by small farmers (63.33%). Under the last factor, Institutional supply constraints

majority of marginal (100.00%) and small (91.67%) expressed Difficult procedure to get subsidies from Govt. for adoption of smart irrigation technologies. Lack of appreciation and incentives for using water judiciously were expressed equally by both marginal and small farmers (93.33%). majority of the large farmers expressed there is Lack of co-ordination between departments to bring the efficient ways to use water (80.00%) and Lack of transparency in planning and implementation (75.00%). The data in Table 3 shows the overall constraints faced by all the farmers in total in adopting groundwater conservation practices. Out of all the constraints unprecedented monsoon leads to less scope to collect rainwater ranks first (94.44%). Lack of appreciation and incentives for using water judiciously ranks second (86.11%). Third rank was given to Difficult procedure to get subsidies from Govt. for adoption of smart irrigation technologies (83.89%). Fear of success of conservation techniques and Large widening gap between irrigation potential created and utilized through conservation techniques were ranked fourth (82.78%). Fifth rank constraints were Family labours are less supportive (79.44%). Some conservation techniques are expensive were ranked as sixth (75.00%), Unwillingness of groundwater marketing among the farmers were ranked seventh (73.33%). Eight position was taken by Lack of unity and cooperation among groundwater users and Lack of trainings and demonstrations of water conservation techniques (72.22%). Lack of coordination between departments to bring the efficient ways to use water (71.67%) was ranked ninth. Scarcity of farm labours (65.56%) were ranked as tenth rank. Lack of transparency in planning and implementation were grouped as eleventh rank (63.89%). twelfth rank was given to Availability of small and fragmented land holdings (62.22%). Lack of awareness on the fact that water conservation not only saves water but also enhance productivity (60.00%) comes in rank XIII. Financially not feasible / financially instable to adopt the conservation techniques and Misuse of money for non-farming purposes (54.00%) were in fourteenth rank. Finally, rank XV was Adoption of water conservation structure obstruct the regular cultivation activities (51.67%).

**Table 2:** Constraints faced by marginal, small and large farmers in practicing Groundwater conservation. (n=180)

Sl. No.	Constraints*	Marginal farmers n <sub>1</sub> =60		Small farmers n <sub>2</sub> =60		Large farmers n <sub>3</sub> =60	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
<b>I. Socio- Economic constraints</b>							
1	Family labors are less supportive	40	66.67	53	88.33	50	83.33
2	Scarcity of farm labors	35	58.33	55	91.67	28	46.67
3	Lack of unity and cooperation among groundwater users	50	83.33	46	76.67	34	56.67
4	Unwillingness of groundwater marketing among the farmers	48	80.00	54	90.00	30	50.00
<b>II. Technological constraints</b>							
1	Fear of success of conservation techniques	60	100.00	52	86.67	37	61.67
2	Large widening gap between irrigation potential created and utilized through conservation techniques	53	88.33	48	80.00	48	80.00
3	Lack of awareness on the fact that water conservation not only saves water but also enhance productivity	42	70.00	36	60.00	30	50.00
4	Lack of trainings and demonstrations of water conservation techniques	44	73.33	48	80.00	38	63.33
<b>III. Situational/environmental constraints</b>							
1	unprecedented monsoon leads to less scope to collect rainwater	58	96.67	56	93.33	56	93.33
2	Availability of small and fragmented land holdings	52	86.67	45	75.00	15	25.00
3	Adoption of water conservation structure obstruct the regular cultivation activities	35	58.33	40	66.67	18	30.00
<b>IV. Financial constraints</b>							
1	Financially not feasible / financially instable to adopt the conservation techniques	43	71.67	35	58.33	20	33.33
2	Some conservation techniques are expensive	58	96.67	40	66.67	37	61.67
3	Misuse of money for non-farming purposes	35	58.33	38	63.33	25	41.66
<b>V. Institutional Supply Constraints</b>							
1	Difficult procedure to get subsidies from Govt. for adoption of smart irrigation technologies	60	100.00	55	91.67	36	60.00
2	Lack of appreciation and incentives for using water judiciously	56	93.33	56	93.33	43	71.67
3	Lack of co-ordination between departments to bring the efficient ways to use water	46	76.67	35	58.33	48	80.00
4	Lack of transparency in planning and implementation	35	58.33	35	58.33	45	75.00

\*Multiple response

### Suggestions given by farmers for the improvement of Groundwater source

Suggestions are the ideas put forward by the farmers to overcome the scarcity problem of groundwater and constraints they are facing to adopt various conservation practices. Farmers were asked to express their suggestions the different factors of constraints. Open ended questionnaire was used for data collections. All the farmers didn't give suggestions for all the constraint.

### Suggestions given by farmers for the improvement of Groundwater source according to their land holding

It is observed in Table 4 that the suggestion given by marginal, small and large farmers based on the level of constraints they were facing in adoption groundwater conservation practices in their farm land. The majority of

marginal farmers had given suggestion that Govt. should come up with initiatives keeping in view of demand side of groundwater (90.00%) , Subsidies on electricity need to be cut short and encourage on use of solar pump sets (90.00%), Provision of sufficient financial assistance for taking up water conservation structures (80.00%), Tank irrigation needs more concentration (76.67%), Groundwater user associations need to be made for sharing common problems and solutions (75.00%), and Adopting energy efficient irrigation pump sets to minimize repair and maintenance cost (75.00%). Greater percent of the small farmers (93.33%) have given suggestion that Groundwater user associations need to be made for sharing common problems and solutions and Govt. should come up with initiatives keeping in view of demand side of Groundwater.

**Table 3:** Overall ranking of Constraints faced by the farmers in practicing Groundwater conservation

(n= 180)

Sl. No.	Constraints*	Farmers		
		Frequency	Percent	Rank
<b>I. Socio- Economic constraints</b>				
1	Family labors are less supportive	143	79.44	V
2	Scarcity of farm labors	118	65.56	X
3	Lack of unity and cooperation among groundwater users	130	72.22	VIII
4	Unwillingness of groundwater marketing among the farmers	132	73.33	VII
<b>II. Technological constraints</b>				
1	Fear of success of conservation techniques	149	82.78	IV
2	Large widening gap between irrigation potential created and utilized through conservation techniques	149	82.78	IV
3	Lack of awareness on the fact that water conservation not only saves water but also enhance productivity	108	60.00	XIII
4	Lack of trainings and demonstrations of water conservation techniques	130	72.22	VIII
<b>III. Situational/environmental constraints</b>				
1	unprecedented monsoon leads to less scope to collect rainwater	170	94.44	I
2	Availability of small and fragmented land holdings	112	62.22	XII
3	Adoption of water conservation structure obstruct the regular cultivation activities	93	51.67	XV
<b>IV. Financial constraints</b>				
1	Financially not feasible / financially instable to adopt the conservation techniques	98	54.44	XIV
2	Some conservation techniques are expensive	135	75.00	VI
3	Misuse of money for non-farming purposes	98	54.00	XIV
<b>V. Institutional Supply Constraints</b>				
1	Difficult procedure to get subsidies from Govt. for adoption of smart irrigation technologies	151	83.89	III
2	Lack of appreciation and incentives for using water judiciously	155	86.11	II
3	Lack of co-ordination between departments to bring the efficient ways to use water	129	71.67	IX
4	Lack of transparency in planning and implementation	115	63.89	XI

\*Multiple response

Likewise, cent percent of large farmers have given suggestion that Govt. should come up with initiatives keeping in view of demand side of Groundwater. Further it can be assessed in Table 5 the suggestions provided by all the farmers, greater percent of farmers have expressed that Govt. should come up with initiatives keeping in view of demand side of groundwater (94.44%).

nearly eighty five percent of farmers suggested for Tank irrigation needs more concentration. Groundwater user associations need to be made for sharing common problems (78.89%) farmers were expressed this suggestion. Subsidies on electricity need to be cut short and encourage on use of solar pump sets (76.11%) were the some of the major suggestions expressed by the farmers to overcome the problem to adopt the groundwater conservation practices.

**Table 4:** Suggestions given by marginal, small and large farmers for the improvement of Groundwater source.

(n=180)

Sl. No.	Suggestions*	Marginal farmers n <sub>1</sub> =60		Small farmers n <sub>2</sub> =60		Large farmers n <sub>3</sub> =60	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
1.	Adoption of Conservation techniques should be made compulsory for the heavy water user crops growers.	25	41.67	32	53.33	34	56.67
2.	Groundwater user associations need to be made for sharing common problems and solutions	45	75.00	56	93.33	41	68.33
3.	Govt. should come up with initiatives keeping in view of demand side of Groundwater	54	90.00	56	93.33	60	100.00
4.	Should encourage more in rainwater harvesting for GW recharge	23	38.33	28	46.67	35	58.33
5.	More initiatives towards watershed development and rejuvenation of irrigation tanks need to be taken	20	33.33	34	56.67	32	53.33
6.	Adopting energy efficient irrigation pump sets to minimize repair and maintenance cost	45	75.00	50	83.33	25	41.67
7.	Subsidies on electricity need to be cut short and encourage on use of solar pump sets	54	90.00	50	83.33	33	55.00
8.	Diversification of high value and less water intensive horticultural crops with best technological package.	32	53.33	30	50.00	47	78.33
9.	Tank irrigation needs more concentration	46	76.67	53	88.33	55	91.67
10.	Encourage farmers on testing and check on quality of groundwater regularly	23	38.33	16	26.67	20	33.33
11.	Provision of sufficient financial assistance for taking up water conservation structures.	48	80.00	42	70.00	32	53.33

\*Multiple response

**Table 5:** Suggestions given by farmers for the improvement of Groundwater source

(n=180)

Sl. No.	Suggestions*	Farmers	
		Frequency	Percent
1.	Adoption of Conservation techniques should be made compulsory for the heavy water user crops growers.	91	50.56
2.	Groundwater user associations need to be made for sharing common problems and solutions	142	78.89
3.	Govt. should come up with initiatives keeping in view of demand side of Groundwater	170	94.44
4.	Should encourage more in rainwater harvesting for GW recharge	86	47.78
5.	More initiatives towards watershed development and rejuvenation of irrigation tanks need to be taken	86	47.78
6.	Adopting energy efficient irrigation pump sets to minimize repair and maintenance cost	120	66.67
7.	Subsidies on electricity need to be cut short and encourage on use of solar pump sets	137	76.11
8.	Diversification of high value and less water intensive horticultural crops with best technological package.	109	60.56
9.	Tank irrigation needs more concentration	154	85.56
10.	Encourage farmers on testing and check on quality of groundwater regularly	59	32.78
11.	Provision of sufficient financial assistance for taking up water conservation structures.	122	67.78

\*Multiple response

**Conclusion**

It is a need of the hour to make farming communities understand groundwater science, demystifying it and helping these communities to use the information for proper decision making. Thus, this gravity of the groundwater scarcity problem were treated as Socio- Economic constraints, Technological constraints, Situational/environmental constraints, Financial constraints, Institutional Supply Constraints, in these category of constraints according to farmers of kolar and chikkaballapur district Institutional Supply Constraints and Technological constraints were majorly ranked , hence there is a need of technological change and external change to take up any change at village level. Farmers also suggested for the Provision of sufficient financial assistance for taking up water conservation structures and Govt. should come up with initiatives keeping in view of demand side of Groundwater. hoping these changes would taken into consideration and make the use and conservation of groundwater for our future generations.

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