Institutional Performance in Natural Resource Management: A Study of Institutional Interaction in the Implementation of Watershed Development in Andhra Pradesh, India

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Abstract

The effective management of natural resources is increasingly critical for growth and development in India. The research examines the nature and impact of the interaction between formal and informal institutional structures in the rural areas in the context of the implementation of the major national initiative of watershed development programmes in India. It uses the concepts of new institutional economics and management theories of governance. It develops a conceptual framework which can be used to understand and explain the need and dynamics of institutional interaction and its relationship to institutional performance. The relevance of the framework is examined through case studies and a primary survey on the determinants of institutional performance in Andhra Pradesh, India. It seeks to contribute to the theory of institutions and the better design of institutions in watershed development.

1. Introduction

Natural resources management is increasingly becoming a major necessity for agricultural growth in developing countries such as India. It is becoming clear over time that technology alone cannot continuously support the agricultural growth and there is need to effectively manage natural resources, particularly, water, land and land/soil fertility. Watershed Development (WSD) programmes is a major national initiative, through which natural resource management has been pursued over the years in India to develop backward, water-scarce/ rainfed areas. WSD programmes aim particularly to improve natural resource management so as to raising production and incomes, improving livelihoods, alleviating poverty, mitigating drought impact and reducing vulnerability of the large poor populations in rural areas.

Given the importance of watershed development, the World Bank has provided $1.73 billion for watershed development from 1990 to 2004 (World Bank 2007), and the Government of India has spent over $6 billion from 1996-2004 (World Resources Institute 2005). In the recent years, the Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS) with an annual budget of Rs. 40,000 crores is being dove-tailed with the WSD programmes in most states. This is to synergise and enhance their contribution to

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development. This has enormously increased the support and importance of WSD programmes in India.

In this context, much research and experience indicates that the proper development and performance of institutions involved in natural resource management is extremely important (see Saleth 1996, Vaidyanathan 1999, Brisco and Malik 2006, Crase and Gandhi 2009). The research examines the nature and impact of the interaction between formal and informal institutional structures in the rural areas in the context of the implementation of the major national initiative of watershed development programmes in India using the concepts of new institutional economics and management theories of governance.

2. Watershed Development in India: Concept and Institutional Set up

A major reason why WSD programmes have been given huge importance in India is that about 50-60 percent of the country's population, including the majority of the poor, depend (directly or indirectly) on agriculture for incomes and livelihoods, and poverty is particularly acute in the rainfed areas. These WSD programmes are implemented under different schemes/ projects of the Government of India, the state governments and other agencies. This includes Drought Prone Area Programmme (DPAP), Desert Development Programme (DDP) and Integrated Wastelands Development Programme (IWDP), see Table1. India follows a three prong approach of watershed development (Kerr, 2007; Shiferaw et al, 2008) involving conservation and strengthening of the natural resource base as a primary step, accompanied by measures to make agriculture and other natural resource-based activities more productive and supporting rural livelihoods to alleviate poverty.

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

Name of Programme	Number of projects sanctioned	Area covered in million ha.	Total funds released by Central Government (Rupees Million)
DPAP	27439 (60.9 %)	13.02 (41.2 %)	28378 (36.7 %)
DDP	15746 (34.9 %)	7.87 (24.9 %)	21032 (27.2 %)
IWDP	1877 (33.9 %)	10.70 (33.9 %)	27976 (36.1 %)
Total	45062	32.29	77386

A watershed, in principle, is considered to be a geo-hydrological unit or an area that drains to a common point. Practical definitions of the watershed have varied over the years but usually for government projects and budgeting purposes, it has been defined as an area of approximately 500 hectares in a catchment village (Gandhi, 2010) (the area definition is being expanded in the recent years). For watershed development, 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).

Watershed development is given very high priority in Andhra Pradesh, especially in the dry regions. Andhra Pradesh is the largest state in the southern plateau region of India with a population of about 80 million and a geographic area of about 27 million hectares. Since it is over 50 percent rainfed, it provides a very good setting for WSD work. There have been many water and land management initiatives in the state. Andhra Pradesh has the highest number of watershed projects among the states in the country (over 9000), which are at different stages of implementation.

Over the years, WSD projects have been taken up in Andhra Pradesh through various programmes/ schemes primarily supported by the Government of India in cooperation with state governments. These include the Drought Prone Area Programme (DPAP), the Desert Development Programme (DDP), the Integrated Wasteland Development Projects scheme (IWDP), and the National Watershed Development Programme in Rainfed Area (NWDP). In addition, Andhra Pradesh also had WSD projects under the Andhra Pradesh Rural Livelihoods Project (APRLP). While these programmes/ schemes differ somewhat, the common aim has been to improve land and water resource management for sustainable production and incomes in the rural areas by focusing on activities within a defined watershed.

Very recently since 2009 there has been a consolidation of all WSD programmes into the Integrated Watershed Management Programme (IWMP) under unified guidelines. Initially, the WSD included only natural resource management (NRM) activities, but later for increasing and widening the impact, following various evaluations and reviews, they have come to include production enhancement (PE) activities, and enterprise promotion (EP) activities in many areas/ states. The older projects did not have these components. Andhra Pradesh has led the country in terms of the number of watershed development projects and has also been at the forefront of strengthening of participatory processes in watershed development and the focus on improving livelihoods especially of the poor. The institutional arrangements consist of a hierarchy of government and other bodies which undertake the planning and implementation of WSD (see Box 1).

Box 1 : Higher and lower level Entities

Higher level Entities

- The National & State Watershed Programme Implementation and Review Committee:
- Department of Rural Development
- District Rural Development Authority (DRDA)
- District Water Management Agency (DWMA)
- District Watershed Development Advisory Committee

Lower Level Entities

- Project Implementation Agencies (PIA), Voluntary Agencies
- Watershed Development Teams
    - Panchayati Raj Institutions (Zilla Parishad, Panchayat Samiti, Gram Panchayats
- Watershed Association, Village Organisation (VO)
- Watershed Committee, User Groups (UGs)
- Watershed Secretary & Volunteers, Self help Groups (SHGs)

At grass root level, the institutional environment for watershed development can be divided into formal and informal structures (see Box 2). Informal structures either exist or are created and assist in building awareness, increasing acceptability and monitoring of efforts put for watershed development and natural resource management. At the formal level, a project implementation agency is usually designated and it may handle one or more watersheds.

Box 2: Formal and Informal Structures at grass-root level

Formal structures

- Project Implementation Agency for a cluster of 2-10 watersheds
- Autonomous Support Organization (Line Department, Field Support, Panchayati Raj Institutions, Banks and Financial Institutions, Market Institutions, NGOs, Other govt departments and resource agencies, Water User associations).

Informal structures

- Community Based Organizations (Labor groups, Farmer Groups/ User groups, Women Group/SHGs)
- Various village leaders, Caste groups, religious groups and political groups.
- Local NGOs:
- Various local groups and user associations like Farmers' group, Farmer Cooperatives, Marketing cooperatives, Consumer cooperatives, etc
- Villagers

The planning and implementation has been structured through guidelines and institutional frameworks which have evolved over the years through various experiences and reviews. In Institutional Arrangements for old DPAP and DDP programmes projects are implemented by District Rural Development Agencies/Zilla Parishads (DRDAs/ZPs) through Project Implementing Agencies (PIAs). PIAs could be a Line Department or its officer (of the State Government), Panchayati Raj Institutions or a reputed NGO. One PIA normally handles 10-12 watershed projects covering an area of about 5000-6000 hectares. The PIA is required to maintain a technical team of 4 experts called Watershed Development Team (WDT) and individual projects (500 hectares) are planned and executed by the local people living in the watershed area called the Watershed Association (WA) through an elected body called Watershed Committee (WC).

A watershed specific District Watershed Management Agency (DWMA) has taken over the functions of watershed from DRDA in last few years. APRLP programme allows for involvement of local NGO in the capacity of PIA and it also adds up institutional arms like Village Organization (VO), comprising of many existing or newly created Self Help Groups (SHGs), to carry out PE and EP activities (See figure 1). Institutional arrangements for Hariyali programme involve Gram Panchayats in implementation, thus providing devolution to local government entities.

Procedurally, in the present system there is state funding for the WSD activities; followed by implementation of those WSD activities; and then withdrawing, and leaving assets, structures and initiatives to be managed by communities. Some models of devolution

have emerged but still substantial challenges remain. A major institutional constraint facing the adoption and impact of WSD is the difficulty of moving from the state delivery of watershed infrastructure/ technologies, to community management and ownership.

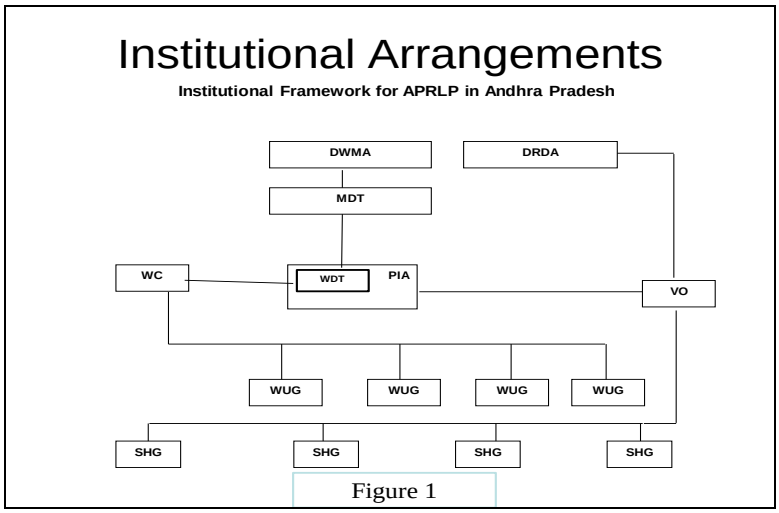

Figure 1

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3. The Concept of Institutions and their Performance

The impact of institutions on economic development has been a subject of considerable interest in the recent years. In the new institutional economics literature, *institutions are considered humanly devised constraints that structure human interaction* (North 1990). It is now being widely acknowledged that apart from the standard factors such as capital, labour and technology, institutions matter substantially in determining performance and the outcomes of development. North (2000) argues that laissez-faire markets do not really exist. Also all social systems (including markets) are actually humanly devised and are a complex mix of rules, norms, conventions, and behavioural beliefs. This complex mix shapes the way operations take place and determines the goal achievement.

Coase (2000) indicates that the productivity of economic systems depends upon specialisation, but this is possible only with exchange which has costs. The costs of such exchange or transactions costs depend largely on the institutions. Transactions costs include all the costs of making an exchange (i.e., discovering exchange opportunities, negotiating exchange, monitoring exchanges, and enforcing agreements) along with the cost of maintaining and protecting the institutional structure. New institutional economics uses various approaches to justify and understand institutions, (see North 1997, Drobak and Nye 1997). Two important concepts among these are transaction costs and property rights. According to North (1997), a major challenge is to evolve institutions that minimise transaction costs and create incentives that favour cooperative solutions which utilise cumulative experiences and collective learning.

In India, historically there has been substantial focus on the development of natural resources but the emphasis has been mainly on the technical side (Gandhi 2009). In natural resources such as water and soil, market failure is common given their physical and economic nature and the presence of institutions is essential. A substantial lack of understanding exists on how to design good institutions for water and other natural resources in India (Saleth, 1996; Gandhi, 1998; Brewer et.al., 1999; Vaidyanathan, 1999; Crase and Gandhi, 2009;

Gandhi and Namboodiri, 2009). Kerr (2007), while assessing the performance of watershed institutions in India, noted the inequitable outcomes for landless through watershed institutions. Sreedevi et al. (2008) found that those institutional arrangements which involve elements of capacity building and development of social capital could improve livelihoods in terms of gender, equity and sustainability. Wani et al. (2008) have found that in last two decades more responsibilities of natural resource management have been given to local communities; but the institutions do not have necessary capacities to deal with the complexities involved in natural resource management (Sreedevi et al, 2008). Thus, there is an immense need for better institutional arrangements (Wani, 2003 & 2008).

3.1 Institutional Performance and New Institutional Economics

Based on the foundations of new institutional economics, and the empirical literature (e.g. Ostrom 1992, Goodin, 1996, Gandhi 1998; Crase et. al, 2002, Herath, 2002), Pagan (2003& 2009) has identified five key characteristics that may be required and observed in effective institutions. They are as outlined below:

1) *Clear objectives*: Good institutions should have clear objectives and clarity of purpose. Clear objectives and their acceptance among stakeholders will result in greater congruence, less conflict and lower transaction costs.
2) *Good interaction (Interconnectedness between formal and informal institutions)*: Good institutions should have good interaction that brings the formal and informal rules and objectives together. It helps in reducing transaction costs and promoting cooperative solutions by bringing the logic and various forces together. They also show good interaction with other institutions so that external transaction costs are also minimised.
3) *Adaptiveness*: Good institutions show adaptiveness to varying external and internal environments. This reduces transaction costs and generates sustainable performance.
4) *Appropriate scale*: Good institutions base themselves on appropriate scales (spatial and administrative) in scope and size. This will avoid large transaction costs and provide for better control on internal and external environment.
5) *Compliance capacity*: Good institutions achieve good compliance to its rules among its members. Non compliance to the rules by large section of the members increases the transaction costs and thus making the institutional less meaningful.

Empirical studies examining the relationship of these factors to the performance of institutions in water resource management have confirmed the relevance and importance of each of these factors (see Pagan, Crase and Gandhi 2009, and Gandhi, Crase and Roy 2009). The importance of adaptiveness in the performance of water resource management institutions has been studied and confirmed by Bhamoriya (2010).

3.2 Institutional Performance and Management Theories of Governance

Management theories of organisational design and governance also indicate important features which are related to institutional performance (Nystrom and Starbuck, 1981; Groth,

1999; Ackroyd, 2002), and have identified three rationalities which need to be addressed for good governance and performance. These are:

1. *Technical rationality*: Good institutions show technical rationality which deals particularly, with the efficient conversion of inputs into outputs. It needs good technology along with various other determinants of highly productivity.
2. *Organisational rationality*: Good institutions show specialisation, division of labour, and effective coordination, in its various functions and tasks for good institutional performance.
3. *Political rationality*: Good institutions show political rationality that deals with the perceptions of fairness and justice across individual and groups. It helps in bringing effective and sustainable institutional performance.

Crase and Gandhi (2009) have applied these concepts to water institutions in India and have found them relevant and significant.

3.3 Sociology and the Importance of Interaction in Institutions

Sociologists examine interaction from the perspective of social behaviour or group behaviour of human beings in an institution. Some sociologists feel that interactions construct and propel forward the meaning of institutions while Institutions, in return provide raw materials and guidelines for interactions (Blumer, 1969; Hallet and Ventresca, 2006). Some researchers call people as mere "carriers" of institutional processes (DiMaggio, 1988; Scott, 2001; Creed et al., 2002) but some critics have countered this view by emphasizing the role of interaction in giving meaning to the actions of the people. Scully and Creed, (1997) argues that institutions are not inert containers of meaning but have humans involved, thus they cannot be decoupled from social interactions. Hallet (2003) argued that people with social skill (leaders) do induce cooperation in other people and without examining actual interactions there is very little sense about the origin of that social skill. Nee and Ingram (1998) state that interactions or "Network of Social Relations" are due to individuals' response to perception of cost and benefits in exchanges and invest or divest in particular ties. Thus, the production and monitoring of norms, standards of expected behaviour that develop out of consensus in the group or community become part of institutional behaviour.

3.4 New Institutional Economics and the Importance of Interaction

It has been recognised that not only the formal rules but also informal rules outside the direct control play a crucial role in the operation and performance of social systems (Williamson 1985; Ostrom 1993; North 2000; Dovers 2001; Pagan 2009). Formal bodies or rules have various objectives, goals, hierarchies, mechanisms and culture while informal bodies or rules have their culture, values, perceptions, mechanisms and goals (Pejovich, 1999). These Formal rules or structures are determined by the market under pressures while informal rules or structures are derived socially and have its roots in cultural heritage of a community (North, 2000). Thus, they changes slowly and their persistence effectively constrains changes in the market determined formal rules. Pagan (2009), Goodin (1996) and Dovin (2001) argue that inconsistency in performance or poor fit between formal and informal institution demands institutional change. To be effective, institutions need to have

good interaction to bring the formal and informal rules together. Young (1999) indicates that physical, social and cultural factors affect the settings and contexts. Institutions, act as driving force for decision making process and leaders interact to take decisions across different contexts. It is important to examine the interactions among institutions across various settings/ contexts understand institutions. Also, it has been well recognised that to bring about changes in operation and performance of social systems, there is requirement of linkages between their formal and informal structures (Williamson 1985; Ostrom 1993; North 2000; Keefer and Shirley, 2000; Dovers, 2001; Pagan 2009).

Pejovich (1999) argues that formal rules emerge spontaneously in response to changes in the economic environment (e.g., new markets, new knowledge, new sources of supplies, etc.), while informal rules, the changes occur primarily through their erosion, which is a slow and time-consuming process (also in North 2000). The formal rules create new opportunities for human interactions. To get benefit of these opportunities, individuals strive for new contractual arrangements. Contractual arrangements that are market acceptable create the demand for institutional change lowering the transaction costs of benefitting from new opportunities. The new formal rules so emerged should be in tune with the existing informal rules. It also implies that the community that provides an environment appropriate to spontaneous changes in formal rules should be both stable and growing. Thus, interaction depends a lot upon the contexts and other related factors.

It is also a common observation that formal state institutions sometimes are weak or not deemed legitimate in fragile and conflict-affected contexts, there informal institutions thrive well and bring in legitimacy (North, 1990; Grief, 1993; http://www.gsdrc.org). These institutions generally are diverse and may include community mechanisms or local governance institutions. This is so because the primary stakeholders perceive them as their own. Often, they fulfil some of the functions expected of the state because of their better acceptability and inherent flexibility. There is also an element of accountability and reliability that these informal institutions bring in because of less stringent guidelines and involvement of known faces. But, it is also quite possible that informal and local institutions may discriminate, (e.g., towards women); and do a relatively poor job (Keefer ad Shirley, 2000). Thus, good interaction of formal and informal institutions becomes a necessity.

Pagan (2009) has identified some empirical measures and heuristics for assessment of interaction between formal and non formal institutions. They include estimating cost of creation and management (collecting information, monitoring and decision making) of a formal institution instead of naturally occurring informal institution; and comparing the welfare outcomes and extent of reflection of norms and values of existing formal institution with similar formal institutions within different informal institutional environments. Empirically, impact of interactions on institutional performance in context of watershed development can indirectly be assessed using the indicators of institutional performance for watershed, namely: improvements in water availability; conservation of soil, soil fertility and environment; improving sustainability; improvements in crop and animal production; improvements in farmer incomes; improvements in non farm incomes; employment generation; and reduction in migration. Other measures may include addressing the concerns of scarcity; equity; environment; and financial viability (see Gandhi and Namboodiri, 2002).

3.5 Application to watershed development institutions

Many economists and researchers have found that the performance of watershed institution is not as desired and cite disconnection between planners and policy makers, project implementation agency (PIA) and the local community as a primary reason (Rhoades and Elliot 2000; Johnson et al., 2002; Dash 2008; ICAR, 2009). Until recent times, interaction between formal and informal structures of watershed development institutions had never been examined to explain their effectiveness in Indian context. But, an indicator of interaction namely; participation has been used occasionally as a measure to examine the effectiveness of watershed institutions. Kerr and Kolavalli (2002) suggest three important dimensions of participation with respect to group participation namely: *facilitating collective action, transferring critical decision making powers, making communities share the development costs and benefits*. Gandhi (2010) highlights the need for bringing together the formal scientific watershed development approaches and government programmes, with the setting and informal knowledge of village community, resulting in better planning as well as acceptance and ownership by the villagers. Pagan (2003&2009), Crase and Gandhi (2009), Gandhi (2010) and Bhamoriya (2010) have highlighted the importance of institutional features & various rationalities in institutional performance. It was felt that there is an immense need to study the institutional interaction, its quality and quantity, its drivers and thereby identifying its role towards performance of institution, particularly in context of Natural Resource Management.

4. Conceptual Framework

Interaction can be conceptualized in a "demand" and "supply" framework. One can think of a "demand" for interaction which can vary across institutions and over time and this may depend on "drivers" in the external and internal environment. The drivers may be divided into generic drivers and specific drivers. Generic drivers/Influencers may be considered as those macro factors which are part of overall institutional environment and create demand or increase pressure for interaction. They may include *growing population; rising demand for natural resources; changes/variations in natural resource availability; change/variation in social settings, economic & political environment; and change/variation in government policies.* Specific drivers/influencers may be considered as those micro or institutional factors which are specific to the watershed institution at grass root (village) level and creates the demand for interaction. These factors directly affect basic institutional activities such as planning, implementation and management. The specific drivers may include *complexity in decision making; primary stakeholders' concerns and expectations; need for transparency & equity; need for accountability and sustainability; and performance assessment by various agencies.*

The influence of different kinds of drivers would result into demands on the institution for meeting different kinds of rationalities. Three kinds of rationalities that have been already discussed in the context of management and governance theories are: technical, organizational and political. In the context of watershed development, Gandhi (2010) has proposed that there is a need to expand this list to eight rationalities: The full set is given below:

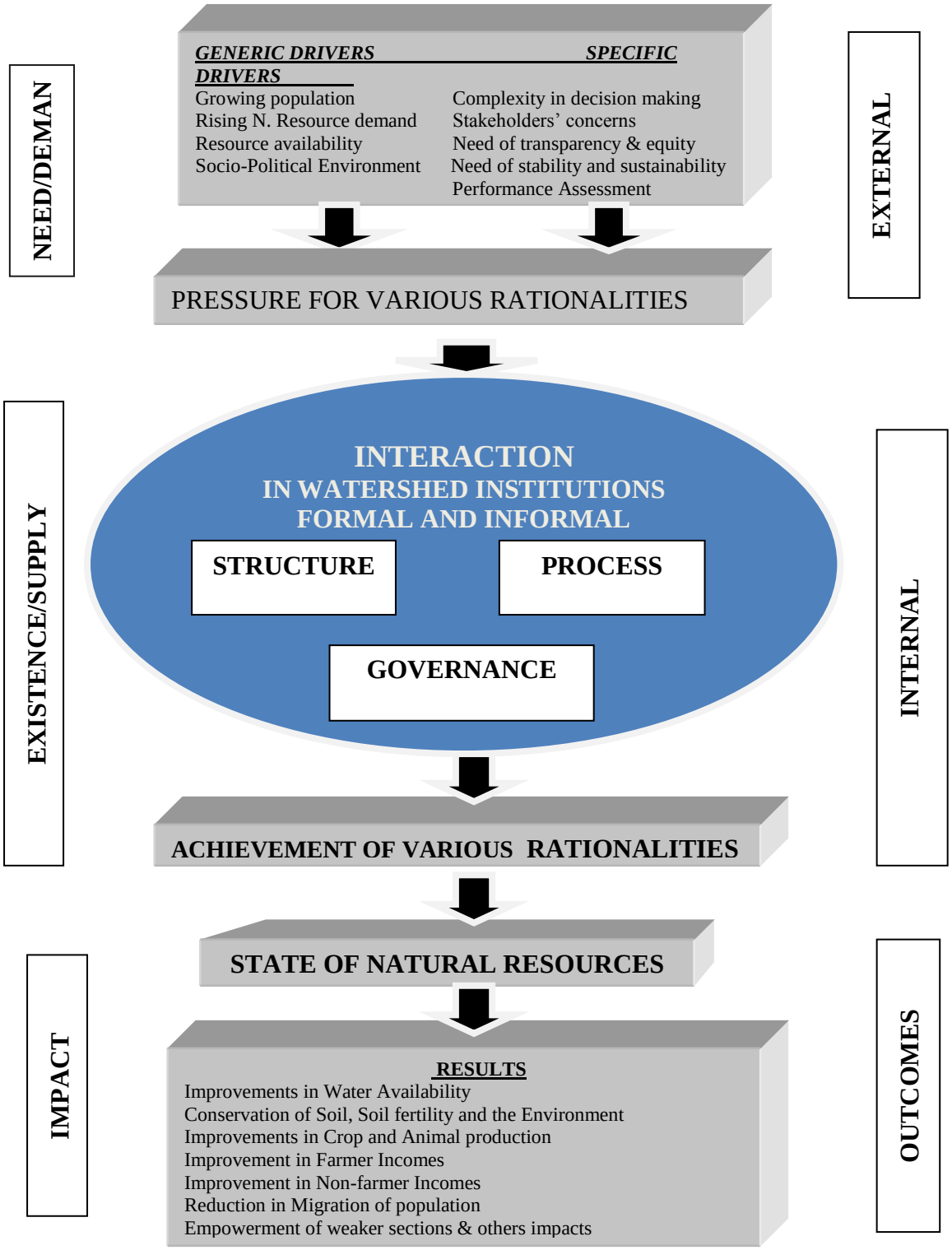
1. *Technical rationality* require involvement of experts or technically skilled people in planning and decision making for activities like selection of the technologies; and type, specification and location of various WSD activities.
2. *Economic rationality* seeks the evaluation and selection of activities by due consideration of markets, demand, prices, profitability and returns to investment.
3. *Environmental rationality* requires the consideration of externalities and contribution to conservation of water, land and natural vegetation on sustainable basis.
4. *Social rationality* seeks considering social or people setting to achieve acceptance and cooperation of various social groups for WSD activities.
5. *Political Rationality* seeks addressing the perceptions of fairness and justice across various individuals and groups to achieve smooth and sustainable functioning.
6. *Organizational rationality* requires consideration of existing level of, and ways to induce and enhance leadership, managerial skills, knowledge as well as training.
7. *Financial rationality* requires considering procedures, responsibility and accounting systems to induce and enhance discipline and care in proper handling of the finances.
8. *Government rationality* requires proper design of programmes, and effective and speedy support from the government system.

The supply of interaction comes from the institutions. It has been conceptualized by Bhamoriya (2010) in the context of institutional adaptiveness that the supply would come through three institutional components or features: structure, processes and governance. Structural features may include the incorporation and functionality of structural components/ positions, the bye-laws, the membership rules, autonomy or independence from the government, structural features requiring participation such as General Body Meetings (GBM). Processes would include the kinds of processes the institutions have for decision-making and whether they are interactive. The governance includes the kind of leadership and the method through which it operates such as autocratic or participatory.

The outcome of interaction can be seen in terms of the achievement of different rationalities, which would lead to the emerging state of the natural resources in the context of watershed development. This can be measured through various measures such as the state of the soils and the depth of water table and more. The observable results may include water availability, soil fertility, crop yields, farm incomes, non-farm incomes, people migration level, and empowerment of weaker sections.

The proposed framework indentifies the demand and supply of interaction; and also enables enquiry into the dynamic nature of the response as well as drive for interaction. It helps to bring macro and micro together and thus enables the study of the cumulative linkages while segregating the need for response. With the increasing complexities in decision making, and increasing awareness and empowerment of stakeholders; it is challenging for institutions to interact effectively addressing the various rationalities. Thus, we need to observe the behaviour of organisation in order to study the institutions. Watershed institutions are not a standalone entity but embedded in socio-economic domain of life. The framework as depicted below involves such inter-linkages and helps the study of interaction in their context.

Figure 2: Conceptual framework for institutional interaction



5. Data

The data was collected for a larger project on enhancing institutional performance in watershed management, funded by ACIAR. This includes good interaction as one of the institutional features to study institutional performance. We have culled out specific data related to interaction to study and understand good interaction. Six case studies were done

first; interviewing key people associated with WSD programmes, and understands the dimensions of WSD implementation and variation in performance. Field level questionnaire survey was carried out at 18 watershed villages in three districts on Andhra Pradesh (see Table 2). The districts and villages were selected for importance of watershed development and diversity in extent and completion of the programme/activity, type of programmes under which WSD have been carried out, administrative and institutional structure present during and after the programme implementation, and government involvement and non government initiatives.

Table 2: Sample coverage of the survey

Watershed Type	District	No. of sample beneficiary household
DPAP/DDP	Mahabubnagar	62
	Anantapur	64
	Nalgonda	62
	Total	188
Hariyali	Mahabubnagar	53
	Anantapur	60
	Nalgonda	69
	Total	182
APRLP	Mahabubnagar	54
	Anantapur	58
	Nalgonda	60
	Total	172
	Grand total	542

The unit of data collection was the beneficiary household associated with the WSD institution associated with watershed development. Structured questionnaires were designed and information was collected through visits, meetings and interviews. Relevant secondary data/information was also collected and analysed.

6. Results and discussion

6.1 **Status of interaction**:

An assessment was made of the type and degree of interaction that took place in WSD implementation. There is considerable variation in responses to different types of interaction (see Table 3). The results indicate that there is there is good interaction between institution and villagers and within institution while a considerable proportion of respondents felt that there is not enough interaction between institution and the government. A large proportion of respondents felt that there were regular meetings and good leadership to facilitate interaction during the implementation of WSD programme.

Table 3: Status of interaction in the WSD sample households (N=542) (Percentage)					
Kind of interaction	**Strongly Agree**	**Agree**	**Partially Agree**	**Disagree**	**Strongly Disagree**
Good Interaction between Institution and Villagers	29.5	54.4	11.1	3.1	1.8
Good Interaction Within Institution	30.4	47.2	16.6	4.2	1.5
Good Leadership to facilitate Interaction	10.8	44.1	30.5	9.5	5.2
Regular Meetings to facilitate Interaction	27.7	37.1	19.6	9.3	6.3
Good Interaction between Institution and Government	14.2	26.2	34.4	21.9	3.4

6.1.1 Status of structural features of interaction

Some structural features related to interaction were examined. The results indicate that among structural features of interaction role of government, chairman and managing committee are very important. A good proportion of respondents agreed that local institution created to carry out WSD activity was good but the same cannot be said with full confidence about the extent of role of general body (see Table 4).

Table 4: Status of structural features of interaction in WSD sample households (N=542) (Percentage)					
Structural features	**Very Active**	**Active**	**Passive**	**None**	**Not reported**
Role Of General Body	9.5	44.2	44.2	2.1	0
Role Of Managing Committee	30.5	56.7	12.4	0.4	0
Role of Chairman	46.8	46	7.2	0	0
Role Of Govt Officials	31.5	59.6	8.5	0.4	0
Local Institution	15.8	54.8	18.4	9.3	1.7

6.1.2 Status of process features of interaction

Some process features of interaction were examined. A lot of variation can be seen in the elements of process features of interaction in the reporting WSD sample households (see table 5). The results indicate that regular meetings, involvement of technical experts in decision making and ensuring fairness and justice while planning and distributing /allotting benefits were frequently followed. A significant proportion of respondents felt that the participation of village leaders was not invited during WSD implementation.

Table 5: Status of process features of interaction in the WSD sample households (N=542) (percentage)						
S. No.	**Process Features**	**Strongly Agree**	**Agree**	**Partially Agree**	**Disagree**	**Strongly Disagree**
1	Regular Meetings	28.2	38.1	20	8.2	5.4
2	Involvement Of Tech Experts	27.5	31.4	11.3	12	17.9
3	Ensuring Fairness and Justice	36.0	37.0	11.6	9.6	5.7
4	Participation of Village Leaders	12.0	30.6	21.6	22.5	13.3

6.1.3 Status of governance features of interaction

Some governance features of interaction were examined. The results indicate that there is a lot of variation in the response for governance features of interaction (see table 6). The results also indicate that among governance features of interaction, good guidance by government officials and experts and good leadership for handling government relationship are frequently seen but many disagree. A sizeable proportion of respondents agreed that there is no mismanagement of funds in WSD implementation.

Table 6: Status of governance features of interaction in the WSD sample households (N=542) (percentage)

S.N.	Governance Features	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree
1	Competent Leadership	21.2	43.4	28.4	5.8	1.3
2	Good Leadership for handling Govt Relations	8.5	37.8	35.6	15.2	2.8
3	Good Government Guidance	16.2	38.1	35.6	9	1.1
4	No mismanagement of funds	15.5	45.4	25.7	10.9	2.2

6.2 Relationship between good interaction and Overall success of WSD

Results of bivariate analysis are given below. The results show that there is a positive and statistically significant relationship between the level of interaction and overall success of the WSD project (see table 7). The results support the view that good leadership to facilitate interaction, good interaction within institution, and good interaction between institution and villagers are positively associated with success of the institution.

Table 7: Relationship between overall success and good interaction (N=542)

Interaction	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree	F statistic	Significance
	(Overall Success Mean Values: 5-1 rating)						
Good Interaction between Institution Villagers	3.82	3.61	3.35	3.24	3.20	8.91	.000
Good Interaction Within Institution	3.69	3.67	3.50	3.39	2.63	6.98	.000
Leadership to facilitate Interaction	4.05	3.69	3.50	3.49	3.14	10.51	.000
Regular Meetings to facilitate Interaction	3.73	3.62	3.62	3.58	3.21	3.56	.004
Good Interaction between Institutions and Government	3.67	3.79	3.60	3.45	3.44	3.91	.002

6.3 Relationship between good interaction and various programmes

The average ratings of interaction (5-1) of different kinds were compared across programme. There is a statistically significant difference across programmes. (see Table 8). The results indicate that compared to DDP/DPAP, Hariyali and APRLP showed higher interaction ratings, and in most cases, APRLP showed the highest interaction ratings. In the interaction between the institution and the government, the difference across programmes is not statistically significant.

Table 8: Relationship between good interaction and various programmes (N=542)					
Interaction mean	Programme			F statistic	Signif icance
	DDP/DPAP	HARIYALI	APRLP		
Good Interaction between Institution and Villagers	3.59	4.32	4.25	48.508	.000
Good Interaction Within Institution	3.70	4.14	4.15	15.557	.000
Good Leadership to facilitate Interaction	3.15	3.51	3.61	10.288	.000
Regular Meetings to facilitate Interaction	3.17	3.74	4.05	26.805	.000
Good Interaction between Institution and Government	3.18	3.14	3.33	1.557	.212

6.4 Multivariate Data Analysis

This section uses multivariate analysis to examine the relationship between interaction features and performance. Since the performance indicators are range bound values 1 to 4 or 1 to 5, we have used TOBIT regressions for the data analysis as the classical regression assumptions would be violated. Dummy variables are used to separate district differences.

6.4.1 Overall Success and Good Interaction

The results indicate many features of interaction, particularly good interaction between institution and villagers, good interaction between institution and government, and good leadership are very important and show a positive and significant relationship with overall success of the WSD Institution (see Table 9).

Table 9: Relationship between overall success and good interaction across various programmes (N=542)				
S.no	Variables	Coefficient	t value	Significance
1	Intercept	2.42	12.21	<.0001
2	Good Interaction between Institution & Villagers	0.10	2.47	0.01
3	Good Interaction Within Institution	0.03	0.83	0.41
4	Good Leadership to facilitate Interaction	0.13	3.63	0.00
5	Regular Meetings to facilitate Interaction	0.02	0.63	0.53
6	Good Interaction between Institution and Govt	0.08	2.76	0.01
7	Dummy Anantapur	-0.07	-1.00	0.32
8	Dummy Nalgonda	-0.14	-1.87	0.06

6.4.2 Overall Success and Rationalities

The model below examines the relationship between overall success and rationalities, through aggregate scores obtained for different rationalities. The results indicate that technical, environmental, organisational and financial rationalities are major and significant determinants of overall success of natural resource management institution (see Table 10). Political rationality seemed to be playing a negative role in institutional performance. This may indicate that excessive focus on political rationality may result in deviations which negatively affect the performance of WSD institutions and WSD results. Other rationalities are also found to be positively affecting the institutional performance.

Table 10: Tobit regression: Dependent Variable – Overall Success (N=542)			
Variables	**Coefficients**	**t value**	**Significance**
Intercept	1.22884	3.47	0.0005
Technical Rationality	0.067174	1.96	0.0502
Environment Rationality	0.081121	2.45	0.0144
Economic Rationality	0.098149	1.4	0.16
Social Rationality	-0.04804	-0.66	0.5088
Political Rationality	-0.13869	-2.55	0.0108
Organisational Rationality	0.222097	2.67	0.0075
Financial Rationality	0.282279	3.72	0.0002
Government Rationality	0.146254	1.61	0.1082
Dummy Anantapur	-0.15792	-2.06	0.0391
Dummy Nalgonda	-0.05565	-0.74	0.461

6.4.3 Rationalities and Good interaction

Having established the relationship of rationalities to performance, this section examines the relationship between different kinds of interaction and each of the rationalities. The conceptual framework proposes that the good interaction lead to the achievement of various rationalities which ultimately results in overall institutional performance. Thus, an attempt is made to study and understand the impact of good interaction on the achievement of rationalities and thereby on good institutional performance.

Technical Rationality and Interaction: The results indicate that good interaction between institution and government play a positively significant role in achieving technical rationality. Other kinds of interaction do not show a significant association. This may be because technical inputs mainly come from the government. (see table 11).

Table 11: Tobit regression: Dependent Variable - Technical Rationality(N=542)				
S.N.	Variables	Coefficient	t value	Significance
1	Intercept	3.52016	11.88	<.0001
2	Good Interaction between Institution and Villagers	-0.06288	-1.01	0.3129
3	Good Interaction Within Institution	0.02144	0.37	0.7079
4	Good Leadership to facilitate Interaction	-0.01355	-0.26	0.7963
5	Regular Meetings to facilitate Interaction	-0.04721	-1.11	0.2656
6	Good Interaction between Institution and Government	0.146351	3.59	0.0003
7	Dummy Anantapur	-0.3025	-2.73	0.0064
8	Dummy Nalgonda	-0.63798	-5.75	<.0001

Environment Rationality and Interaction: The result indicates that most kinds of interaction are not related to environmental rationality, but interaction within institution plays a significant negative role (see Table 12). This may be statistical anomaly and there is a need to further examine this.

Table 12: Tobit regression: Dependent Variable: Environment Rationality(N=542)				
S.no.	Variables	Coefficient	t value	Significance
1	Intercept	3.559892	11.91	<.0001
2	Good Interaction between Institution and Villagers	0.080864	1.29	0.1984
3	Good Interaction Within Institution	-0.16677	-2.89	0.0039
4	Good Leadership to facilitate Interaction	-0.04091	-0.77	0.4399
5	Regular Meetings to facilitate Interaction	0.004154	0.1	0.9226
6	Good Interaction between Institution and Govt.	0.026797	0.65	0.5154
7	Dummy Anantapur	0.116982	1.05	0.2957
8	Dummy Nalgonda	-0.23978	-2.14	0.0324

Economic Rationality and Interaction: The results indicate that Good interaction within institution, good interaction between institution and government, and regular meetings are very important and play a positively significant role in achieving economic rationality (see Table 13).

Table 13: Tobit regression: Dependent Variable: Economic Rationality (N=542)				
S.N.	Variables	Coefficient	t value	Significance
1	Intercept	2.177905	17.09	<.0001
2	Good Interaction between Institution &villagers	0.021992	0.82	0.4119
3	Good Interaction within Institution	0.051392	2.09	0.0368
4	Good Leadership to facilitate Interaction	0.041337	1.83	0.0671
5	Regular Meetings to facilitate Interaction	0.047588	2.61	0.0091
6	Good Interaction between Institution & Govt.	0.079208	4.51	<.0001
7	Dummy Anantapur	-0.0036	-0.08	0.9398
8	Dummy Nalgonda	-0.19058	-3.99	<.0001

Social Rationality and Interaction*:* The results indicate that good interaction within institution, regular meetings, and good leadership to facilitate good interaction play a major positively significant role in achieving social rationality (table 14). Regular meetings are particularly important.

Table 14: Tobit regression: Dependent Variable: Social Rationality (N=542)				
S.no.	Variables	Coefficient	T value	Significance
1	Intercept	2.470527	18.75	<.0001
2	Good Interaction between Institution & villagers	-0.00464	-0.17	0.8669
3	Good Interaction within Institution	0.109827	4.32	<.0001
4	Good Leadership to facilitate Interaction	0.082521	3.54	0.0004
5	Regular Meetings to facilitate Interaction	0.13406	7.11	<.0001
6	Good Interaction between Institution and Govt.	0.031506	1.74	0.0823
7	Dummy Anantapur	-0.27968	-5.67	<.0001
8	Dummy Nalgonda	-0.23067	-4.67	<.0001

Political Rationality and Interaction: The result indicates that good interaction between institutions and the villagers plays a very important, positive and significant role in achievement of political rationality (see table 15). Also, interaction with the government promotes political rationality.

Table 15: Tobit regression- Dependent Variable: Political Rationality (N=542)				
S.no.	Variables	Coefficient	t value	Significance
1	Intercept	2.049631	13.08	<.0001
2	Good Interaction between Institution & villagers	0.104247	3.16	0.0016
3	Good Interaction Within Institution	0.028845	0.95	0.3405
4	Good Leadership to facilitate Interaction	0.037126	1.34	0.181
5	Regular Meetings to facilitate Interaction	0.003363	0.15	0.8808
6	Good Interaction between Institution & Govt.	0.148927	6.9	<.0001
7	Dummy Anantapur	-0.08729	-1.49	0.1365
8	Dummy Nalgonda	-0.02434	-0.41	0.6786

Organisational Rationality and Interaction: The results indicate that regular meetings, good interaction within institution and good interaction with govt play a positively significant role in achievement of organisational rationality (see Table 16). Regular meetings are particularly important, followed by good interaction within the institutions.

Table 16: Tobit regression- Dependent Variable: Organisational Rationality (N=542)				
S.	Variables	Coefficient	t value	Significance
1	Intercept	2.253247	20.34	<.0001
2	Good Interaction between Institution and Villagers	0.007971	0.34	0.7323
3	Good Interaction Within Institution	0.090741	4.24	<.0001
4	Good Leadership to facilitate Interaction	0.100111	5.1	<.0001
5	Regular Meetings to facilitate Interaction	0.132398	8.35	<.0001
6	Good Interaction between Institution and Govt.	0.055299	3.63	0.0003
7	Dummy Anantapur	-0.16597	-4	<.0001
8	Dummy Nalgonda	-0.17056	-4.11	<.0001

Financial Rationality and Interaction: The Tobit regression results indicate that most kinds of interaction are important for this. Good interaction of institution with villagers, with government officials and within itself plays a important and positively significant role towards achievement of financial rationality (see Table 17). Relationship with the government and good leadership are particularly important.

Table 17: Tobit regression: Dependent Variable: Financial Rationality (N=542)				
S.no.	Variables	Coefficient	t value	Significance
1	Intercept	2.279792	20.12	<.0001
2	Good Interaction between Institution and Villagers	0.092008	3.86	0.0001
3	Good Interaction Within Institution	0.05815	2.66	0.0079
4	Good Leadership to facilitate Interaction	0.113342	5.65	<.0001
5	Regular Meetings to facilitate Interaction	0.011985	0.74	0.4598
6	Good Interaction between Institution and Government	0.099685	6.39	<.0001
7	Dummy Anantapur	0.150507	3.55	0.0004
8	Dummy Nalgonda	0.019091	0.45	0.653

Government Rationality and Interaction: The results have shown that good interaction of institution with govt and within itself are very important for achievement of government rationality (see table 18). Government is the key supplier of the funds for the WSD programmes and is expected to have a significant say in activities of WSD institutions. It is also found that good institutional leaders have positive and significant relationship with government rationality (see table 18). This is on expected lines as leaders need to coordinate with government at various stages of WSD planning and implementation.

Table 18: Tobit regression: Dependent Variable: Government Rationality (N=542)

S.No.	Variables	Coefficient	t value	Significance
1	Intercept	2.360463	21.68	<.0001
2	Good Interaction between Institution and Villagers	0.028801	1.26	0.2084
3	Good Interaction Within Institution	0.101785	4.84	<.0001
4	Good Leadership to facilitate Interaction	0.072706	3.77	0.0002
5	Regular Meetings to facilitate Interaction	0.027572	1.77	0.0768
6	Good Interaction between Institution and Government	0.078942	5.27	<.0001
7	Dummy Anantapur	-0.07186	-1.76	0.0777
8	Dummy Nalgonda	-0.13809	-3.38	0.0007

6.4.3 Overall Success and Structure, Process and Governance features of Interaction

An attempt was made to identify some features each for structure, process and governance and examine their relationship with overall success of WSD institutions directly or indirectly.

Overall success and Structural features of Interaction*:* The results indicate that active structural features of the role of chairman and the role of government officials are very important determinant of overall success (see table 19). This indicates that the importance of initiators, facilitators and administrators i.e. government official at district level, and chairman at village level, in generating the overall success. This confirms that active chairman and government are the important faces of WSD programme at watershed level.

Table 19:Tobit Analysis: Overall success and Structural features of interaction (N=542)

S.no.	Variables	Coefficient	t value	Significance
1	Intercept	2.238575	5.72	<.0001
2	Role Of Managing Committee	0.083454	1.62	0.1056
3	Role of Chairman	0.131453	2.43	0.015
4	Role Of Govt Officials	0.141459	2.75	0.0059
5	Role Of General Body	0.023205	0.51	0.6105
6	Good Local Institution Creation	-0.01905	-0.55	0.584
7	Dummy Anantapur	-0.15171	-1.96	0.0496
8	Dummy Nalgonda	-0.20181	-2.66	0.0079

Overall success and Interaction through process*:* The results indicate that regular meetings and consideration of fairness and justice in various processes have positive and significant influence on overall success (Table 20). The consideration of interests of poor, small and marginal farmers, women and other weaker section leads to more inclusive growth.

Table 20-Tobit Analysis : Overall success and Process features of interaction (N=542)				
S.no.	Variables	Coefficient	t value	Significance
1	Intercept	3.106499	17.28	<.0001
2	Regular Meetings	0.0887	3.43	0.0006
3	Ensuring Fairness And Justice	0.065813	2.36	0.0184
4	Involvement of Tech Experts	0.003616	0.15	0.8816
5	Participation of Village Leaders	0.027256	1.05	0.2915
6	Dummy Anantapur	-0.18797	-2.42	0.0153
7	Dummy Nalgonda	-0.23235	-2.89	0.0038

Overall success and Governance features Interaction: Results indicate that good government guidance have a positive and significant influence over overall success (see Table 21). Other features of governance do not show a strong positive association.

Table 21-Tobit Analysis : Overall success and Governance features of interaction (N-542)				
S.no.	Variables	Coefficient	T value	Significance
1	Intercept	3.50815	15.33	<.0001
2	Competent Leadership	-0.0645	-1.68	0.0926
3	No Mismanagement Of Fund	0.044014	1.31	0.1897
4	Good Leadership for handling relationship with Govt.	-0.00102	-0.03	0.978
5	Good guidance from government	0.09783	2.86	0.0043
6	Dummy Anantapur	-0.21584	-2.85	0.0043
7	Dummy Nalgonda	-0.16494	-2.12	0.0337

7. Conclusions

Within a framework based on new institutional economics (NIE) and management theories of good governance, the study has sought to examine the importance of good interaction in the performance of natural resource management institutions, particularly, watershed development institutions in Andhra Pradesh, India. A large number of lessons and findings emerge. Good interaction as an institutional feature emerges as an important determinant of institutional performance. The levels of different kinds of interaction vary across various WSD programmes such as DPAP/DDP, Hariyali and APRLP, and Hariyali and APRLP show more interaction, particularly APRLP. Various features of interaction were found positively related and significant in determining the institutional performance of these natural management institutions. It was found addressing various rationalities is important and many of these play a major role in determining institutional performance. Good interaction between institution and villagers was found to play a very important role towards the achievement of political and financial rationalities. Good interaction within institution was found to act as major determinant in the achievement of economic, social, financial and government rationalities. Good interaction between institution and government was found to play a very important role in achievement of technical, economic, political, organisational, and financial and government rationality. Regular meetings, as an element of good interaction were found to have an important role in achievement of social and organisational rationalities.

Good leadership was found to play a very important role in achievement of social, organisational, financial and government rationalities.

An attempt was also made to analyse the role of interaction embodied in structural, process, governance features towards institutional performance. It was found that the structural features such as active chairman and government officials are very important determinants of success. Process features like regular meetings and ensuring of fairness and justice in decision making were found to play an important role. Governance features of interaction such as good guidance by the government officials and experts was found to be a major determinant of institutional performance. Overall, good interaction which helps bring the formal and informal together emerges as a very important institutional feature for performance in natural resource management.

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