An Analysis of Constraint Faced by the Farmers in The Way of Diffusing Contemporary Water Management Innovations (CWMI) in Similar Agro-Ecological Conditions

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ABSTRACT

Primarily, dryland agro-ecosystems in all states of India were generally a neglected lot. During the years of agricultural development and Green Revolution, undue emphasis on irrigated agriculture and food security of cereal food grains, the drylands were not given adequate support. When regional differences began increasing the gap between drylands and irrigated areas too began widening. Continued neglect of any development initiatives and lack of policy on efficient and judicious use of ground water resources, farmers in drylands were left to fend for themselves and the problems of water scarcity loomed large and resulted in agro-ecological crisis. Now there are several district which became drought-prone and need ameliorative actions in water harvesting, storing, saving and sharing among dryland farmers. In this study, it has been mentioned that in the previous section, that farmer respondents have ardently adopted all the innovations related to water management in drylands, i.e., water harvesting, water budgeting, water sharing and water saving through using micro-irrigation systems, and adopting soil moisture conservation agronomic practices. Case study has also provided evidence that farmers get ample benefits in forming water sharing groups for assured crop yields. In such dryland regions, in order to diffuse these water management innovations among farmers in similar dryland agro-ecosystems, the questions that may arise include: What constraints would come in the way to achieve this? To answer this question, opinions were sought from experts and their consensus was achieved through Delphi technique. The major finding were: Constraints in the way of diffusing CWMIin similar agro-ecosystem were found to be community mobilization and convincing farmers for group actions.

Key words: *Constraints; Delphi technique; CWMI; Agro-Ecological Conditions;*

Ananthapur District is one of the most backward districts in India because of agro-ecological crisis. It is essentially an arid, drought-prone and entirely agrarian economy. In agriculture the main constraint is lack of irrigation facilities (ground water crisis) (*Elliott, et al. 2014*). About 90 per cent of 27.5 lakh acres under cultivation is rainfed and chronically drought-prone (*NRAA.2012*). Further, the industrial development is just next to zero and no industrial employment opportunities. So the rural livelihoods are grossly inadequate for the rural population and the available livelihoods are also highly vulnerable. The Ananthapur challenge calls for a concerted effort by multiple organisations and actors such as Government, media, civil society organisations, private industries, research bodies, and educational institutions. It calls for affirmative policy decisions and programmes from Government side. To think that NGOs or any one kind of organisation alone can address the challenge would be a fallacy. For e.g. NGOs can never be equipped to address the issues of key policies and programmes like irrigation or industrialization, which only Government can address (*Anonymous, 2018*). Nor NGOs can diffuse the effective programmes to the desired level. However, the NGO can develop and demonstrate in the field the effective programmes, practices and systems that are sustainable and diffusible

and lobby with Government for their diffusion. NGOs, can also play a key role of catalyzing, organize people, mobilize people's participation, participate and activate a constructive policy discourse, create convergence of actors, institutions and roles etc. (Action Fraternal Ecology Center, 2017). In this paper to address the constraints a three round consensus were taken to fetch the actual situation are presented here.

METHODOLOGY

The Delphi procedure consists of a series of steps undertaken to elicit andrefine the perspectives of a group of people who are either experts in the area offocus or representative of the target group (*Rothwell and Kazanus, 1997*). The firststep is to select the panel or participants. The second step is developing structuredquestionnaire based on the problems to be investigated, or unstructured, in which anopen-ended invitation to comment on the issues of interest is distributed individuallyto the participants. The information generated is processed and used by theinvestigating team to develop a subsequent more focused questionnaire, which isdistributed together with the results of the previous round to participants in the thirdstep of the procedure. This process of synthesizing data and refining thequestionnaire continues until there is a convergence of perspectives amongparticipants (*Lang, 1998*).

Measuring degree of consensus: The questionnaire for the first round of Delphi was developed by the experts, scientist and extension functionaries after reviewing the existing literature, job description of the experts, scientist and extension functionaries and discussing with the Research Advisory Committee members.

Questionnaires for second round were developed from the responses of first round of Delphi using constant comparative method. Subsequently, the questionnaire for round III (developed using the responses from the round II) was administered in the same manner as in previous two rounds. The data were collected from the experts through questionnaire and electronic mail method.

Furthermore, consensus was said to be high when quartile deviation was less than or equal to 0.5 and IQR less than or equal to 1, medium when quartile deviation was in between 0.5 and 1 and IQR greater than 1 but less than 2 and low consensus if quartile deviation is more than 1 and IQR more than 2. The important levels were: high in which the median value is 4 and above, while medium in which the median value is 3 and low when medium value is less than 3.

In this study, the Delphi technique was used to arrive at consents of various experts working in water science and technology on the constraints coming in the way of diffusing the water management innovations among farmers in similar agro-ecological conditions.

RESULTS AND DISCUSSION

Technological constraints: The results technique on technological constraints are given in Table 1. As can be seen, the most important constraints turned out to be lack of research rain water harvesting and rain water use efficiency by agricultural scientists and No research on social institutions, community mobilization for managing common property resources. In fact, these water management innovations demand participation by all the farmers as harvesting rain water requires group actions by all in a concerted manner. Similarly, forming community based organisations (CBOs) is essential for managing these common properties of ground water resources. In addition, many of the water related innovations were at the level of individual adoption. But innovations need to be generated for community adoption on a large scale, for ground water management.

Socio-political constraints : Since ground water resources are available for the whole society in a village, the socio-political dynamics play a crucial role in equitable access to ground water resources. These constraints are presented in Table 1.

Over the years, farmers in dryland villages have lost their vast store of traditional wisdom of contingency crop planning, indigenous technical knowledge of mulching, and other means of survival in arid climates. They have also neglected the existing soil and water conservation structures like check dams. Local administrative bodies like Gram Panchayats too did not give any encouragement to maintenance of community water bodies and for promoting water percolation pits, soaking pits and farm ponds. Socio-political dynamics of dominance and oppression have resulted in social exclusion of poor and *dalits* on sharing common property resources of villages. These constraints were considered important for diffusing water management innovations.

Table 1. Constraints coming in the way of diffusing water management innovations in similar dryland agro-ecosystems (N=23)

Technological constraints	Median	Q1	Q3	IQR	QD	Remark
Lack of ground level area specific information on ground water status at village level and matching data from remote sensing satellites	3	3	5	2	1	LH
No research data on efficacy of complete package application of all innovations of harvesting, conserving, sharing and micro-irrigating large crop fields	5	4	5	1	.5	HH
Lack of research on water supply devices and efficacy leading to innovative and affordable technologies	5	4	5	1	.5	HH
No research on rain water harvesting and rain water use efficiency by agricultural scientists	4	4	5	1	.5	HH
No research on social institutions, community mobilisation for managing common property resources	4	4	5	1	.5	HH
Socio-Political constraints						
Erosion of traditional wisdom, indigenous knowledge, social values, social capital in societies of dryland villages	5	4	5	1	.5	HH
Social exclusion of resource poor farmers on lines of *dalit*, caste and backwardness	4	4	4	0	.5	HH
Lack of encouragement of community water bodies with support of local administration.	5	4	5	1	.5	HH
Neglect of existing soil and water conservation structures and their regular maintenance	4	3	4	2	1	HM
Lack of interest in promoting water percolation pits, soaking pits and farm ponds by Gram Panchayats and block administration	5	4	5	1	.5	HH
Socio-political dynamics of dominance and oppression on sharing common property resources of pasture lands, water bodies and ground water resources	4	3	4	1	.5	HH
Socio-psychological constraints						
Lack of knowledge and practical experience in practicing scientifically water management practices, crop-water budgeting and understanding hydrological cycle	4	4	5	1	.5	HH
Non-cooperation of bore well owners for water sharing with other farmers.	4	4	5	1	.5	HH
Lack of conviction in the innovations of water harvesting, saving and sharing as these practices seem *very strangely new.*	4	4	5	1	.5	HH
Lack of initiative and hope of success in farming and running water sharing group as social institutions.	4	3	4	1	.5	HH
Doubts on accountability and responsibility of water sharing group for care and maintenance of water storage structures and distribution pipelines	5	5	5	0	0	HH
Administrative and policy constraints						
Lackadaisical (apathetic) approach of policy makers towards management of valuable ground water resources of the country.	5	5	5	0	0	HH
Lack of innovative social regulation programmes and suitable agency for construction and maintenance of community level water harvesting infrastructure and sharing systems.	4	3	4	1	.5	HH
No government initiative for provision of robust technology, infrastructure and research and development support to rainfed systems	3	3	4	2	1	MH
Lack of mixed approach of penalty and incentives for community (as well as at individual level) for water harvesting sharing, and saving.	4	4	4	0	0	HH
Very difficult to mobilize community for participatory ground water management and for formation of water users' association.	5	4	5	1	.5	HH

**HH*-high consensus with high importance, *MH*-medium consensus with high importance, *LH*- low consensus with high importance, *HM*-high consensus with medium importance,

Socio-psychological constraints : The socio-psychological constraints are given in Table 1. At the individual level, i.e., at socio-psychological level, the constraints like individual ignorance and fears play a role as constraints, which comprise the socio-psyche of the villagers. Lack of knowledge on the crucial details of water harvesting and micro-irrigation techniques and lack of conviction on the efficacy of these water management innovations pose as great constraints in dealing with motivating farmers for adoption of these new innovations on water management. Doubts on the issues of social responsibility and accountability due to their past experiences of lack of faith also act as constraints. Non-cooperation of bore well owners and lack of initiative among young farmers in forming water sharing groups were other constraints perceived by the experts, scientists and extension functionaries and NGO activists.

Administrative and Policy Constraints: Constraints related to administration and policy issues are given in Table 1. In designing and implementing innovative programmes of water sharing groups and water harvesting and using through micro-irrigation techniques, few administrative constraints may arise. These constraints need attention of extension functionaries.

CONCLUSION

The administrative constraints were: lack of innovative social regulation programmes and suitable agencies for construction and maintenance of community level water harvesting infrastructure in the dryland villages and lack of mixed approach of penalty and incentives for community (as well as at individual level) for water harvesting sharing, and saving. In addition, it was found to be very difficult to mobilize community for participatory ground water management and for formation of water users' associations in villages. At the policy level, the apathetic approach of policy makers towards management of valuable ground water resources was another constraint. No government initiative was taken for provision of robust technology, infrastructure and research and development support to rainfed systems.

At the outset, the major constraints were: lack of research information on rain water use efficiency, lack of focus on research on community mobilization of managing common property resources of ground water. The socio-political constraints were social exclusion of poor farmers and lack of attention for maintenance of water harvesting measures at Gram Panchayat level. The issues of generating conviction among farmers on the efficacy of water saving technologies and water sharing institutions were socio-psychological constraints. Lack of Government support for innovative social regulation programmes of water sharing and saving was another constraint.

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