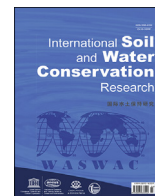




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Original Research Article

Institutional performance and participatory paradigms: Comparing two groups of watersheds in semi-arid region of India

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ABSTRACT

Watershed development programmes carried out in different agroclimatic conditions in India resulted in beneficial impact in terms of productivity enhancement and natural resources conservation, but less attention paid to institutional and participatory aspects. This paper explored the performance of various institutions regarding execution of watershed development programmes in semi-arid region of India. Recorded observations from documents maintained at watershed level and information collected through primary survey as well as focus group discussion with different types of stakeholders were used for analysis. The results indicated lacunae in participatory aspects during programme implementation process like monitoring activities, management of common property resources and equity. Gap in linkages and differential level of performance of various watershed level functionaries indicates the necessity for corrections in the structures and linkages pattern for sustainability of the infrastructure and institutions. The study also showed unequal priorities by the implementing agencies towards institutions, land and water resources development, production enhancement activities and fodder resources development as well as rationalities of technical, economic, financial, political and social aspects among the watersheds.

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1. Introduction

Since 1990s, watershed development (WSD) programmes stands as one of the massive and effective rural development initiatives in India with substantial budget outlay. Major investments have been made from public sources through government organizations (Gray & Srinidhi, 2013), though voluntary organizations and non-governmental organizations (NGOs) are also implementing watershed development programmes in various parts of India. During 1990's and 2000's, Indian Rupees (INR) 77 billion (1.04 billion US\$) were spent on WSD programmes. Due to evolving importance, the World Bank has also sanctioned US\$ 1.73 billion during 1990–2004 (Darghouth, Ward, Gambarelli, Styger, & Roux,

2008), and Government of India has spent more than US\$ 6 billion during the period 1996–2004 (World Resources Institute, 2005). During recent years, the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), with an annual budget of INR 400 billion (5.41 billion US\$), is being mingled with the WSD programmes in various states to synergize and augment their impact to development, and it has immensely increased the significance and backing of WSD programmes in India (Jain & Gandhi, 2016). Such huge investment made during last few decades certainly calls for assessment of the impact and other necessary paradigms.

Currently, watershed development projects are implemented through diverse group of institutions, which include the

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government organizations (GOs) like state government departments and *panchayat raj* institutions (PRIs) and non-governmental organizations (NGOs). The NGOs were found to enjoy greater freedom in choosing their area of work (Farrington, Turton, & James, 1999; Fernandez, 1994; Kerr, 2002). Though several NGOs are working in diverse agroclimatic zones of the country, rarely does one NGO take up watershed projects in totally different agroclimatic situations at the same time. Furthermore, they choose watersheds, where there are greater scope of land as well as non-land based activities. For example, Mysore Resettlement and Development Agency (MYRADA), an NGO that has had extensive experience in land and water development programmes in southern India prefers villages with less landless people (Fernandez, 1994). Farrington et al. (1999) indicated that usually NGOs and donor agencies look for watersheds where there is less of social stratification and administrative boundaries of the villages coincide with the watershed boundaries. Hence, it is said that NGOs are 'choosy' in their selection of watersheds (Reddy, 1998). The watershed projects implemented by the government agencies invariably have to tackle a large agroclimatic landscape with varied spread and features, partly by following the guidelines and sometimes due to compelling socio-political pressure. Hence, evaluation of differential impact has to see from the inherent structures/characteristics of the organizational set up for the purpose.

Evaluation studies carried out for past as well as new generation watersheds located in different agroclimatic situations and it was indicated mostly positive externalities through productivity enhancement besides conservation of natural resources (Joshi, Jha, Wani, Joshi, & Shiyani, 2005; Kerr, Pangare, & Pangare, 2002; Mondal et al., 2017; Pal et al., 2017; Palanisami & Kumar, 2009; Reena, Siwach, & Singh, 2019; Samra & Sharma, 2009). Adoption of soil and water conservation approaches arrests surface run-off water, which become prime source during dry spells in rainfed semi-arid regions (Wani et al., 2008). Pathak, Chourasia, Wani, and Sudi (2013) reported several benefits from the watershed development program in terms of availability of water, reduction of soil loss, enhanced agricultural productivity, income and environmental/ecological status as well as socioeconomic well-being of the households. There are also quite a few studies, which underlined the advantage of participatory watershed development programmes and identified the factors which are responsible for sustainable watershed development through people's participation (Bagdi & Kurothe, 2014; Mondal, Singh, & Sekar, 2013; Sharma & Sisodia, 2008). There is no difference of opinion about the beneficial impact of watershed projects, but the varied nature of interventions and its implementation procedures under different programmes/schemes like Drought Prone Areas Programme (DPAP), National Watershed Development Project for Rainfed Areas (NWDPA) and Integrated Wasteland Development Programme (IWDP), certainly had differential impact of the project. Most of the earlier watershed projects laid more stress on the nature of works being carried out rather than on the extent and efficiency of resource enhancement that the particular work is supposed to bring about (Vaidyanathan, 2001). Even though few workers have attempted earlier to understand the institutional arrangements (Kurian, 2004; Mondal et al., 2015; Saravanan, 2002; Tanguilig & Tanguilig, 2009), interaction and linkages among various stakeholder groups in the watershed development programmes were not addressed adequately. Therefore, it was imperative to study the role performance of different institutions in the process of watershed development programmes. This paper evaluated the watershed development programmes that had been implemented under different institutional structures and agencies (government department vs. NGOs) under semi-arid situations and the programmes were assessed in terms of participatory and institutional dimensions.

2. Methodology

2.1. Study area and sample

Geographically, about 17% and 36% of total land area of the country comes under arid and semi-arid regions, respectively (Government of India, 2004; Sathyakumar and Sivakumar, 2007), which is characterized by low and inconsistent rainfall, recurrent droughts and different types of vegetation and soils. Amongst different rainfed areas, semi-arid regions are most vulnerable (Kumar, Raizada, Biswas, Srinivas, & Mondal, 2016) and the states which are accommodating in semi-arid region include Andhra Pradesh and Karnataka and parts of Gujarat, Madhya Pradesh, Chhattisgarh, Maharashtra, Rajasthan and Tamil Nadu. The proportion of rainfed agriculture is about 73% in above-mentioned states, of which the two states (Karnataka and Andhra Pradesh) contribute around 40% (Bhatia, 2005). The crops grown mainly in this region include coarse cereals like jowar, bajra and ragi; pulses like bengalgram and horsegram and oilseed crops like groundnut and sunflower. Per hectare yield are low in rainfed areas of semi-arid regions and the instability in both area and yield for most of the crops in these states is much higher than the all-India average. Further, the semi-arid areas have been subject to degradation of natural resources at different scales caused by the soil erosion, depletion of forests and declining common pool resources (Kumar et al., 2016; Mondal, Loganandhan, & Raizada, 2014; Raizada et al., 2018).

Most of the parts of Andhra Pradesh and Karnataka falls under semi-arid tracts, hence, these two states were selected and one district each, viz. Bellary (Karnataka) and Anantapur (Andhra Pradesh) were chosen purposively because of typical representation of semi-arid region like low soil depth, high run-off/soil loss and low average rainfall (Mondal et al., 2014). In a district, one watershed each implemented under government organization (Lottinekere and Mangampally watershed) and NGO (Kalvi and Mallapuram watershed) were selected for detailed investigation. A brief outline of the characteristics of selected watersheds is presented in Table 1. The area of selected watersheds ranged between 500 and 864 ha. Average rainfall varied between as low as 350 mm to maximum of 587 mm and rainfed area varied between 75 and 96% of the arable area. Sorghum, bajra, sunflower, groundnut, cotton and sesamum are major crops grown in the area with lower yields that ranges from 0.8 t ha⁻¹ in case of cereals, 0.6 to 0.8 t ha⁻¹ in sunflower and 0.5 t ha⁻¹ in groundnut.

Stakeholders are the actors or groups who affect and/or are affected by the policies, decisions and actions of the any developmental programme (Nuga, Akinbola, & Nuga, 2009). There exists two groups of stakeholders in this study, the first group includes members of project implementing agency (PIA), watershed development team (WDT) and, representatives of various community-based organizations like watershed committee (WC), self-help groups (SHGs) and user groups (UGs) as well as various line department officials associated with the watershed programme (Table 1). Another group of stakeholders are the beneficiary households, who directly could be affected by the externalities, either positively or negatively. Two representatives from each of the stakeholder institutions under first group and fifteen beneficiary households with representation of various land-holding size classes under second group from each micro-watershed village were chosen as respondents for the study.

2.2. Data and analysis

2.2.1. Participatory paradigms

Documented observations (from records maintained at watershed office) as well as information on various participatory

Table 1
Profile of the selected watersheds and number of sample respondents.

Particulars	Karnataka		Andhra Pradesh	
	Kalvi	Lottinekere	Mallapuram	Mangampally
Implementing agency	SNEARDS ^a , Hadagali	DWDO ^b , Bellary	RDT ^c , Anantapur	Multi-Disciplinary Team ^d
Duration of implementation	2000-01 to 2008-09	2001-02 to 2009-10	2000-01 to 2005-06	2005-06 to 2010-11
Average annual rainfall (mm)	531	587	350	540
Treated area (ha)	500	500	864	500
Rainfed area (%)	75	87	83	96
Villages covered	Kalvi; Bhanayana, Dungabati, and Beethana Tanda	Lottinekere and Hyalya Hampapur	Mallapuram	Mangampally
Households (no.)	465	435	246	128
Major crops	Sorghum, bajra, sunflower, maize, hybrid cotton and groundnut	Bajra, red gram, groundnut, maize sesamum, sunflower and sorghum	Groundnut, red gram, rage and sunflower	Groundnut, red gram, ragi and sunflower
Stakeholder group – I (Members of PIA, WDT, SHGs and UGs)	16	18	20	20
Stakeholder group – II (Beneficiary households)	15	15	15	15

Notes.

PIA: project Implementing Agency; WDT: Watershed Development Team.

SHGs: Self-Help Groups; UGs: User Groups.

^a Sri S. Nijalingappa National Education and Rural Development Service Trust (SNEARDS): An NGO based at Hadagali, Bellary district of Karnataka state, engaged in village development programmes including watershed development.

^b District Watershed Development Office (DWDO): District level office responsible for watershed development programmes.

^c Rural Development Trust (RDT): An NGO based at Anantapur district of Andhra Pradesh state, carrying out welfare and integrated programmes of development.

^d Watershed Development Advisory Committee at the district level which consists of specialists from different disciplines of government departments, voluntary agencies and research and training institutions.

indicators collected through primary survey of first group of respondents were used for analysis of various participatory aspects. For judging the priority given to different components of the watershed programmes, 80 questions framed by Dogra, Tripathi, Sharda, and Dhyani (2005) covering all aspects of participatory watershed development were used. These 80 questions were further grouped into ten individual categories based on the broad aspects of participatory watershed development programmes for assessing the preferences for particular components. Based on the response of field level functionaries of a particular watershed development project, a score (1: Yes or 0: No) for each of 10 major components was estimated by summing up the positive response with respect to individual component. A participation paradigm index (PPDI) for each watershed was estimated for each major component as:

$$PPDI = \frac{\text{Obtained score}}{\text{Maximum score}} \times 100 \quad (1)$$

Before data collection, the questionnaire was sent to about 15 experts to assign weights. The assigned weights were averaged, ranked and put final weight from 10 to 1 in descending order. The obtained score was then multiplied by final weight and a maximum weighted score was estimated for each of 10 major components. For evaluation in terms of all 10 major components, a participatory watershed development index (PWDI) was estimated as:

$$PWDI = \frac{\sum_{i=1}^{10} \text{Weighted score}}{\sum_{i=1}^{10} \text{Maximum weighted score}} \times 100 \quad (2)$$

Following Dogra et al. (2005), each of the categories of participatory paradigms were rated from “excellent” to “poor” (Table 2).

2.2.2. Stakeholder analysis and their interactions

To understand the institutional arrangements of watershed development programmes, information from both secondary as well as primary sources were collected and analysed. Formal and informal institutional arrangements were explored from various sources such as watershed guidelines (MoRD, 2001); detailed

project reports (DPRs) and other records/documents maintained by watershed functionaries. Data collected by primary survey using structured interview schedule as well as conducting focus-group discussions with the first group of stakeholders. Information on roles and responsibilities of various organizations and their linkages were collected by using different stakeholder analysis tools/matrices (e.g. stakeholder role matrix and stakeholder linkage matrix). Stakeholder role matrix exercises were conducted with respect to selected activities for each type of stakeholders and rating was given as good, moderate and poor performance based on the responses of beneficiary farmers as respondents. Stakeholder linkage matrix was developed with responses from different stakeholder institutional groups separately and indicated whether linkages are structural, functional or both and the intensity of linkages in terms of poor, moderate and good (Nuga et al., 2009; Sreedevi et al., 2008).

2.2.3. Priority and rationality analysis

Personal interview of second group of respondents comprising beneficiary households were conducted using structured schedule to obtain information for judging the priority and rationality of various activities taken up during implementation as well as post-project sustainability after withdrawal. They have been asked to respond to questions with two-point scale (agree/disagree) regarding priority of PIA in respect of development of local institutions, land and water resources development, fodder/grassland development, production enhancement activities, employment

Table 2
Rating of participation paradigm index (PPDI) and participatory watershed development index (PWDI).

S.No.	Category	PPDI/PWDI
1	Excellent	>90
2	Very Good	80–90
3	Good	50–80
4	Fair	20–50
5	Poor	<20

generation activities or equity aspects during implementation of the programme and categorized as high, medium and low. Further, for judging the importance given to organizational, social, technical, economic, financial and political issues addressed during implementation of each of the watershed programmes. The second group of respondents were asked to response the questions with a five-point scale regarding various rationality issues during the implementation of the watershed development programmes. The following rationality indicators (Gandhi, 2010) were used.

- Organizational rationality, which deals with the organizational and coordination issues.
- Social rationality, which deals with the social or people setting that include caste groups, farmers with different landholding sizes, people with various professions, women and poor people.
- Technical rationality, which deals with the conversion of inputs into outputs efficiently. Good institutions are equipped with best/appropriate technology and operational procedures that lead to high productive efficiency.
- Economic rationality, which deals with the consideration of costs, benefits and returns and involves the economically efficient use of scarce resources.
- Financial rationality, which deals with the discipline and care that required for proper handling of financial resources as strong procedures and accounting systems need to exist for effective use of resources for the intended purposes and not misused or lost.
- Political rationality, deals with the involvement and participation of various leaders and power/interest groups in the formulation of rules and plans, and the settlement of differences/disputes that may arise during the course of watershed development programmes.

3. Results and discussion

3.1. Institutional arrangements and fund flow mechanism in watershed development programme

In Karnataka, since 2001 a separate Watershed Development Department exist, which is headed by a Commissioner and assisted by Director of Watershed and Joint Director of different other departments. At the district level, District Watershed Development Officers are the authority to implement the programmes, who are assisted by a multi-disciplinary team under the overall control/supervision of District Rural Development Agency (DRDA) (Fig. 1). In Andhra Pradesh state, the Watershed Project Implementation and Review Committee is the apex body which is headed by the Chief Secretary and supported by Additional Chief Secretary, Agricultural Production Commissioner and Development Commissioner of the state and Department of Rural Development is the nodal agency. District Water Management Agency (DWMA) which is headed by a Project Director is apex body at District level and *zilla panchayat* is the nodal agency. Administration and implementation of watershed development projects lies with the *zilla panchayat*, who receive funds from Government of India and hold the ultimate power of administrative and financial control over PIAs and managing the accounts. A Multi-Disciplinary Team (MDT) or Watershed Development Advisory Committee at the district level also exists, which consists of specialists from different disciplines of the Government in DRDA, voluntary agencies and research and training institutions at the district level.

At the watershed level, group of members from the village community, who indirectly or directly use watershed resources to meet their livelihood needs from farming or other activities, is formed and registered as Watershed Association (WA). The WA,

nominate one President and other office bearers during a general body meeting with the representation of SHGs, UGs, women and scheduled caste (SC)/scheduled tribe (ST) and *gram panchayat* (GP) members and form a Watershed Committee (WC) for coordination and execution of different activities. WC received the fund directly from Government of India through DRDA and the WC and WA used to make responsible for managing these funds. The WC allocate the funds to SHGs as revolving fund, to user groups for developing natural resource linked asset base, and so on. The capacity building of watershed level institutions used to be done by the watershed development team (WDT). The voluntary contributions, made by the UGs are to be accumulated to form a watershed development fund, meant for maintenance and management of natural resource base/assets of the village.

3.2. Complementarity and convergence of institutions and programmes

The new generation of watersheds sanctioned since 2008–09 is implemented under a single programme namely Integrated Watershed Management Programme (IWMP) following 'Common Guidelines (2008)' (Government of India, 2011). A state level nodal agency (SLNA) constituted of representatives from Rural Development Department, National Rainfed Area Authority (NRAA), NABARD and Department of Agriculture, Animal Husbandry, Ground Water Board, NGOs and professional experts from research institutions for managing and coordinating the different activities and fund-flow for watershed programmes in the state.

Government of India intended to develop a new project model in order to congregate the IWMP with the ongoing Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA), as more than 50% of MNREGA works relate to land based activities, more specifically, soil and water conservation works. As such the funds available under watershed development project are insufficient to treat a watershed fully, hence the convergence with other development programmes helps not only to supplement resources for holistic treatment but will also complement other development programmes. Under MNREGA, most of the watershed-based interventions are permitted; however, there is neither any specific cost norms for per unit area as in watershed development project, nor unit cost of work or activity. Therefore, the unit cost for works/activity in the watershed project area funded by MNREGA used to be as per IWMP norms. Where convergence between MNREGA and a watershed programme funded by department of land resources (DoLR) is envisaged, the activities to be undertaken by MNREGA to be identified by the Programme Implementing Agency (PIA) preparing the detailed project report for the watershed programme.

3.3. Participation paradigms

Participation paradigm index (PPDI) for the major components of watershed development programmes and an overall participatory watershed development index (PWDI) for all the selected watersheds were estimated. The results indicated that the participation rate was higher in NGO implemented watersheds which might be due to better relation of NGO people with watershed community and groups which are existing prior to implementation (Table 3). In all the selected watersheds, high priority was given for watershed plan preparation though most of them were not technically sound with subject matter specialists; however, they had a better previous experience in watershed plan preparation and execution with better social mobilization capability. In GOs implemented watersheds (Lottinekere and Mangampally), the PIA comprised of members from various government departments and was technically sound and capable of good plan preparation for

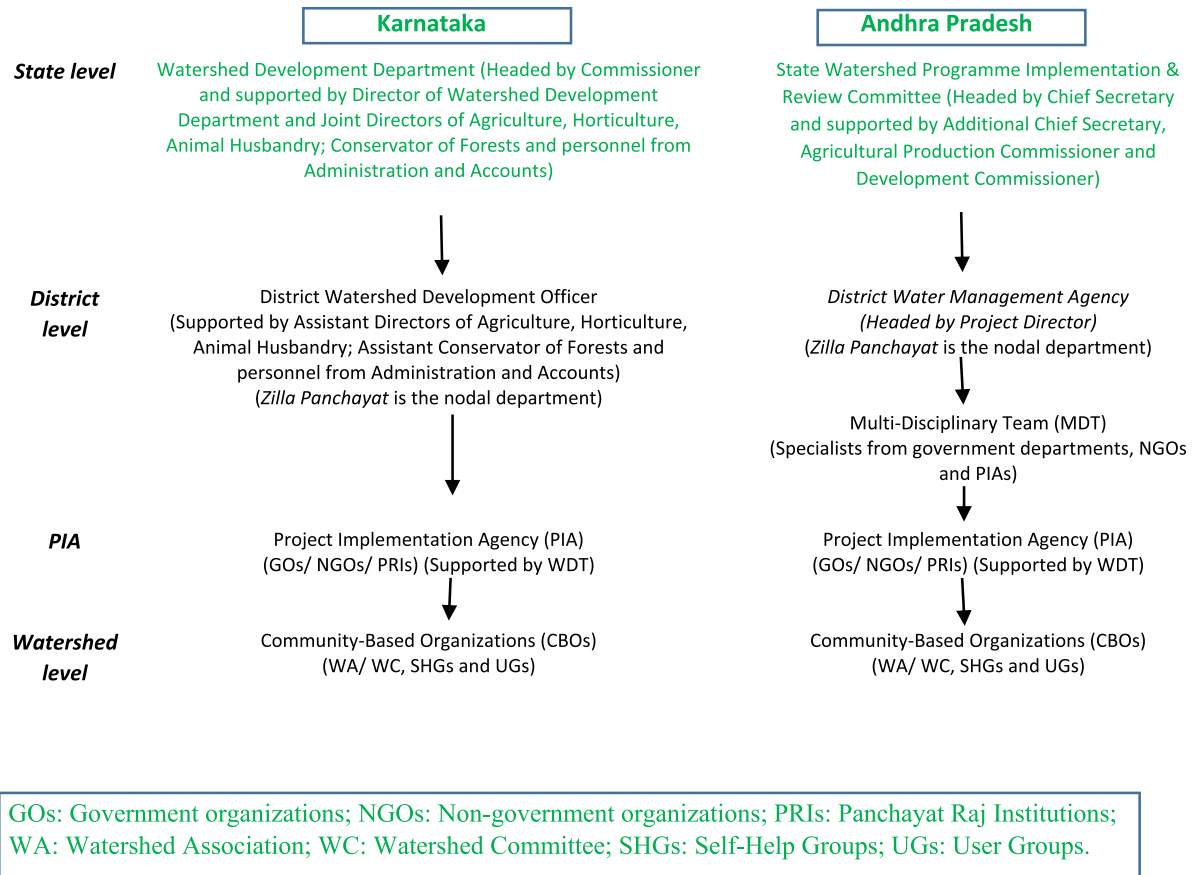


Fig. 1. Institutional structure of watershed management programmes in Karnataka and Andhra Pradesh state.

Table 3 Participation paradigm indices (PPdIs) and Participatory Watershed Development Index (PWDI) of selected watersheds in Karnataka and Andhra Pradesh (in %) as rated by respondents from community-based organizations.

Major Components	Kalvi (PIA: NGO)	Lottinikere (PIA: GO)	Mallapuram (PIA: NGO)	Mangampalli (PIA: GO)
Participation (15)	86.7	46.7	73.3	58.3
Transparency (15)	66.7	66.7	71.7	65.0
Watershed Plan Preparation (7)	85.7	85.7	75.4	60.7
Watershed Stakeholders Institutions (9)	77.8	55.6	61.1	30.6
Watershed Meetings & Accounts Records (10)	70.0	40.0	67.5	56.3
Monitoring (6)	16.7	33.3	50.0	50.0
Common Property Resource Management (9)	22.2	33.3	44.4	38.9
Project Implementing Agency (2)	50.0	50.0	50.0	70.0
Watershed Development Team (3)	100.0	100.0	58.3	58.3
Equity (4)	50.0	25.0	50.0	54.2
PWDI	70.1	54.8	67.3	55.2

Notes.

- Components of participatory indicators arranged in descending order of final weights from 10 to 1.
- Figures in parenthesis indicates number of questions as well as maximum score under each component.

solving problems prevailed in the area through watershed-based interventions. The Mallapuram watershed executed by a reputed NGO (Rural Development Trust, Anantapur) and was capable of mobilizing people and integrated them into various activities of watershed development programmes. The number of various stakeholders' institutions was higher that yielded higher participation index for NGO implemented programmes compared to GOs implemented programmes.

The transparency in implementing different activities by both NGO and GOs were found to be satisfactory as indicated by higher index, which in fact, is necessary for crafting sustainable institutions (Blair, 1996). In Kalvi and Mallapuram watersheds,

number of meetings conducted with beneficiaries including maintenance of records and accounts was higher than their counterparts at Lottinikere and Mangampalli watershed. All the activities of watershed programme were carried out with confidence of stakeholders and also the accounts/records were maintained well. In Lottinikere watershed, few meetings were conducted and almost all the watershed activities were implemented as per the norms with less discussion among the watershed committee members. However, accounts were maintained correctly. All the selected watershed projects-initiated activities with standard action plan by adhering to the stipulated norms for different interventions, however, failed to include mid-term corrections in the

action plan. The farmer's contribution collected was not utilized for watershed maintenance which was indicated through poor index for them.

In semi-arid watersheds, sustainability of the programme crucially depends on the maintenance of common property resources and when the institutions adapt to the resource management problems better, it ensures higher participation of stakeholders across groups for a sustainable institutional set-up (Dovers & Dore, 1999; IDS Workshop, 1998). However, it was indicated that permanent water harvesting structures were constructed and non-arable/community lands treated without any clear-cut guidelines regarding distribution of benefits and/or maintenance of vegetation and common facilities. These resulted in 'poor' to 'fair' index for the programmes. Equity is one of the major policy issues, with past watershed programmes often failed to target the poor beneficiaries and disproportionately benefiting the better-off sections of the community. The value of index related to equity was 50% for Kalvi watershed and it was only 25% for Lottinekere watershed. The lower values were attributed to non-allocation of usufruct rights to poor/women for development of common land and no leasing out of surplus land by rich farmers to poor/landless. Though equal wage opportunity for women/different sections of society prevails, no proper guidelines were observed to uphold livelihoods of the poor people.

The value of the PWDI, which considers the values of all PPDIs, ranged between 56% and 70% for the selected watersheds. These indicate that implementing agencies were able to fulfil around 56%–70% of the possible components of participatory watershed development programmes with the rating of "good", which placed exactly in the middle of 5-point scale.

3.4. Household and gender equity

Equity is about assuring livelihoods for the poor families through deriving maximum benefits out of watershed development programmes. There are several ways of interpreting, facilitating and measuring equity in the perspective of watershed development. Economic, social and gender equity by harmonizing activities for men and women, different land holding classes, landless people and members from different communities were found to be effective to augment the impact of watershed programmes (Sreedevi, Wani, & Pathak, 2007; Sreedevi & Wani, 2007; Wani, Anantha, & Sreedevi, 2014). However, this study was particularly looked upon the institutional space of equity and observations related to the sharing of watershed benefits, and the following observations have been made based on focus group discussion with various stakeholder groups:

- The PIAs in all the watersheds created some space in different institutions for marginalized people; most of the beneficiaries belonging to one or other groups like WC, SHGs and UGs. Which is of immense importance from the equity point of view. However, due to inherent bias of watershed development programmes towards the landed families, more benefits would accrue to them as indicated by the small and marginal farmers.
- Guidelines of watershed programmes stated employment generation as one of the prime objectives, hence, preferences were given to landless and marginal farmers for every land-based activity. During discussion with the farmer, it was perceived that though employment potential increased in agricultural activities, migration rate did not halt due to continuous drought situation in the area. Hence, there was no significant increase in agricultural labour incomes for landless people also.
- Though representation of women in programme activities is an important aspect, gender equity is generally less understood

aspects in the context of watershed development programmes. In fact, women have been benefited because the family lands have been treated and the gains so obtained flow into the household incomes. The enhanced income does lead to improved standards of living, better food, shelter and clothing. Another key gain for women had been the parity in wages received. Further, through women thrift groups, they received institutional space in terms of maintenance of some of the community assets and even ensure increased control over household resources as well as decision-making.

- The value of index related to equity was ranged between 25% and 54% for the selected watersheds. The lower values were attributed to non-allocation of usufruct rights to poor/women for development of common land and no leasing out of surplus land by rich farmers to poor/landless. Though equal wage opportunity for women/different sections of society prevails, no proper guidelines were observed or livelihood opportunities created for the poor people.

3.5. Performances and linkages among stakeholders

For understanding how different institutional structures have performed in each of the programme activities, a matrix was prepared and it was observed that WC is the prime institutional structure which is mainly responsible for implementation and management of the programme at the watershed level (Table 4). The PIA was involved fully in many aspects of the programme activities. The role of UGs and SHGs were limited to few activities only. Line departments were also involved insufficiently and role of *gram panchayat* found to be inadequate in different aspects of the programmes.

In order to assess the linkages between different stakeholder groups, two criteria were used: (i) type of linkage i.e. structural/functional; and (ii) intensity of the linkage in terms of good/moderate/poor. It is evident from the study that there were deficiencies among the stakeholder groups both in terms of type and intensity of linkages. Linkages between PIA/WC and other organizations, which provide technical support and knowledge, were recorded as deficient in all the watershed programmes studied (Table 5).

3.6. Priority and rationality by institutions

Watershed management towards sustainability can be realised if there is assimilation between natural, institutional, technological and financial resources (Sriyana, De Gijt, Parahyangsari, & Niyomukiza, 2020). Though there was a clear-cut distinction in terms of participatory aspects, the different categories of projects can only be compared using qualitative ordinal scale in relation to the priority given to various components (Joshi et al., 2005) and the results indicated a mixed trend, when judged by the beneficiary households with regard to emphasis on different components of watershed development programmes (Table 6). In fact, biomass development and production enhancement activities were less emphasized in all the watershed programmes. Even though, the impact in terms of various bio-physical and socio-economic indicators can be measured, the degree of impact in terms of creating economic opportunities are not strictly comparable due to variation in physiographic and demographic characteristics of the watersheds located across the states. Hence, the selected watersheds were compared in terms of number of issues addressed and measured by rationality analysis and it was observed that NGO implemented projects addressed organizational, financial and socio-political aspects better, whereas, GO implemented programmes addressed technical aspects strongly (Table 7). In an

Table 4
Role and performance of the watershed level institutions in the four watersheds as rated by beneficiary households.

Activities	WC				UG				SHG				PIA				Line dept.				GP			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Selection of village	0	0	0	0	0	0	0	0	0	0	0	0	G	G	G	G	0	M	0	M	0	0	0	0
Delineation of watershed	G	G	G	G	0	0	0	0	0	0	0	0	G	G	G	G	0	0	0	0	0	0	0	0
Awareness generation and rapport building	G	G	G	G	0	0	0	0	0	0	0	0	G	G	G	G	P	M	M	M	P	P	P	P
Baseline survey	G	G	G	G	0	0	0	0	0	0	0	0	G	G	G	G	0	0	0	0	0	0	0	0
Identification and planning of activities	G	G	G	G	M	P	M	M	P	P	M	P	G	G	G	G	P	M	M	M	P	P	P	P
Work estimates preparation	G	G	G	G	0	0	0	0	0	0	0	0	G	G	G	G	0	0	0	0	0	0	0	0
Work implementation	G	G	G	G	M	G	M	M	P	P	M	P	G	G	G	G	P	M	M	M	P	P	P	P
Monitoring and checking of works	P	P	M	M	0	0	0	0	0	0	0	0	P	P	M	M	0	0	0	0	M	M	M	M
Financial management	G	G	G	G	0	0	0	0	0	0	0	0	G	G	G	G	0	0	0	0	0	0	0	0
Maintenance of assets & structures	G	G	G	G	G	G	G	G	0	0	0	0	0	0	0	0	0	0	0	0	M	M	M	M

Note.
Good (G): all stakeholders satisfied with role performance, Moderate (M): not all stakeholders satisfied with role performance.
Poor (P): Poor performance of roles; 0 indicates no role under the activity.
1: Kalvi watershed (NGO-Karnataka); 2: Lottinekere watershed (GO-Karnataka); 3: Mallapuram watershed (NGO-Andhra Pradesh); and 4: Mangampalli watershed (GO-Andhra Pradesh).
WC: Watershed committee; UGs: User Groups; SHGs: Self-Help Groups; PIA: project Implementing Agency; GP: Gram Panchayat.

Table 5
Matrix of inter-institutional linkages among various stakeholder institutions based on responses of respondents from community-based organizations.

	Watersheds	WC	UG	SHG	PIA	Line dept.	GP
WC	Kalvi	S&F/G	S&F/M	F/G	F/P	S&F/M	
	Lottinekere	S&F/M	S&F/M	F/M	F/P	S&F/M	
	Mallapuram	S&F/G	S&F/M	F/G	F/P	S&F/M	
	Mangampalli	S&F/M	S&F/M	F/M	F/P	S&F/M	
UG	Kalvi		S/M	F/M	-	-	
	Lottinekere		S/P	F/P	-	-	
	Mallapuram		S/M	F/M	-	-	
	Mangampalli		S/M	F/M	-	-	
SHG	Kalvi			F/M	-	-	
	Lottinekere			F/P	-	-	
	Mallapuram			F/M	-	-	
	Mangampalli			F/P	-	-	
PIA	Kalvi				F/P	F/P	
	Lottinekere				F/M	F/P	
	Mallapuram				F/P	F/P	
	Mangampalli				F/M	F/P	
Line dept.	Kalvi					-	
	Lottinekere					-	
	Mallapuram					-	
	Mangampalli					-	
GP	Kalvi						
	Lottinekere						
	Mallapuram						
	Mangampalli						

Note: Type of linkages: S&F = structural and functional linkage, S = only structural linkage, F = only functional linkage; Intensity of the linkage: P = poor, M = moderate, G = good.
-: No linkages.

Table 6
Priority^a accorded by project implementing agency to different components of watershed development programmes under different institutions.

Items	Karnataka		Andhra Pradesh	
	Kalvi (PIA: NGO)	Lottinekere (PIA: GO)	Mallapuram (PIA: NGO)	Mangampalli (PIA: GO)
Development of local institutions	High	Medium	High	Medium
Development of land & water resources	Medium	Medium	High	Medium
Fodder/grassland development, afforestation and plantation	Low	Low	Medium	Medium
Production enhancement activities	Low	Low	Medium	Low
Increase in employment opportunities	High	High	High	High
Equity/gender	Medium	Medium	Medium	Low

^a Based on responses of farmer respondents on a two-point scale (Agree = 1; Disagree = 0) and categorized as High: >75%; Medium: 50–75% and Low: <50%.

earlier study, Mondal et al. (2015) also observed that the projects those are implemented by NGOs addressed the economic, social and political aspects better, whereas projects implemented by government organizations addressed technical aspects strongly.

4. Conclusions and policy implications

It is evident from the study that there was lacuna in participatory aspects during programme implementation process like monitoring activities, common property resources management, and equity aspects that needs to be emphasized for new generation of watershed programmes. Biomass development through plantation (horticultural plants) and afforestation in non-arable lands as well as production enhancement activities (through demonstration) should be emphasized for greater acceptance by the beneficiaries and viability/sustainability of the watershed project impact. PIAs from government organizations were technically sound but less efficient in social mobilization, whereas NGOs did not have technically-sound subject matter specialists but were capable of mobilizing people and integrating them into various activities of watershed development programmes.

Gap in linkages and differential level of performance of various watershed level functionaries indicates the requirements of corrections in the structures and linkages patterns for better performance. Project implementing agencies should put extra effort in the creation and intensification of structural and functional linkages among institutions as well as various resource agencies like banks and markets to enhance the efficiency and sustainability of the programmes.

The study has explored the differential priorities of different components of watershed development programmes in semi-arid region of India. Biomass development and production

Table 7
Rationality[€] analysis of activities undertaken under different watersheds (in %).

Rationalities	Karnataka		Andhra Pradesh	
	Kalvi (PIA: NGO)	Lottinikere (PIA: GO)	Mallapuram (PIA: NGO)	Mangampalli (PIA: GO)
Organizational & Financial	73	57	77	67
Technical & Economic	52	64	66	66
Social & Political	65	49	78	67

€ Results based on responses on rationality issues from farmer respondents collected on a five-point scale and scoring was done as: Strongly Agree = 5; Agree = 4; Partially Agree/Disagree = 3; Disagree = 2; and Strongly Disagree = 1.

enhancement (crop & livestock) activities were less prioritized and they need to be emphasized more for greater acceptance and viability of the programme. Social rationalities are very important for achieving equity; financial and economic rationalities for the performance on financial soundness, whereas, technical rationalities are important for quality of works undertaken. Results emanated from rationality analysis exhibited a mix picture in this study and observed that NGO implemented projects addressed organizational, financial and socio-political aspects better, whereas, GO implemented programmes addressed technical aspects strongly. This indicate the nature of adjustments of various components of the programme required to achieve precise goals as productivity enhancement, employment generation and ensuring greater of participation and equity.

Declaration of competing interest

None.

References

- Bagdi, G. L., & Kurothe, R. S. (2014). People's participation in watershed management programmes: Evaluation study of Vidarbha region of Maharashtra in India. *International Soil and Water Conservation Research*, 2(3), 57–66.
- Bhatia, M. S. (2005). *Viability of rainfed agriculture in semi-arid regions. Occasional paper – 40*. Mumbai (India): Department of Economic Analysis and Research, National Bank for Agriculture and Rural Development (NABARD).
- Blair, W. H. (1996). Democracy, equity and common property resource management in the Indian subcontinent. *Development and Change*, 27, 475–499.
- Darghouth, S., Ward, C., Gambarelli, G., Styger, E., & Roux, J. (2008). *Watershed management approaches, policies, and operations: Lessons for scaling up. Water Sector Board discussion paper series*. Washington, DC: World Bank. no. 11.
- Dogra, P., Tripathi, K. P., Sharda, V. N., & Dhyani, S. K. (2005). Quantitative evaluation of participation paradigms of watershed development projects – a methodology. *Indian Journal of Soil Conservation*, 33(2), 152–161.
- Dovers, S., & Dore, J. (1999). Adaptive institutions, organisations and policy process for river basin and catchment management. In *The 2nd international river management symposium, brisbane, 29 september–1 october*.
- Farrington, J., Turton, C., & James, A. J. (1999). *Participatory watershed development: Challenges for the 21st century*. New Delhi: Oxford University Press.
- Fernandez. (1994). *The MYRADA experience: The interventions for a voluntary agency in the emergence and growth of people's institutions for sustained and equitable management of micro-watersheds*. Bangalore: MYRADA.
- Gandhi, V. P. (2010). *A conceptual framework for studying institutions in watershed development. Working paper No. 2010-11-04*. Ahmedabad: Indian Institute of Management (IIM).
- Government of India. (2004). *India first national communication to UNFCCC (2004)*. Ministry of Environment and Forests (MoEF), Government of India.
- Government of India. (2011). *'Common guidelines for watershed development projects – 2008' (Revised edition 2011)*. New Delhi, India: National Rainfed Area Authority, Planning Commission.
- Gray, E., & Srinidhi, A. (2013). *Watershed development in India: Economic valuation and adaptation considerations. Working paper*. Washington, DC: World Resources Institute. Available online at: <http://www.wri.org/publication/watershed-development-india-economicvaluation-adaptation-considerations>.
- IDS Workshop. (1998). Towards a learning organisation: Making developmental agencies more participatory from the inside. In J. Blackburn, & J. Holland (Eds.), *Who changes? Institutionalising participation in development* (pp. 145–152). London: Intermediate Technology.
- Jain, D., & Gandhi, V. P. (2016). Reforming watershed management institutions for inclusive and sustainable growth: Role of institutional interaction and participative decision making. *IIM Kozhikode Society & Management Review*, 5(1), 22–40.
- Joshi, P. K., Jha, A. K., Wani, S. P., Joshi, L., & Shiyani, R. L. (2005). *Meta-analysis to assess impact of watershed program and people's participation. Research Report 8, Comprehensive Assessment of watershed management in agriculture*. International Crops Research Institute for the Semi-Arid Tropics and Asian Development Bank, 21 pp.
- Kerr, J. (2002). Watershed development, environmental services, and poverty alleviation in India. *Water Resources Management*, 30(8), 1387–1400.
- Kerr, J., Pangare, G., & Pangare, V. L. (2002). *An evaluation of watershed development projects in India, research report 127*. Washington, DC: Inter-national Food Policy Research Institute.
- Kumar, S., Raizada, A., Biswas, H., Srinivas, S., & Mondal, B. (2016). Application of indicators for identifying climate change vulnerable areas in semi-arid regions of India. *Ecological Indicators*, 70, 507–517. <https://doi.org/10.1016/j.ecolind.2016.06.041>.
- Kurian, M. (2004). *Institutional analysis of integrated water resources management in river basins - a methodology paper. Working Paper 79*. Colombo, Sri Lanka. International Water Management Institute (IWMI).
- Mondal, B., Loganandhan, N., & Raizada, A. (2014). Meteorological drought and coping strategies by small and marginal farmers in semi-arid Karnataka. *Indian Journal of Soil Conservation*, 42(1), 54–61.
- Mondal, B., Singh, A., & Sekar, I. (2013). Dimensions and determinants of people's participation in watershed development programmes in Bundelkhand Region of Madhya Pradesh: An econometric analysis. *Indian Journal of Soil Conservation*, 41(2), 177–184.
- Mondal, B., Singh, A., Sekar, I., Sinha, M. K., Kumar, S., & Ramajayam, D. (2015). Institutional arrangements for watershed development programmes in bundelkhand region of Madhya Pradesh, India: An explorative study. *International Journal of Water Resources Development*. <https://doi.org/10.1080/07900627.2015.1060195>.
- Mondal, B., Singh, A., Singh, S. D., Kalra, B. S., Samal, P., Sinha, M. K., et al. (2017). Augmentation of water resources potential and cropping intensification through watershed programs. *Water Environment Research*, 90(2), 101–109. <https://doi.org/10.2175/106143017X14902968254700>.
- MoRD. (2001). *Guidelines for watershed development – (revised 2001)*. New Delhi: Ministry of Rural Development, Government of India.
- Nuga, B. O., Akinbola, G. E., & Nuga, O. O. (2009). Stakeholder analysis: A conceptual framework for sustainable watershed development in the ikwuano watershed in south east Nigeria. *Global Approaches to Extension Practice (GAEP)*, 5(2), 77–85.
- Palanisami, K., & Kumar, S. D. (2009). Impacts of watershed development programmes: Experiences and evidences from Tamil nadu. *Agricultural Economics Research Review*, 22, 387–396.
- Pal, P. K., Ganguly, B., Roy, D., Guha, A., Hanglem, A., & Mondal, S. (2017). Social and biophysical impacts of watershed development programmes: Experiences from a micro-watershed area in India. *Water Policy*, 19(4), 773–785. <https://doi.org/10.2166/wp.2017.189>.
- Pathak, P., Chourasia, A. K., Wani, S. P., & Sudi, R. (2013). Multiple impact of integrated watershed management in low rainfall semi-arid region: A case study from eastern Rajasthan, India. *Journal of Water Resource and Protection*, 5, 27–36.
- Raizada, A., Adhikari, R. N., Kumar, S., Patil, S. L., Ramajayam, D., Prabhavathy, M., et al. (2018). Impact assessment of watershed interventions under low rainfall situations in semi-arid Karnataka. *Indian Journal of Soil Conservation*, 46(2), 1–8.
- Reddy, V. R. (1998). Managing the commons in transitory economics towards a theory of collective actions. In *Papers presented at the international conference of the European society of ecological economics, geneva, 4-7 march*.
- Reena, Siwach, M., & Singh, A. (2019). Impact of watershed development programmes on livelihood conditions of farmers in Haryana. *Journal of Rural Development*, 38(1), 144–170.
- Samra, J. S., & Sharma, K. D. (2009). Watershed development: How to make 'invisible' impacts 'visible'? *Current Science*, 96(2), 203–205.
- Saravanan, V. S. (2002). Institutionalizing community-based watershed management in India: Elements of institutional sustainability. *Water Science and Technology*, 45(11), 113–124.
- Sathyakumar, S., & Sivakumar, K. (Eds.). (2007). *Galliformes of India. ENVIS bulletin: Wildlife and protected areas* (Vol. 10, p. 252). Dehradun, India: Wildlife Institute of India.
- Sharma, C., & Sosodia, S. S. (2008). People's participation in watershed development programme: A case study of Rajasthan. *Indian Research Journal of Extension Education*, 8(1), 71–72.
- Sreedevi, T. K., Reddy, T. S. V., Wani, S. P., Dave, S., D'Souza, M., Kumari, A. S., et al.

- (2008). *A comparative analysis of institutional arrangements in watershed development projects in India. Global Theme on Agro-ecosystems Report No. 50*. Hyderabad, India: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).
- Sreedevi, T. K., & Wani, S. P. (2007). Leveraging institutions for enhanced collective action in community watersheds through harnessing gender power for sustainable development. In S. Mudrakartha (Ed.), *Empowering the poor in the era of knowledge economy* (pp. 27–39). Gujarat, India: VIKSAT, Ahmedabad.
- Sreedevi, T. K., Wani, S. P., & Pathak, P. (2007). Harnessing gender power and collective action through integrated watershed management for minimizing land degradation and sustainable Development. *Journal of Financing Agriculture*, 36, 23–32.
- Sriyana, I., De Gijt, J. G., Parahyangsari, S. K., & Niyomukiza, J. B. (2020). Watershed management index based on the village watershed model (VWM) approach towards sustainability. *International Soil and Water Conservation Research*. <https://doi.org/10.1016/j.iswcr.2020.01.003>.
- Tanguilig, H. C., & Tanguilig, V. C. (2009). Institutional aspects of local participatory strategies in natural resource management. Field Actions Science Report. Retrieved from www.factsreports.org.
- Vaidyanathan, A. (2001). Watershed development: Reflections on recent developments. In K. N. Nair, & Chattopadhyay & Srikumar (Eds.), *Watershed management for sustainable development field experiences and issues*, Kerala research programme on local level development, Trivandrum.
- Wani, S. P., Anantha, K. H., & Sreedevi, T. K. (2014). Gender issues in watershed management. In A. A. Cronin, P. K. Mehta, & A. Prakash (Eds.), *Gender issues in water and sanitation programmes: Lessons from India* (pp. 99–119). India: Sage.
- Wani, S. P., Joshi, P. K., Raju, K. V., Sreedevi, T. K., Wilson, J. M., Shah, A., et al. (2008). *Community watershed as a growth engine for development of dryland areas. A comprehensive assessment of watershed programs in India. Global theme on agroecosystems, ICRISAT, patancheru, Andhra Pradesh* (p. 145). Report No. 47.
- World Resources Institute. (2005). *World resources report 2005*. Washington, DC: World Resources Institute.