Determinants of Institutional Performance in Watershed Management: A Study of the Nature and Performance of Watershed Development Institutions in Andhra Pradesh, India

Vasant P. Gandhi
Indian Institute of Management, Ahmedabad, India

Lin Crase
Latrobe University, Victoria, Australia

Determinants of Institutional Performance in Watershed Management: A Study of the Nature and Performance of Watershed Development Institutions in Andhra Pradesh, India

Vasant P. Gandhi
Indian Institute of Management, Ahmedabad, India

Lin Crase
Latrobe University, Victoria, Australia

Abstract

The study examines the nature and performance of watershed development institutions in India. Improving productivity and incomes in rainfed areas, which have much poverty, is a major challenge in India, and a huge initiative through which this is pursued is Watershed Development (WSD) programs which are massively funded by the Government of India, state governments and external donors. In watershed development, combining scientific approaches with community participation and knowledge is a major problem and requires effective institutions, which is a major weakness. The study examines the design and performance of watershed development institutions using new institutional economics, and management theory of governance. It analyzes data collected in a primary survey of 18 watershed institutions and 542 beneficiary households in Andhra Pradesh. The results identify a number of features including rationalities and institutional characteristics closely related to performance, and this could add to new institutional economics theory as well as the better design of institutions.

Introduction

The research examines the nature and performance of natural resource management institutions, particularly, institutions involved in watershed development in India, which is being implemented on a large scale by the government since it is found to be a powerful instrument of transformation and poverty alleviation in the rural areas. The research first develops a conceptual framework based on new institutional economics, and management theories of governance to study watershed institutions. It then uses it through a large primary survey to examine the institutions at the grassroots to understand their behavior and identify features associated with performance and success. This helps develop recommendations for better design of such institutions.

Effective management of natural resources is becoming increasingly crucial for growth and development in India and many other counties. This is particularly so in rainfed areas where much scarcity, fragility and poverty exist. Researchers indicate that there is a crisis in the management of natural resources in India (Saleth 1996, Vaidyanathan 1999, Brisco and Malik 2006, Gandhi and Namboodiri 2002,

2009, and Crase and Gandhi 2009), and the crisis is not about having too little but about managing the resources badly (World Water Vision 2000). Research and experience indicates that the major difficulty is not physical or technical but of poor institutional development and design (Saleth 1996, Crase and Gandhi 2009). This is particularly in combining scientific approaches with community participation, knowledge and ownership. Natural resource management is complex and good institutional arrangements are urgently needed. Effective management of natural resources is increasingly critical for agriculture, rural livelihoods and poverty alleviation.
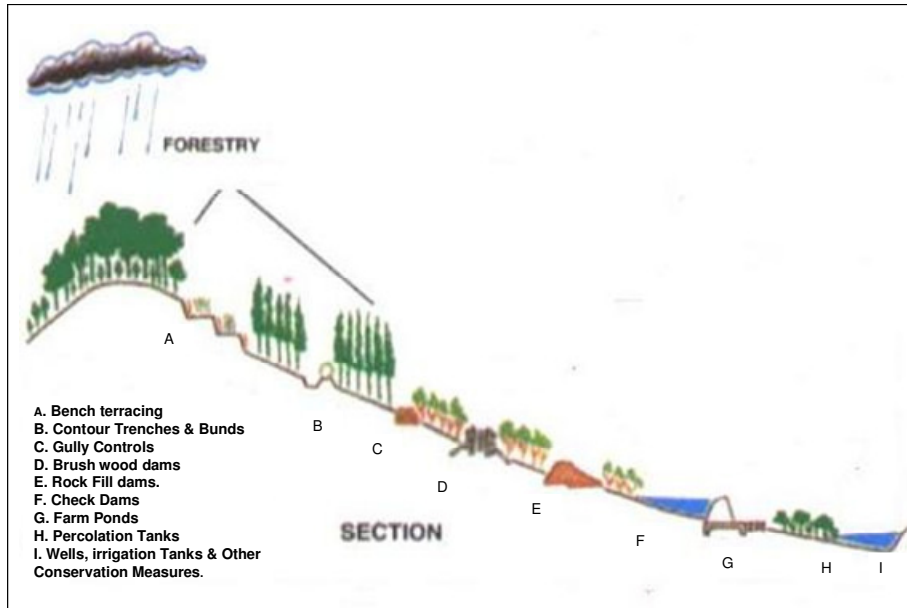
Watershed Development in India

Watershed Development (WSD) programs are a major national initiative, and receive enormous importance and government funding in India, mainly because their huge potential for improving incomes and livelihoods, and alleviating poverty in rainfed areas. From 1995-96 to 2007-08, over Rs. 77 billion were spent on WSD programmes. The World Bank has provided $1.73 billion for WSD from 1990 to 2004 (World Bank 2007). In the recent years, the Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS) with an annual budget of Rs. 4000 billion is being dove-tailed with the WSD programmes in most states. This has enormously increased the support to and importance of WSD programmes in India.
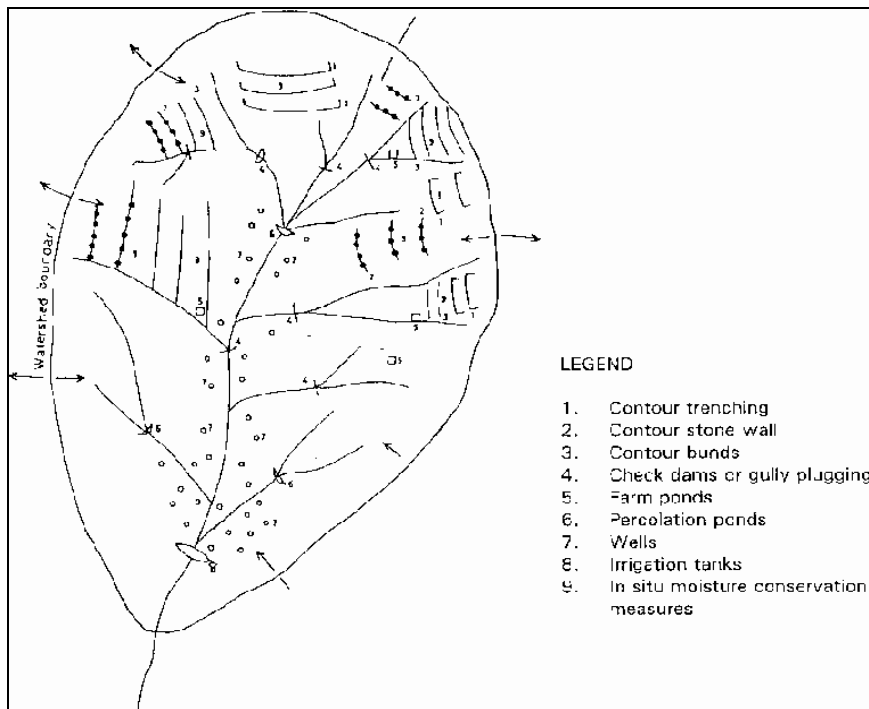
Shiferaw et al (2008) observe that India, in particular, gives high priority to watershed programs as a strategy for integrated development of rural communities, especially in rain-fed and drought-prone areas. Kerr (2007) observes that India follows a three prong approach of watershed development: conserve and strengthen the natural resource base, make agriculture and other natural resource-based activities more productive, and support rural livelihoods to alleviate poverty. The Indian approach to watershed development goes much beyond conservation technologies and emphasises the need to amalgamate technological tools with broad-ranging social, political, and economic factors (Shiferaw et al 2008).

A watershed is technically considered a geo-hydrological unit or an area that drains to a common point (see Figure 1), and scientists and engineers have developed a variety of technologies which offer solutions to difficult watershed conditions. These include interventions ranging from simple check-dams to large percolation and irrigation tanks, from vegetative barriers to contour bunds, and changes in agricultural practice e.g. in-situ soil and moisture conservation, agro-forestry, pasture development, horticulture and silvi-pasture (ICAR 2009). These are shown to have dramatic results for the area. Practical definitions of the watershed have varied but for government projects and budgets, a watershed project is treated as an area of about 500 hectares in a village (Gandhi, 2010). A varied hierarchy of institutional arrangements of the government and other agencies undertakes the planning and implementation. Examples of watershed development in a "Ridge to Valley" concept, and a watershed development area are shown in Figure 1.

Figure 1: A: Watershed Development in a "Ridge to Valley" Concept

A. Bench terracing
B. Contour Trenches & Bunds
C. Gully Controls
D. Brush wood dams
E. Rock Fill dams.
F. Check Dams
G. Farm Ponds
H. Percolation Tanks
I. Wells, irrigation Tanks & Other Conservation Measures.

B: Outline of a Watershed Development Area

LEGEND

1. Contour trenching
2. Contour stone wall
3. Contour bunds
4. Check dams or gully plugging
5. Farm ponds
6. Percolation ponds
7. Wells
8. Irrigation tanks
9. In situ moisture conservation measures

The history of watershed development in India can be traced to the Famine Commission of 1880, again the Royal Commission of Agriculture of 1928, which recognized its importance for India. After independence in 1947, the government establishment a special centre at Jodhpur in 1952 and in 1959 this was designated as Central Arid Zone Research Institute (CAZRI). The first large scale government supported watershed programme was launched in 1962-63, and a mega sized project named the Drought Prone Area Development Programme (DPAP) was launched in 1972-73. Then, a special programme for the hot desert areas, the Desert Development Programme (DDP) was launched in 1977-78. Later the Integrated Wastelands Development Programme (IWDP) was added. In 1993, the Government of India constituted a technical committee headed by Dr C.H Hanumantha Rao to review these programmes. The Committee proposed a revamp, recommending various measures including sanctioning of works on the basis of the action plans on watershed basis, and introduction of participatory modes of implementation, through involvement of beneficiaries of the programme and NGOs. Based on its recommendations a new set of guidelines came into effect in 1995. The coverage of various programs since then is outlined in the Table below, and shows the huge size.

Table 1 : Number of Projects, Area Covered and Funds released for Watershed Development from 1995-96 to 2007-2008 in India

Name of Programme	Number of projects sanctioned	Area covered in lakh ha.	Total funds released by Central Government (Rupees Million)
DPAP	27439 (60.9 %)	130.20 (41.2 %)	28378 (36.7 %)
DDP	15746 (34.9 %)	78.73 (24.9 %)	21032 (27.2 %)
IWDP	1877 (33.9 %)	107.00 (33.9 %)	27976 (36.1 %)
Total	45062	322.93	77386

The watershed programme has become the centre-piece of rural development in India. In 2003 under the "Hariyali" guidelines, watershed development was put under the implementation of the Panchayati Raj Institutions (PRIs). In 2006, an apex national body called the National Rainfed Area Authority (NRAA) was setup and brought out new "Common Guidelines for Watershed Development Projects" in 2008 for a unified approach combining of most programmes into the Integrated Watershed Management Programme (IWMP).

Initially, the watershed development included only natural resource management (NRM) activities, but later to enhance the income impact from the improved resources, production enhancement (PE) activities such as modern inputs and technology where added. Later to include and have an impact on the landless and women, the livelihood component of enterprise promotion (EP) activities where added.

The institutional arrangements for implementation of watershed development programmes includes higher level entities such as the National and State level Watershed Programme Implementation and Review Committees, and the state Department of Rural Development. At the district level, the District Rural Development Agency (DRDA) earlier and now the District Water Management Agency (DWMA) is the highest body for headed by a Project Director (PD). The lower level entities include Multi Disciplinary Teams (MDT), Project Implementing Agencies (PIA) and Watershed Development Teams (WDTs), and other entities such as the Panchayat, Watershed Committee, Village Organization, Water User Groups and Self Help Groups. The examples of two institutional structures seen in WSD programmes at the district level are given in Figures 2 & 3 below:
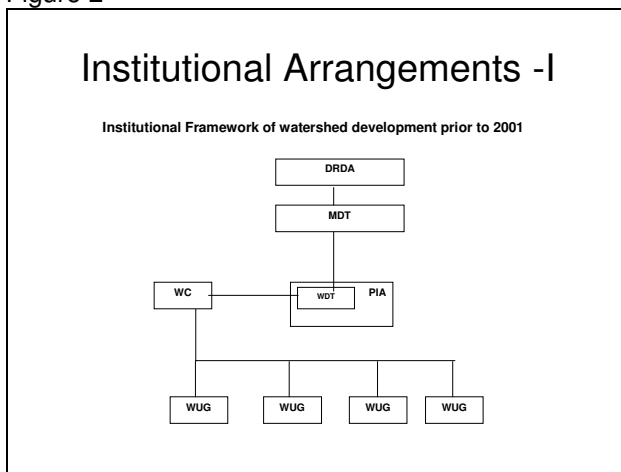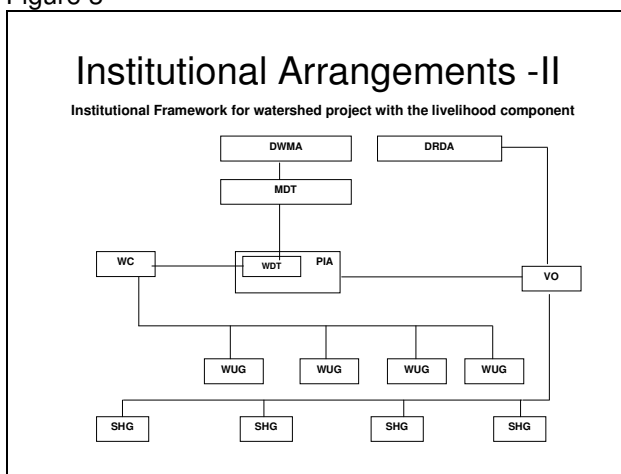
Figure 2

Figure 3

Conceptual Framework for Studying Institutions

In the new institutional economics, institutions are considered humanly devised constraints that structure human interaction (North 1990). New institutional

economics offers different approaches to understand the institutions, including transaction costs and property rights (North 1997, Drobak and Nye 1997). A principal premise is that economic activities have both transformation costs and transaction costs. Often, transaction costs are ignored, and when large, substantially reduce performance. Good institutions is to reduce transaction costs. According to North (1997), the major challenge is to evolve institutions in which: (1) The transaction costs are minimized, (2) The incentives favour co-operative solution, in which cumulative experiences and collective learning are best utilised.

Based on the foundations of new institutional economics, and the empirical literature which has followed (for example Ostrom 1992, Crase et.al. 2002, Herath 2002), Pagan (2009) has identified characteristics that should be expected in effective institutions, linked to new institutional economics fundamentals. These are very briefly described below:

1. Clear Objectives: Good institutions show clear objectives and clarity of purpose.

2. Good Interaction: Good institutions show good internal interaction, bringing formal and informal rules together.

3. Adaptiveness: Facing change and variation, successful institutions demonstrate adaptiveness.

4. Appropriateness of Scale: Good institutions have the appropriate scale of size and scope.

5. Compliance Ability: Good institutions show ability to bring compliance.

Apart from these, the management theory of organizational design and governance (Nystrom and Starbuck 1981, Groth 1999, Ackroyd 2002, Crase and Gandhi 2009) indicates that good institutions should address at least three important rationalities which are very briefly described below:

1. Technical Rationality: The efficient conversion of inputs into outputs, requiring technology, expertise and efficient methods.

2. Organizational Rationality: Division of labor, specialization and coordination.

3. Political Rationality: addressing the perceptions of fairness and justice.

To refine the conceptual framework further, case studies of six watershed development projects in three districts in Andhra Pradesh were done during 2009/10 under an the ACIAR supported collaborative project on "Enhancing Institutional Performance in Watershed Management in Andhra Pradesh". The case studies showed that it was necessary to expand the framework and include a number of additional rationalities. The expanded list is given below:

1. <u>Technical Rationality</u>: Efficient conversion of inputs into outputs, technology and operational procedures, experts, soundness in the selection of technologies and structures, their location, their specifications and their construction.

2. <u>Economic Rationality</u>: Consideration of costs, benefits, and net returns, economically efficient use of resources, demand, markets, prices, costs, profitability and returns to investment, impact on improving incomes and livelihoods

3. <u>Environmental Rationality</u>: Consideration of the environment in the selection of methods and activities, conservation of water, land and natural vegetation, externalities, sustainability

4. <u>Social Rationality</u>: Consider the social or people setting, seeking the acceptance and cooperation of the different social groups, participation, distribution of the support and benefits

5. <u>Political Rationality</u>: Addressing fairness and justice, leaders, powers and interests, meetings and contact with leaders/ groups, involvement in the formulation of rules and plans, balancing of needs and concerns, avoiding disputes.

6. <u>Organizational Rationality</u>: Organization and coordination, formation of appropriate local organizations, effective leaders/ staff sub-committees/ groups, systems and meetings, bring rationalities together, managerial skills, knowledge, training.

7. <u>Financial Rationality</u>: Discipline and care in proper handling of these financial resources, procedures, responsibility and accounting systems, checks and monitoring, preventing misuse, government sanctions.

8. <u>Government Rationality</u>: A mega mover and supporter, the kind, quantum, speed and nature of government support, the guidelines, budgets as well as structures, procedures of the government, knowledge, guidance, commitment/ drive of government functionaries.

The conceptual framework depicted in the Figure below seeks to comprehensively put together the different aspects discussed above.

Figure 4:   A Depiction of the Conceptual Framework

Government Rationality

Guidelines, Programs, Funding, Structure, Procedures, Expertise, Support, Speed

Demand, Prices, Markets, Costs/ Benefits, Returns, Water & Soil Conservation, Sustainability, Environment

Economic & Environmental Rationality

Organizational & Financial Rationality

Local Organization, WC, VO, UG, SHG, Leadership, Coordination, Financial Discipline

Clear Objectives
Clarity of Purpose

Compliance
To Rules, Procedures

Appropriate Scale
Scale, Size, Scope

Good Interaction
Bringing Formal & Informal Together

Adaptiveness
Adaptation & Flexibility to Settings & Changes

Social & Political Rationality

People, Castes/Tribes, Land Groups, Customs, Beliefs, Power Centers, Leaders, Involvement/ Participation, Distribution of Benefits

Technical Rationality

NRM Methods, Locations, Specifications, Quality, New Crops, Varieties, Technologies, Enterprises

Measuring Performance of Watershed Institutions

What constitutes performance of watershed institutions? Research by Gandhi and Namboodiri (2002) on this question indicates that in a developing country context such as in India multiple objectives need to be achieved and natural resource institutions must address at least four major challenges:

1. Overcoming scarcity (or improving availability and efficiency): Achieving adequate and timely availability, and efficient use

2. Equity: Achieving and improving equity in the resource availability and benefits

3. Environment: Utilization with least ill effects or benefits to the environment, sustainability

4. Financial soundness or viability: Achieving financially soundness and viability

Some specific indicators may include improvement in water availability, conservation of soil, soil fertility and the environment, improvement in stability and sustainability, improvement in crop and animal production, improvement in farmer incomes, and improvement in non-farmer incomes.

Empirical Analysis of Watershed Institutions

Data

Data for the empirical study was collected from several rainfed districts of the state of Andhra Pradesh through the above mentioned ACIAR supported research project. This is the largest state in the southern plateau region of India and is over 50 percent rainfed. It provides a good setting for watershed development work and has substantial incidence of poverty. Watershed development is given high priority and Andhra Pradesh has the highest number of watershed projects among the states in the country (over 9000) at different stages of implementation. WSD projects have been taken up under various development programmes/ guidelines including the Drought Prone Area Programme (DPAP), the Desert Development Programme (DDP), and the Andhra Pradesh Rural Livelihoods Project (APRLP), recently brought together under the Integrated Watershed Management Programme (IWMP) guidelines. Andhra Pradesh is at the forefront of strengthening of institutional and participatory processes in watershed development and the focus on improving livelihoods especially of the poor.

For the primary field survey a sample of 18 varied watersheds, 6 in each of the 3 study districts: Anantapur, Mahbubnagar, and Nalgonda, were selected in

association with the Department of Rural Development, Andhra Pradesh, to cover different agro-ecological conditions including rainfall, water and topography, social conditions, different programmes/ norms/ administrative structures such as DDP, DPAP, APRLP, Hariyali, with and without involvement of NGOs, VOs, SHGs, varying age/ maturity (nearing completion or recently completed), and varying outcomes, as broadly known.

Detailed survey instruments were developed based on the conceptual framework, and the understanding of the ground situation from the 6 case studies. The final sample of 18 watersheds and 542 beneficiary households selected through stratified random sampling. The sample coverage is described in the Table below.

Table 2: Sample Survey Coverage in Andhra Pradesh				
District	Name of the Mandal	Name of the Village and Watershed	Watershed Program/ Type	Number of Beneficiaries covered
Mahabubnagar	Mahabubnagar	Jainallipur	APRLP	30
	Bijnapalli	Vattem	Hariyali I	34
	Koilkonda	Malkapur	Hariyali IV	30
	Gopalpet	Keshampet	DPAP VIII	26
	Midjil	Narsampally	APRLP	32
	Balanagar	Modampalli	DPAP VIII	36
			Total	188
Anantapur	Kanaganapali	Narasampalli	DDP VIII	28
	Narpala	B.Pappur	APRLP	34
	Mudigubba	Uppalapadu	DDP VI Extended	25
	Atmakuru	Muttala	Hariyali I &II	30
	Gooty	Rajapuram	APRLP	35
	Penukonda	Duddebanda	Hariyali IV	30
			Total	182
Nalgonda	Munugod	Ratipalli	DPAP -IV	30
	Nakrekal	Chandupatla	Hariyali II	30
	Narayanpur	Gudimalkapur	APRLP	30
	Pedagura	Nilikal	APRLP	30
	Kethepalli	Gudiwada	DPAP VII	24
	Shaligolala	Valala	Hariyali I	28
			Total	172
			Grand Total	542

The questionnaire coverage included basic features of the households, agricultural and natural resource features, the watershed activities taken up, their assessment, and the activity level different institutional functionaries. Through sets of pertinent

questions it also sought the assessment of the beneficiaries on the eight different rationalities using a five-point rating scale. Similarly, it sought their assessment on the implementation of the five different institutional features.   The performance of the institutions was recorded in terms of parameters such as change in the depth of water table, change in irrigated area and changes in the cropping pattern. It was also assessed in terms of the perceived overall success of the institution on a five point rating scale, as well as performance on the objectives of overcoming scarcity, equity, environment and financial soundness through response on sets of questions on a five point rating scale. Data was collected during 2010-11. The analysis of the data on selected aspects is presented here.

Sample Profile

The profile of the respondents on selected features is described below. The Table shows the responses on the reliance on the WSD institution. It indicates that for 77 per cent of the sample the reliance is substantial, and very substantial for another 16 percent. Thus, the WSD institution is important for almost all the respondents. The table also indicates that the sample is quite evenly distributed across upper, middle and lower reaches. With respect to land owned, about 50 percent own less than 5 acres of land and only about 11 per cent have more than 10 acres of land. About 20 per cent of the sample is landless. A majority of the villages surveyed are located between 5-20 km from the nearest town.

Table 3: Profile of the Sample		
Reliance on WSD Institution		
	Percent	
Very substantial	15.5	
Substantial	76.8	
Some	7.2	
Very little	.6	
Total	100.0	
Location In Watershed		
	Percent	Percent
n.a.	.2	.3
Upper	19.7	30.2
Middle	19.0	29.1
Lower	26.4	40.4
Total	65.3	100.0
No land/ Not relevant	34.7	
Total	100.0	
Total Land Owned		

Acres	Percent
>0 - 2	13.7
2-4	21.7
4-5	14.3
5-8	11.6
8-10	7.9
Over 10	10.9
Total	79.7
Landless	20.3
Total	100.0
Distance of Village to Nearest Town	
Kms	Percent
Up to 5	11.1
5-10	39.7
10-20	32.3
20-30	11.8
Over 30	5.2
Total	100.0

Watershed Development Activities Observed

A large number of watershed development activities were reported in the survey, see Table below. Check dams have been reported by 205 beneficiaries, percolation tanks by 70, mini percolation tanks by 47 and drip irrigation by 44 beneficiaries. Apart from these, a large number of production enhancement activities such as distribution of fertilizers, good seeds, fruit trees and dairy animals were reported. Further, a large number of enterprise promotion activities such as tea shops, grocery shops, tailoring, cloth business, sheep and goat and many more were reported. Their reported usefulness varies, with check-dams, gully control, sprinkler and drip irrigation showing high scores among the more frequent NRM activities. Thus, the sample of beneficiaries encompasses a large number of different watershed development activity experiences.

Table 4: Watershed Development activities undertaken & reported by the beneficiaries					
Natural Resource Management (NRM) Activities					
	N	**Usefulness rating (1=Poor to 5=Excellent)**			
		Minimum	**Maximum**	**Mean**	**Standard Deviation**
Check Dams	205	1.00	5.00	4.0976	.74770

Village Pond	4	3.00	5.00	3.7500	.95743
Farm Pond	15	3.00	5.00	4.1333	.63994
Percolation Tank	70	1.00	5.00	3.8857	.71308
Mini Percolation Tanks	47	1.00	5.00	3.8936	1.12741
Sunken Pits	2	3.00	4.00	3.5000	.70711
Gully Control	40	3.00	5.00	4.1750	.63599
Drip Irrigation	44	1.00	5.00	4.2273	.77350
Sprinkler Irrigation	39	3.00	5.00	4.4872	.60139
Bunding	20	1.00	5.00	3.3500	1.13671
Leveling	4	4.00	5.00	4.7500	.50000
Agro Forestry	8	1.00	4.00	1.7500	1.38873
Other NaturalVegetation Planted	1	1.00	1.00	1.0000	.
Mango	5	4.00	5.00	4.6000	.54772
Sweet Orange	2	4.00	5.00	4.5000	.70711
Rock Fill Dams	8	4.00	5.00	4.3750	.51755
Production Enhancement (PE) Activities					
Fertilizer	46	3.00	5.00	4.2174	.55430
Seed	45	1.00	5.00	3.6667	.95346
Plants	83	1.00	5.00	3.8313	1.32351
Drip Irrigation	18	3.00	5.00	4.5556	.61570
Sprinkler Irrigation	7	4.00	5.00	4.8571	.37796
Animals	6	4.00	5.00	4.3333	.51640
Others	44	2.00	5.00	4.0682	.54550
Enterprise Promotion (EP) Activities					
Retailing Food	72	3.00	5.00	4.5278	.53001
Retailing General	38	3.00	5.00	4.3421	.58246
Ag. Proc/ Livestock/ Poultry	148	1.00	5.00	4.3378	.64475
Skilled/ craft Activities	52	4.00	5.00	4.4231	.49887
Others	17	3.00	5.00	4.1765	.52859

Involvement in Watershed Development Institutions

The Table below indicates that there was considerable variation in the activity level of different groups and structures in relation to the watershed development institution. The Table indicates that 53 percent report the general body was active to very active and 44 percent report that it was passive. However, the leader or head of the institution was reported active by 90 percent of the respondents. The landless were reported passive by 51 per cent and the women were reported active by 44 percent. The involvement and activity level would have a bearing on the performance.

Table 4: Activity or involvement in the WSD Institution					
	Very Active	Active	Passive	None	Not relevant or reported
1. General Body	9.4	43.7	43.7	2.0	1.1
2. Managing Committee	29.0	53.9	11.8	0.4	5.0
3. Chairman/ Leader/ Head	44.6	43.9	6.8	-	4.6
4. Secretary/ Staff	24.7	59.4	10.7	0.6	4.6
5. Watershed Committee (WC)	22.7	31.2	8.5	0.6	37.1
6. Village Organization (VO)	50.4	22.3	9.6	2.2	15.5
7. User Groups (UGs)	16.6	18.6	17.3	2.6	44.8
8. Self Help Groups (SHGs)	39.1	31.2	18.8	6.8	3.9
9. Panchayat	7.6	40.4	47.2	4.8	-
10. Sarpanch	22.0	33.4	41.3	3.1	0.2
11. Government Officials	31.5	59.6	8.5	0.4	-
12. Technical experts	20.1	61.8	15.7	2.2	0.2
13. NGO	18.5	13.5	0.9	32.8	67.2
14. Upper Caste	31.5	38.9	26.0	3.3	0.2
15. Backward Caste	41.5	55.9	2.2	0.4	-
16. Schedule Caste	17.3	66.8	14.2	1.7	-
17. Schedule Tribes	14.9	36.7	19.4	5.2	23.8
18. Women	44.3	31.2	22.3	2.2	-
19. Poor	5.5	42.6	45.6	6.3	-
20. Large/medium farmers	31.2	56.1	12.2	0.6	-
21. Small/marginal farmers	26.8	65.9	7.2	0.2	-
22. Landless	5.0	36.9	50.9	7.0	0.2
23. Labour/wage earners	4.4	43.2	45.9	6.5	-
24. Youth – young people	2.4	19.2	72.5	5.9	-

Assessment on Rationalities

Different questions were asked to make an assessment about the status of different rationalities. The table below shows a few of the questions asked on technical, environmental, economic, and social rationalities and the responses obtained from

the beneficiaries. On technical rationality, the Table shows that technical experts and considerations were reported to be involved in most cases for NRM activities but not so far EP activities. With respect to the maintenance of structures substantial number only partially agree that this was good and on the high capability of experts many only partially agree.

With respect to environmental rationality, whereas this was reported to have been taken into consideration in most cases for NRM activities, environment was not reported as considered for a large number of PE and EP activities. On economic rationality, most beneficiaries agree that the NRM structures were well selected for economic benefits, but a vast number indicated that market demand and profitability were not considered and good marketing arrangements were not created. With respect to social rationality, most beneficiaries agree that mobilization and involvement of various social groups was actively done, but many indicate that the interest and benefits of small and marginal farmers and the landless were not taken into consideration. On all these counts there appears to be considerable variations.

Table: Assessment on rationalities I – selected questions and responses (percent)					
Technical Rationality					
	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree
1. Technical experts and considerations were actively involved in the constructions/ implementation of NRM structures/ activities	26.2	65.1	7.4	0.6	0.6
2. The structures were well maintained and in very good condition for conservation of water and soil	22.6	49.1	23.9	3.8	0.6
3. Technical experts were involved in selection and training for enterprise promotion (EP) activities.	8.3	16.6	3	24.9	47.2
4. The technical experts involved were highly capable.	6.6	36.1	32.7	15.9	8.7
Environmental Rationality					
1. The environmental impact (on soil, water, forests and natural vegetation) was actively considered in deciding NRM struct/ activ.	18.3	57.5	16.1	6.8	1.2
2. In deciding the PE and EP activities, environmental impact (on groundwater, soil, natural vegetation) was taken into consideration.	2.4	32.1	19.1	26.1	20.3
Economic Rationality					
1. NRM structures/ activities were correctly selected for the best economic benefit to the villagers.	39	55.9	4.6	0.6	0
2. Market demand, prices, and profitability were actively considered in the selection of WSD activities.	0.4	2.6	6.4	39.8	50.8

3. Good marketing arrangements existed/ were created for the produce from WSD activities.	0.2	2.3	5.8	18.9	72.8
Social Rationality					
1. Mobilization and involvement of various social groups was actively done in deciding about the WSD activities.	20.1	50	17.5	11.8	0.6
2. Interests and benefits to small and marginal farmers were actively considered in deciding about WSD activities.	25.8	34.6	27.3	7.7	4.7
3. Interests and benefits to landless households were actively considered in deciding about WSD activities.	7.5	23.6	40.8	22.3	5.8

The table below gives the responses of the beneficiaries on selected questions pertaining to political, organizational, financial and government rationalities. On political rationality, most beneficiaries indicate that the participation of all village leaders was invited at the start of the project, but a large number indicate that the institutions did not have strong politically able leadership, and they were not able to balance the demands of various power groups, and settle major disputes.   On organizational rationality, most beneficiateis indicate that good local institutions were created for WSD activities, but in a large number indicate that user groups were not created for NRM activities, and many indicate that there was lack of regular meetings, and also deficiencies in the coordination and management of activities.

On financial rationality, around 60 per cent of beneficiaries indicate that the funds were efficiently handled and there was no dispute about the management of funds but the rest indicate some difficulty with respect to this, and a majority indicate that the financial position of the institution is not very sound. On government rationality, whereas about 20 to 30 per cent benefiaries indicate that there was substantial government help and it was speedy, the rest indicate difficulty with respect to this, and majority indicate that the government could not help in resolving disputes and problems. There is, however, substantial variation in these responses.

Table: Assessment on rationalities II – selected questions and responses (percent)					
Political Rationality					
	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree
1. The participation of all village leaders was invited through meetings and consultation at start of the WSD project	34.5	39	14.1	10.9	1.5
2. The WSD institution had strong politically able leadership	4.3	20.5	51.6	16.6	7
3. WSD institution was able to balance the demands of various village powers, and	3.7	25.2	17.1	40.6	13.4

groups, and settle all major disputes					
Organizational Rationality					
1. Good local institutions/organizations were created/ designated clearly to lead, plan and implement WSD activities	15.8	54.8	18.4	9.3	1.7
2. Active User Groups (UGs) were created for NRM activities	18.5	22	18	17.8	23.7
3. There were regular meetings for all WSD activities (NRM, PE and EP)	28.2	38.1	20	8.2	5.4
4. Planning, implementation and delivery of the WSD activities (NRM, PE and EP) was very well coordinated and managed.	11.9	47.9	28.3	9.7	2.2
Financial Rationality					
1. The funds were very efficiently handled for the intended purpose and beneficiaries	28.1	40.5	27.7	3.7	0.0
2. There was no dispute about the management of funds	15.7	45.4	25.7	10.9	2.2
3. The financial position of the WSD institutions is extremely sound/ surplus	9.6	17.5	22.6	27	23.2
Government Rationality					
1. The government officials helped in mobilizing village people and creating the local organizations for WSD	8.7	33	33	14.9	10.3
2. The local organization and government officials received speedy support and cooperation from the higher officials.	2.6	20.5	37.1	34.8	5
3. The government officials helped in resolving any disputes and problems.	0.2	10.2	14.1	20	55.4

Assessment on Institutional Features

The table below provides responses on a few of the questions regarding the presence of institutional features, which are derived from the concepts of new institutional economics. On the clarity of objectives, a majority indicate that the objectives of the WSD institution were cleared to everyone, but a signficiant number indicate that there were deviations from the objectives in various WSD activities. On the presence of good interaction, a majority indicate that there was a good interaction between WSD institution and the villagers, but many indicate deficiency in good leadership to facilitate the interaction and also deficiency in the interaction between the WSD institution and higher level institutions such as the government.

On adaptiveness, most beneficiaries indicate the rules and procedures were flexible/not very rigid, but many find deficiencies in the process for adapting the rules, and in actual adaption of rules by the institution. With respect to the issue of scale, most indicate that the scale was appropriate but many indicate that the higher

level issues were not properly addressed by higher level authorities. With respect to compliance, most beneficiaries indicate that the institution used its powers to bring compliance, but a large percentage only partially agree, and in a majority of cases, no external monitoring or enforcement was indicated.

Table: Assessment on institutional features – selected questions and responses (percent)					
Clarity of Purpose/Objectives					
	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree
1. The WSD institution's objectives and purpose were clear to everyone	33	55.7	6.9	3.9	0.6
2. Deviations from NRM, PE and EP objectives were not frequent.	17.5	39.2	26	15.1	2.2
Good Interaction					
1. There was good interaction between the WSD institution and the villagers.	29.5	54.4	11.1	3.1	1.8
2. There was good leadership to facilitate and guide the interactions	10.8	44.1	30.5	9.5	5.2
3. There was good interaction between the WSD institution and higher level institutions such as the government.	14.2	26.2	34.4	21.9	3.4
Adaptiveness					
1. The rules and procedures of the WSD institution/ project were flexible/ not very rigid	13.3	65.9	12.9	6.8	1.1
2. There were processes/ ways for adapting the rules and procedures according to the needs and suggestions.	7.3	30.9	43.8	16.3	1.7
3. There were instances when the rules and procedures were adapted by the institution to improve the benefits.	21.5	35.7	14.3	23.6	4.9
Scale/Size					
1. The area governed by the WSD institution was appropriate for good management and results	25.9	44.3	26.8	2	0.9
2. The higher level/ bigger issues/ matters were properly addressed by higher level authorities/ institutions/ government	2.8	14	40.3	33.2	9.7
3. The lower level/ smaller issues/ matters were properly addressed by lower level groups (e.g. UG, SHG, individuals)	24.3	40.1	13.4	11.9	10.3
Compliance					
1. The WSD institution used its powers to bring compliance	21.8	36.8	35.5	5.2	0.7
2. The compliance to the rules was sufficient	13.1	54	26.4	5.4	1.1

3. There was external monitoring and enforcement of the rules, procedures and funds handling/ utilization	5	13.9	40.5	33.1	7.4

Assessment of Performance

The performance of WSD institutions in a setting such as India needs to be assessed on several dimensions (see Gandhi and Namboodiri 2002) and this includes dealing with scarcity (conservation, availability, and efficiency in scarce resources such as water). It also includes dealing with equity which addresses the distribution of benefits across villagers - large and small farmers and landless, and different social groups. Further, environmental issues need to be addressed such as sustainability, soil erosion, flooding, and depletion of groundwater. Next, financial soundness such as obtaining, raising and managing funds, and having a surplus, needs to be assessed. Finally, the perceived overall success of the institutions can also be assessed.

The table below gives responses on a few of the questions asked to assess performance on these different counts. The responses indicate that in a majority of cases, structures for conservation of natural resources have been created and water conservation has improved, but there are deficiencies regarding maintenance and protection of the structures, and in most cases, there is inadequate monitoring of water use. With respect to equity, most agree that there is a fair distribution between small and large farmers, but in many cases, not so across farmers and the landless, and often there is no monitoring for equality in the distribution of benefits.

On the environmental front, most indicate that soil erosion has reduced and there is no flooding or water logging. However, in many cases, there has been a depletion of the groundwater and that institutions have hardly monitored or controlled the environmental harm. With respect to finance, most beneficiaries indicate that the institutions got sufficient funds from the government, but in a majority of cases, contributions could not be raised from the beneficiaries, the financial disciplines was not monitored by the government, and the institutions was not financially sound. With respect to the overall success, about 47 per cent consider the institutions to be successful, but 43 per cent consider the performance only satisfactory and only 9 per cent consider their institutions highly successful. There is a large amount of variation in the responses regarding various parameters of success, indicating considerable variation in performance.

Table: Assessment of performance – selected questions and responses (percent)					
Scarcity					
	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree
1. A number of structures for conservation of water, soil and natural resources were constructed	25.0	62.4	11.7	1.0	0.0

2. Water conservation has improved	35.5	55.7	8.6	0.2	0.0
3. The structures were well maintained & protected	13.5	51.4	26.4	7.7	1.0
4. Water use of villagers was monitored and controlled	2.3	16.7	38.4	33.9	8.7
Equity					
1. The benefits were equally distributed between small and large farmers	16.4	42.8	24.0	15.1	1.7
2. The benefits were equally distributed between farmers and the landless	5.6	29.9	27.1	22.7	14.7
3. The benefits of were equally distributed between different social groups	11.7	44.6	22.6	16.3	4.8
4. Distribution of benefits was monitored/ controlled for equality	8.9	37.9	34.2	14.9	4.1
Environment					
1. Soil erosion reduced in the village	14.2	47.8	34.3	2.6	1.1
2. There was no flooding or water logging in the village	43.8	31.2	20.0	4.1	0.9
3. There was no great depletion of ground water in the village	4.8	48.4	32.0	14.0	0.7
4. The institution monitored and controlled environmental harm/ depletion	1.1	13.7	25.9	43.3	15.9
Finance					
1. The institution got sufficient funds from the government	14.4	65.1	16.1	4.4	0.0
2. The institution could raise contributions from the beneficiaries	6.7	14.5	17.6	26.3	34.9
3. Financial discipline was monitored by the government	9.2	21.4	34.7	30.6	4.1
4. The institution was financially sound/ surplus	10.9	17.9	17.5	28.9	24.8
Overall Assessment of Success					
	Highly Successful	Successful	Satisfactory	Somewhat poor	Very poor
Rating percent	8.7	46.5	43.4	1.3	0.2

Results of Multivariate Analysis

A major purpose of the research was to examine the relationship between institutional characteristics and the performance of the WSD institutions. The relationship of different institutional features to the institutional performance indicators is examined through multivariate estimation here. Since the performance indicators are range-bound ratings with values from 1 to 5, OLS regression would be unsuitable and a limited dependent variable procedure is required. The TOBIT regression is selected and used for econometric estimation (see Madala 1983). The Table below presents the results of the Tobit regression between the overall success rating and the different rationalities. The assessment of each rationality has been done based on response to a set of pertinent questions, shown above, and these

responses have been aggregated to provide an aggregate assessment. Dummy variables have been included for the districts.

The results validate the usefulness of the framework in explaining institutional performance. Results show that overall success is positively and strongly related to technical rationality. It is also strongly related to environmental, organizational and financial rationality. However, the relationship with economic, social and government rationality is not statistically significant. The relationship with political rationality is found to be negative. The results indicate a strong institutional importance of technical, environmental, organizational, and financial rationality in the overall success of watershed institutions. Financial rationality followed by organizational rationality are particularly important. The negative relationship with political rationality indicates that excessive focus on this is associated with poorer performance.

Table 6: Tobit Model: Overall success and Institutional Rationalities

Variable	DF	Parameter Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	1.22884	0.354505	3.47	0.0005
TechR	1	0.067174	0.034307	1.96	0.0502
EnvR	1	0.081121	0.033154	2.45	0.0144
EcoR	1	0.098149	0.069857	1.4	0.16
SocR	1	-0.04804	0.072712	-0.66	0.5088
PolR	1	-0.13869	0.054413	-2.55	0.0108
OrgR	1	0.222097	0.083072	2.67	0.0075
FinR	1	0.282279	0.075892	3.72	0.0002
GovtR	1	0.146254	0.091045	1.61	0.1082
DummyAnantapur	1	-0.15792	0.076559	-2.06	0.0391
DummyNalgonda	1	-0.05565	0.075492	-0.74	0.461
_Sigma	1	0.673758	0.022022	30.59	<.0001
n=541					

The Table below provides the results on the relationship of overall success to new institutional economics based institutional features. Each feature has been assessed through a set of questions, of which the responses have been aggregated. Results indicates a strong association with the features of good interaction and adaptiveness at 99 percent level of significance. The relationship with scale is also strong at 90 percent level. The relationship with compliance and with clear objectives is not significant. The results validate the relevance of new institutional economics in determining the performance of institutions. In particular it shows that good interaction, adaptiveness, and scale are very important institutional features for good performance of watershed institutions.

Table 7: Tobit Model: Overall success and Institutional Features

Variable	DF	Parameter Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	1.408218	0.333682	4.22	<.0001

ClObj	1	-0.01437	0.054897	-0.26	0.7935
GoodInt	1	0.262728	0.059559	4.41	<.0001
Adpt	1	0.208558	0.06714	3.11	0.0019
Scale	1	0.121771	0.067606	1.8	0.0717
Comp	1	0.075421	0.0713	1.06	0.2902
DummyAnantapur	1	-0.03377	0.076867	-0.44	0.6605
DummyNalgonda	1	-0.08406	0.078856	-1.07	0.2864
_Sigma	1	0.677771	0.022187	30.55	<.0001
n=540					

It has been indicated above that the performance of watershed institutions has four important dimensions. These are performance in overcoming scarcity, achieving equity, addressing the environment, and financial soundness. Assessment has been made on a 5 point rating scale through sets of pertinent questions regarding the performance of the institutions on each of these performance measures, which have been aggregated. The Table below provides the results on the relationship between scarcity and the different rationalities. The results indicate a positive, strong and statistically significant relationship with technical rationality, economic rationality and organizational rationality. The relationship with political rationality is found to be negative and significant. The results indicate that on technical, economic and organizational rationality within institutions are critical for performance on overcoming scarcity. Over-emphasis on political rationality may have a negative impact on the institutional performance on scarcity.

Table 8: Tobit Model: Performance on Scarcity and Institutional Rationalities					
Variable	DF	Parameter Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	2.375267	0.186494	12.74	<.0001
TechR	1	0.064098	0.018371	3.49	0.0005
EnvR	1	0.017346	0.018159	0.96	0.3395
EcoR	1	0.093409	0.03684	2.54	0.0112
SocR	1	0.023782	0.038483	0.62	0.5366
PolR	1	-0.10426	0.028726	-3.63	0.0003
OrgR	1	0.143504	0.044187	3.25	0.0012
FinR	1	0.030678	0.040797	0.75	0.4521
GovtR	1	0.017055	0.048243	0.35	0.7237
DummyAnantapur	1	-0.00649	0.040531	-0.16	0.8727
DummyNalgonda	1	-0.09934	0.040198	-2.47	0.0135
_Sigma	1	0.356272	0.011037	32.28	<.0001
n=521					

The Table below indicates the relationship between the performance on equity and the different rationalities. The results indicate a strong and statistically significant relationship with social, environmental, organizational and financial rationalities. The results indicate that for achievement of equitable outcomes, the institutional focus on social, environmental, organizational, and finacial rationalities are particularly

22

important. Technical rationality is negative and mildly significant indicating a mild inverse relationship.

Table 9: Tobit model: Performance on Equity and Institutional Rationalities					
Variable	DF	Parameter Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	1.329258	0.263096	5.05	<.0001
TechR	1	-0.04357	0.02559	-1.7	0.0886
EnvR	1	0.131793	0.024664	5.34	<.0001
EcoR	1	0.076976	0.051926	1.48	0.1382
SocR	1	0.25027	0.054005	4.63	<.0001
PolR	1	-0.05744	0.040413	-1.42	0.1552
OrgR	1	0.186862	0.061832	3.02	0.0025
FinR	1	0.161262	0.056713	2.84	0.0045
GovtR	1	-0.11604	0.067978	-1.71	0.0878
DummyAnantapur	1	-0.17331	0.057122	-3.03	0.0024
DummyNalgonda	1	-0.23699	0.056254	-4.21	<.0001
_Sigma	1	0.506655	0.015389	32.92	<.0001
n=542					

The Table below examines the relationship between performance on environmental outcomes and the different rationalities. The results indicate a strong positive relationship with environmental rationality and organizational rationality. The relationship with political rationality is negative and significant. The results indicate the importance and need for environment, and organizational rationalities for achieving good environmental outcomes. Over-emphasis on political rationality may lead to negative outcomes.

Table 10: Tobit model: Performance on Environment and Institutional Rationalities					
Variable	DF	Parameter Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	2.438907	0.16902	14.43	<.0001
TechR	1	-0.0229	0.016555	-1.38	0.1666
EnvR	1	0.04467	0.015936	2.8	0.0051
EcoR	1	0.03014	0.033387	0.9	0.3667
SocR	1	0.001747	0.034717	0.05	0.9599
PolR	1	-0.07531	0.026084	-2.89	0.0039
OrgR	1	0.209646	0.03978	5.27	<.0001
FinR	1	0.042304	0.036451	1.16	0.2458
GovtR	1	0.031008	0.043799	0.71	0.479
DummyAnantapur	1	0.137554	0.036723	3.75	0.0002
DummyNalgonda	1	-0.05647	0.036164	-1.56	0.1184
_Sigma	1	0.325438	0.009903	32.86	<.0001
n=540					

23

The Table below provides results on the relationship between financial soundness and performance with the different rationalities. The results indicate a strong association with financial rationality as may be expected. It also indicates a strong relationship with environmental, economic, social political and organizational rationalities. The results indicate that institutional focus on these rationalities are very important for financial soundness and performance. The technical rationality shows a negative association which may indicate that technical rationality may involve large expenditures which may weaken the financial position of the institution.

Table 11: Tobit Model: Performance on Finance and Institutional Rationalities					
Variable	DF	Parameter Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	1.16655	0.156298	7.46	<.0001
TechR	1	-0.05603	0.015202	-3.69	0.0002
EnvR	1	0.048137	0.014652	3.29	0.001
EcoR	1	0.031029	0.030848	1.01	0.3145
SocR	1	0.11395	0.032083	3.55	0.0004
PolR	1	0.060842	0.024008	2.53	0.0113
OrgR	1	0.118801	0.036733	3.23	0.0012
FinR	1	0.261087	0.033692	7.75	<.0001
GovtR	1	-0.01596	0.040384	-0.4	0.6927
DummyAnantapur	1	0.100742	0.033935	2.97	0.003
DummyNalgonda	1	-0.00479	0.033419	-0.14	0.8859
_Sigma	1	0.300989	0.009142	32.92	<.0001
n=542					

Conclusions and Implications

The management of natural resources is assuming great importance for sustaining growth and development in India. Natural resources are becoming a significant limiting factor and it is increasingly clear that technology alone cannot solve the growth problem particularly in the rainfed areas; the good management of natural resources plays a critical role in improving livelihoods and alleviating poverty. Given its importance, the government has made huge efforts through watershed development programmes. However, institutional limitations in the delivery of these programmes has affected the outcomes. It is critical to combine the scientific approaches and funding of watershed development with community participation, knowledge and ownership to bring success, and in this institutional design is critical.

The study has applied new institutional economics and management theories of governance to understand the performance of watershed institutions. A framework has been developed and empirically explored through a large sample of watershed development institutions and beneficiaries in Andhra Pradesh, India. The results indicate the substantial importance of the institutional features of good interaction, adaptiveness and appropriate scale for the performance of watershed institutions. The results also show that the addressing of critical rationalities particularly technical, organizational and financial is extremely important for the performance of

these institutions. The results are somewhat mix with respect to social, environmental, and economic rationalities. Social and environmental rationalities are found to be very important for achieving equity; environmental and government rationalities important for performance on the environment; and financial, economic and social rationalities for the performance on financial soundness. Strong emphasis on political rationality seems to diminish performance on many fronts.

The results show that the good design of watershed development institutions is very important for successful outcomes of livelihoods and environment. It is important that the structure and processes of these institutions strongly provides for technical rationality in the implementation through the deployment of experts, good technology and guidance. It is also important that community mobilization for formation of strong local organizations to implement watershed development is given substantial emphasis. Through setting proper procedures and monitoring, it is also of great importance to ensure financial rationality in the implementing organizations. Overall the institutions must ensure good interaction to bring the formal and informal together for planning and implementation. This is strongly related with performance. Adaptiveness in the rules and procedures, and appropriate scale of operation is also found to be very important to bring good performance. These features need to be clearly incorporated in the government guidelines and the institutional structures and systems involved in watershed development programs to improve their impact on productivity, livelihoods and poverty alleviation.

References

1. Ackroyd, Stephen (2002), Organization of Business: Applying Organizational Theory to Contemporary Change, Oxford University Press, Oxford.

2. Briscoe, John and Malik, R.P.S. (2006). "India's Water Economy: Bracing for a Turbulent Future". The World Bank. Oxford University Press, New Delhi.

3. Crase, Lin; Dollery, Brian and Lockwood, Michael (2002). "Transaction Costs Emanating from Policy Flexibility in Water Markets", in Brennan, Donna (ed) Water Policy Reform: Lessons from Asia and Australia, Australian Centre for International Agricultural Research (ACIAR), Canberra.

4. Crase, Lin and Gandhi, Vasant P. Ed. (2009) Reforming Institutions in Water Resource Management: Policy and Performance for Sustainable Development, London: Earthscan.

5. Drobak, John K. and Nye, John, V.C. (1997). "Introduction", in John K. Drobak, and John, V.C. Nye, (Eds), The Frontiers of the New Institutional Economics, Academic Press, California.

6. Gandhi, Vasant P. (1998). "Rapporteur's Report on Institutional Framework for Agricultural Development", Indian Journal of Agricultural Economics, July-September.

7. Gandhi, Vasant P and N.V. Namboodiri. (2002), "Water Resource Management in India: Institutions and Development", in Brennan, Donna (ed) in Brennan, Donna (ed) Water Policy Reform: Lessons from Asia and Australia, Australian Centre for International Agricultural Research (ACIAR), Canberra.

8. Gandhi, Vasant P., Crase, Lin, and Roy, Ashutosh (2009), "Institutional Analysis of the Performance of Water Institutions in Three Major States of India," in Lin Crase and Vasant P. Gandhi (eds.), Reforming Institutions in Water Resource Management: Policy and Performance for Sustainable Development, London: Earthscan.

9. Gandhi, Vasant P.,& Namboodri, N.V. (2009); "Water Resource Development and Institutions in India: Overview and Profile" in Lin Crase and Vasant P. Gandhi ,Edited, "Reforming Institutions in Water Resource Management: Policy and Performance for Sustainable Development", Earthscan: London, 2009.

10. Groth, Lars (1999), Future Organizational Design: The Scope for IT-Based Enterprise, John Wiley & Sons, Chichester.

11. Herath, Gamini (2002). "Issues in Irrigation and Water Management in Developing Countries with Special Reference to Institutions", in Brennan, Donna (ed) op.cited.

12. ICAR. (2009). Handbook of Agriculture. New Delhi:.Indian Council of Agricultural Research (ICAR)

13. Kerr, J. (2007). Watershed Management: Lessons from Common Property Theory. International Journal of the Commons , 1 (1), 89-109.

14. North, Douglass, C. (1990). "Institutions, Institutional Change and Economic Performance", Cambridge University Press: Cambridge UK.

15. North, Douglass, C. (1997). "Prologue", in John K. Drobak, and John, V.C. Nye, (Eds), The Frontiers of the New Institutional Economics, Academic Press, California.

16. Nystrom, Paul C. and Starbuck, William H. (Ed), (1981). "Handbook of Organizational Design", Oxford University Press.

17. Olson, Mancur and Kahkonen, Satu, 2000. "Introduction: The Broader View" in A New Institutional Approach to Economic Development, Kahkonen, S. and Olson, M. (Eds.); Oxford University Press, 1-36.

18. Ostrom,Elinor (1992). Crafting Institutions for Self-Governing Irrigation Systems, ICS Press, San Francisco.

19. Pagan P., (2009) "Laws, Customs and Rules: Identifying the Characteristics of Successful Water Management Institutions", in Crase, Lin and Gandhi, Vasant P. Ed. Reforming Institutions in Water Resource Management: Policy and Performance for Sustainable Development, London: Earthscan

20. Report of the Technical Committee on Drought prone Areas Programme and Desert Development Programme ,April 1994 (Hanumantha Rao Committee Report)

21. Report of the Technical Committee on Watershed Programmes in India Department of Land Resources Ministry of Rural Development Government of India, January 2006 (From Hariyali to Neeranchal).

22. Saleth, Maria R. (1996). Water Institutions in India: Economics, Law and Policy, Commonwealth Publishers, New Delhi.

23. Shiferaw, B., Kebede, T., & Reddy, V. R. (2008). Community Watershed Management In Semi-Arid India: The State of Collective Action and its Effects on Natural Resources and Rural Livelihoods. CAPRi. Washington DC: IFPRI.

24. Vaidyanathan, A., (1999); "Water resource management: institutions and irrigation development in India"; New Delhi, Oxford University Press.

25. Williamson, Oliver E. (2000). "Economic Institutions and Development: A View from the Bottom" in A New Institutional Approach to Economic Development, Kahkonen, S. and Olson, M. (Eds.); Oxford University Press, 92-118.

26. World Bank. (2007). Watershed Management Approaches, Policies and Operations:Lessons For Scaling-Up. In Kerr, J. (2007). Watershed Management: Lessons from Common Property Theory.

27. World Water Vision (2000), (Cosgrove, William J. and Frank R. Rijsberman), Making Water Everybody's Business, World Water Council.