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## Enhancing institutional performance in watershed management in Andhra Pradesh, India

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# 1 Acknowledgments

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## 2 Executive summary

Raising productivity and incomes in rain-fed areas continues to be a major challenge in India. A key initiative through which this objective has been pursued is Watershed Development (WSD) programs, taken up under different schemes by the Government of India and various state governments. Expenditure equivalent to about US \$500 million is being committed annually to such programs and in some states additional government resources are deployed (e.g. Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS)).

Notwithstanding some of the successes of WSD, experience has shown that in a significant proportion of cases the farmers/villagers show little enthusiasm for adopting the proposed WSD technologies and program failures are common. Anecdotal reasons for failure include the weak linkages and poor performance among institutional structures and dysfunctional rules and operational systems. Understanding and dealing with the weaknesses in the institutional apparatus for delivering WSD was expected to directly improve the outcomes from the substantial investments in such programs. The analysis focussed on Andhra Pradesh, where a variety of different approaches to WSD have been trialled.

Two broad levels of analysis were employed with the first using primary data from selected watersheds to understand the mechanics of the lower order institutions. These data were then modelled empirically to identify cogent 'success' drivers at this level. The second approach sought to analyse the hierarchy of decision making that attends WSD i.e. the relationships between all levels of WSD administration from national to state to village.

The data collected from the project gives empirical support to the study framework and the perceived positive impact of WSD in rural India, when delivered appropriately. Important determinants of success include:

- attention to technical details, like ensuring that on-ground works are appropriately designed and located to yield the best possible outcomes for agriculture and the environment;
- environmental soundness of projects;
- organisational elements of the institutional architecture such that there is ongoing investment in the creation of strong and well-trained local organisations, and;
- adequate control systems, including auditing capacity.

The findings from the project have already been adopted by the Department of Rural Development in Andhra Pradesh with the creation of separate Watershed Committees at the village level and attention to the involvement of NGOs. There is also increased support for the inclusion of enterprise promotion and production enhancement activities within WSD. In addition, there is now a substantial recruitment effort for securing technically qualified personnel as project officers. We anticipate that these initiatives will have an immediate impact on the efficacy of WSD delivery and thus result in substantial gains in cost effectiveness. The project has also had a national influence with the findings incorporated into reviews of the national guidelines for WSD.

Using relatively conservative estimates based on earlier experience, it is anticipated that farmer incomes in Andhra Pradesh could be raised by about Rs. 18200 million or US \$ 460 million annually as a result of improving the efficacy of WSD.

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## 3 Background

Raising productivity and incomes in rain-fed areas continues to be a major challenge in India. A key initiative through which this objective has been pursued is Watershed Development (WSD) programs, taken up under different schemes by the Government of India and various state governments. Expenditure equivalent to about US \$500 million is being committed annually to such programs and in some states additional government resources are deployed (e.g. Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS)).

WSD programs have evolved over time and comprise three objectives. First, some elements of WSD focus specifically on maintaining and/or improving natural resource management, including increasing groundwater recharge. This element includes activities focussing on technical water harvesting solutions - ranging from simple check-dams to large percolation and irrigation tanks - and vegetative barriers and contour bunds. Second, WSD focusses on raising the productivity of agriculture. Solutions in this context include uptake of HYV seeds, horticulture and other alternate crops. Third, a more recent iteration of the program has seen WSD expand to encompass the needs of the landless through, for example, enterprise developments at the local level. In this regard the Indian approach to WSD 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). Perhaps not surprisingly, relatively complex institutional arrangements have developed to support delivery of these solutions.

A watershed is considered to be a geo-hydrological unit or an area that drains to a common point. 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. A varied hierarchy of institutional arrangements involving government and other agencies undertakes the planning and implementation.

The history of watershed development in India can be traced to the Famine Commission of 1880 and the Royal Commission of Agriculture of 1928. After independence in 1947, the government established a special centre at Jodhpur in 1952 and in 1959 this was designated as the Central Arid Zone Research Institute. The first large scale government supported WSD program was launched in 1962-63, and a large scale project named the Drought Prone Area Development Program (DPAP) followed in 1972-73. A special program for the hot desert areas, known as the Desert Development Programme (DDP) was subsequently launched in 1977-78. Later the Integrated Wastelands Development Program (IWDP) was added.

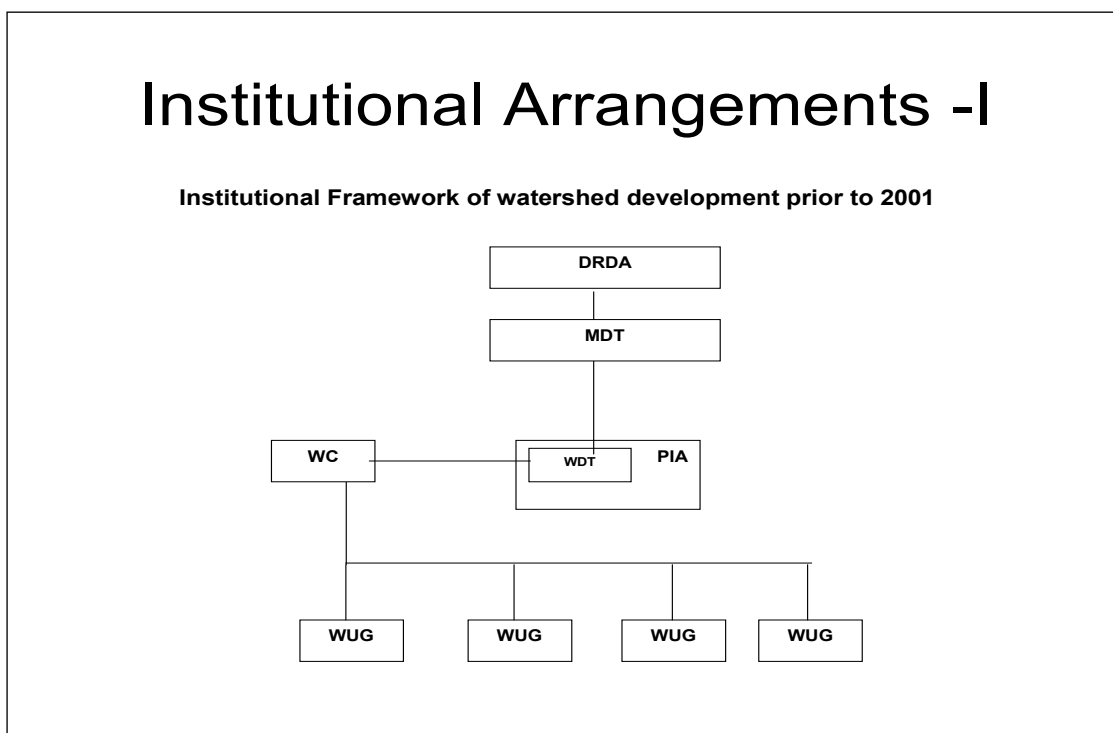
In 1994, the Government of India constituted a technical committee to review these programs, headed by Dr C.H Hanumantha Rao. The Committee proposed a revamp and recommended various measures including sanctioning of works on the basis of the action plans at a watershed level, and the introduction of participatory modes of governance, through involvement of beneficiaries of the program and NGOs. Based on its recommendations a new set of guidelines came into effect in 1995. The extent of various programs since the release of those guidelines is summarised in Table 1 below:

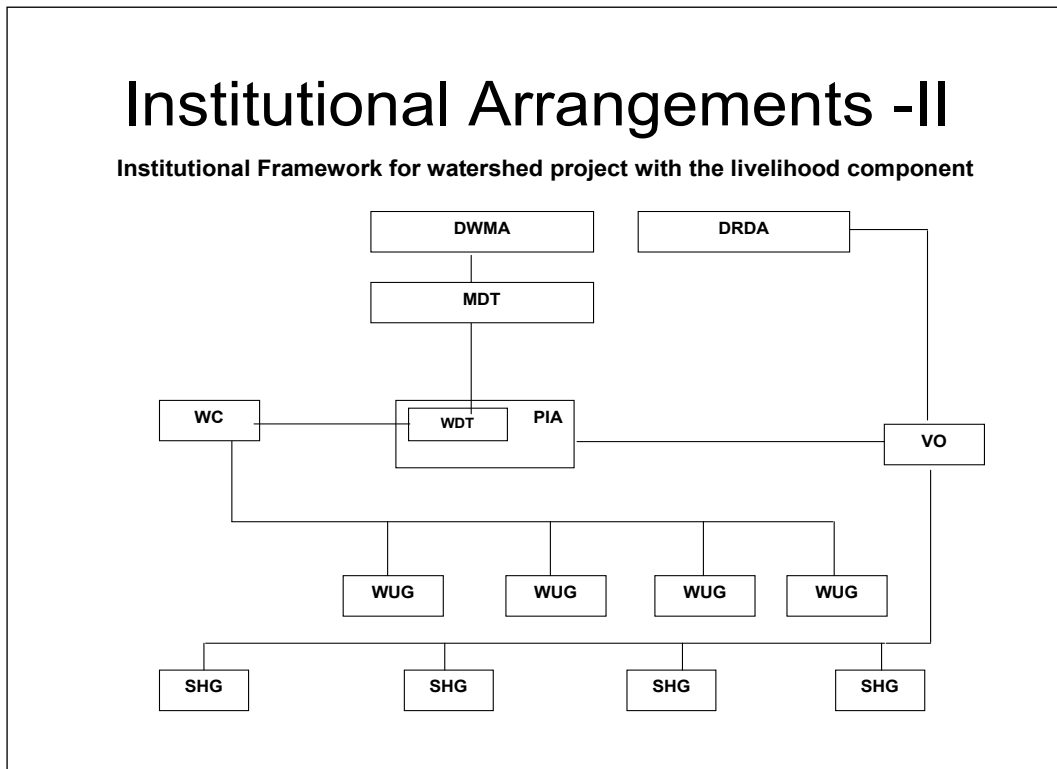
<b>Table 1 : Number of Projects, Area Covered and Funds released for Watershed Development in India (1995-96 to 2007-2008)</b>			
Name of Programme	Number of projects sanctioned	Area covered (100,000 ha)	Total funds released by Central Government (Rupees Million)
DPAP	27439 (60.9 %)	130.20 (41.2 %)	28378 (36.7 %)
DDP	15746 (34.9 %)	78.73 (24.9 %)	21032 (27.2 %)
IWDP	1877 (4.2 %)	107.00 (33.9 %)	27976 (36.1 %)
<b>Total</b>	<b>45062</b>	<b>322.93</b>	<b>77386</b>

The WSD program has become the centre-piece of rural development in India. In 2003 under the “Hariyali” guidelines, WSD fell to the Panchayati Raj Institutions (PRIs). In 2006, an apex national body called the National Rainfed Area Authority (NRAA) was established and it set about developing “Common Guidelines for Watershed Development Projects” which were released in 2008. The focus of the new guidelines was the notion of an Integrated Watershed Management Program (IWMP).

The institutional architecture for implementation of WSD includes higher level entities, such as the National and State level Watershed Program Implementation and Review Committees, and the state Department of Rural Development. At the district level the peak body initially was the District Rural Development Agency (DRDA) although this role is now assumed by the District Water Management Agency (DWMA) which is 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. Examples of some of the contrasting governance arrangements are given in Figures 1 below:

Figure 1: Examples of WSD institutional structures





Notwithstanding some of the successes of WSD, experience has shown that in a significant proportion of cases the farmers/villagers show little enthusiasm for adopting the proposed WSD technologies and program failures are common. Challenges include high initial investments, high operational and maintenance costs and the requirement for high technical input. There remains an urgent need for a participative approach and more efficient institutional mechanisms to integrate scientific know-how and support with appropriate local technologies, materials and capabilities, and the local socio-economic environment.

It has become increasingly apparent that WSD projects frequently give rise to poor outcomes and often fail to achieve their objectives, and this has often been attributed to weak institutional arrangements. Anecdotal reasons include the weak linkages and poor performance among institutional structures and dysfunctional rules and operational systems which, in turn, lead to high transaction costs, poor participation and poor decision-making.

Whilst there is a general perception that institutional deficiencies existed, very little empirical evidence is on hand to compare across alternatives. A workable framework, by which to adjudge the various iterations of WSD, is also absent. This project sought to specifically deal with these shortcomings.

Two broad levels of analysis were employed within the major part of the project. First, primary data from selected watersheds was obtained to capture the mechanics of the lower order institutions. These data were then modelled empirically to identify cogent 'success' drivers at this level. This work was led by the partners at the Indian Institute of Management. The second approach sought to analyse the hierarchy of decision making that attends WSD i.e. the relationships between all levels of WSD administration from national to state to village. Here two techniques were initially proposed; one tracing the behaviour and cognition of key institutional actors against WSD policy goals, the other using Structural Equation Modelling to analyse institutional relationships. The

International Water Management Institute was charged with leading this component of the work.

A minor element of the project sought to draw lessons and synergies between WSD and various water and resource-focussed initiatives in Australia. The operation of catchment management organisations and the various reforms in the hierarchy of water management in the Murray-Darling Basin were anticipated to provide useful Australian cases. In addition these cases were to act as a vehicle for developing knowledge exchange activities between Indian and Australian agencies.

By undertaking the analysis of institutions involved in WSD in India, the project was expected to deliver significant improvements to the functioning of the WSD program. This was expected to increase the cost effectiveness of WSD and thus enhance the economic, environmental and social impacts from the US \$500 million invested annually by governments in India. Using relatively conservative estimates based on earlier experience, it was anticipated that farmer incomes in Andhra Pradesh could be raised by about Rs. 18200 million or US \$ 460 million annually as a result of improving the efficacy of WSD. The project was also expected to deliver on the social and environmental fronts by helping to shape the rules and coordinating mechanisms for ensuring that the development and extraction of groundwater remained within sustainable limits.



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## 4 Objectives

Overall, the project aimed to enhance livelihoods in rain-fed areas of the Indian Central Plateau, (particularly Andhra Pradesh), by improving the institutional performance of WSD programs.

The project's specific objectives were to:

- Map, understand and evaluate all the institutional relationships involved in WSD programme design and implementation in Andhra Pradesh. This included:
  - Mapping and studying the current arrangements for managing WSD activity and groundwater in rain-fed areas of Andhra Pradesh using state-of-the-art approaches such as New Institutional Economics and management/organizational design frameworks
  - Identifying institutional strengths and weaknesses in the current setting, and relate them to performance – specifically addressing the dimensions of efficiency, equity, sustainability and viability
  - Drawing upon the findings of clustered ACIAR projects that focus primarily on the technical dimensions of WSD, develop an integrated model for enhancing institutional performance.
- Develop and suggest optimal institutional arrangements for improving land and water resource management through WSD, and explore transition arrangements. This included:
  - Integrating a participatory approach based on the real life experience of end users with lessons from empirical analysis of institutional performance
  - Harnessing the findings of related work and experience in Australia to inform institutional design and policy formulation
  - Identifying the benefits and costs of transition, including the costs of closing off future alternatives
- Provide a vehicle for sensitization and capacity building within various Indian agencies to improve institutional design for WSD and other resource management activities. This encompassed:
  - Training activities to assist NGO's drive grassroots institutional change
  - Engagement of district, state and national policy makers and administrators in a participatory process to explain and assist transition.

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## 5 Methodology

A mixed methodology was adopted for the project in order to tap qualitative information as well as undertake quantitative analysis to adjudge elements of institutional performance. As noted earlier, there was no established theoretical framework for comparing across different iterations of WSD. Thus, the project initially sought to combine qualitative information from case studies in order to refine theoretical approaches used in the past. The cornerstone of this framework would be New Institutional Economics and the notion of transaction costs, embellished by management theories of good governance and organizational design (described in section 7 of this report).

For simplicity the methodology is described below in the context of the three main areas of analysis – the lower level institutional performance; upper level relationships in WSD programs and; sensitisation, training and engagement components of the work.

### **Analysing lower level institutional performance**

The lower level institutional apparatus was primarily analysed by researchers from the Indian Institute of Management, in collaboration with the research team from La Trobe University.

A distinction was made initially between lower-level entities which operate close to the community and are involved in the implementation of WSD, and higher-level entities who are somewhat removed from the community interface and are primarily engaged in planning, coordination and control.

Lower level entities deemed important as part of this analysis were:

- Project Implementation Agencies (PIA), Voluntary Agencies (VAs)
- Watershed Development Teams
- Panchayati Raj Institutions<sup>1</sup>
  - Zilla Parishad
  - Panchayati Samiti
  - Gram Panchayats
- Watershed Association, Village Organization
- Watershed Committee, User Groups
- Watershed Secretary & Volunteers, Self Help Groups.

The study commenced by developing a broad understanding of the WSD activities and the role of the above groups in Andhra Pradesh. Given the complex history of WSD, the analysis took the wider understanding of WSD to then work towards a detailed mapping and evaluation of the lower level bodies, initially using case studies. The cases were purposefully sampled to cover variations in:

- overall performance – as known a priori
- the presence/ absence of an NGO
- the extent of completion of the project/activity (age)
- the program under which the WSD was undertaken (e.g. DDP; DPAP; NWDRAP; APRAP; APFAMGS)
- the administrative structure in place at the time of the project (i.e. 1994-2000; 2000-2003; 2003 onwards)

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<sup>1</sup> These are local government entities.

- government involvement versus non-government initiatives.

The six case sites used as part of this phase are detailed in Table 2, below:

Table 2: Case study sites by watershed, district and program type.

Watershed	District	WSD Program
Narasamapalli	Anantapur	DDP
B. Pappuru	Anantapur	APRLP
Vattem-II	Mahbubnagar	Hariyali
Jainallipur	Mahbubnagar	APRLP
Rathipalli	Nalgonda	DPAP
Chandupatla	Nalgonda	Hariyali

The case analysis revealed the need to expand the theoretical framework and this is described in greater detail in section 7.

The modified theoretical framework was then used to develop a survey instrument that was intended to provide primary data for measuring the performance of WSD institutions. The research by Gandhi and Namboodiri (2002) was important in guiding measures of performance in this context. They argued that in a developing country context multiple objectives are common and it is important for institutions involved with natural resource management to address at least four major challenges. Namely:

1. Overcoming scarcity (or efficiency):

achieving adequate and timely availability, and efficient use of the resource (water)

2. Equity:

achieving and improving equity in the resource availability and distribution of benefits

3. Environment:

utilisation of the resource with least ill effects or benefits to the environment

4. Financial soundness (or viability):

achieving financial soundness.

Whilst not prescribing empirical models, Gandhi and Namboodiri (2002) argue that specific indicators might include improvements in water availability, conservation of soil, improved soil fertility, enhanced crop and animal production, improvements in farmer incomes, and improvements in non-farmer incomes. Data would thus be required on these types of variables along with institutional dimensions to test if there were relationships of significance.

Data for the quantitative analysis was collected from several rain-fed districts throughout Andhra Pradesh. The field survey was administered across 18 varied watersheds, 6 in each of the 3 case study districts: Anantapur, Mahbubnagar, and Nalgonda. These were chosen in order to capture different agro-ecological conditions - including rainfall, water availability and topography; different social conditions; variations in the WSD program, norms and administrative structures (e.g. DDP, DPAP, APRLP, Hariyali, with and without involvement of NGOs, VOs, SHGs); varying ages and maturity of programs and ; varying outcomes, as broadly known.

The final sample across the 18 watersheds comprised 542 beneficiary households (i.e. households who have purportedly derived some advantage from WSD activities) and these were chosen using a stratified random sampling. Data were collected in person, with a trained interview team visiting villages and transcribing results manually. The sample coverage is described in the Table 3 below.

Table 3: Sample Survey Coverage for Analysing Lower Level Institutional Performance

District	Name of Village/ Watershed/ Institution	Number of Beneficiaries interviewed <sup>2</sup>
Mahabubnagar	Jainallipur	30
	Vattem	34
	Malkapur	30
	Keshampet	26
	Narsampally	32
	Modampalli	36
	Total	188
Anantapur	Narasampalli	28
	B.Pappur	34
	Uppalapadu	25
	Muttala	30
	Rajapuram	35
	Duddebanda	30
	Total	182
Nalgonda	Ratipalli	30
	Chandupatla	30
	Gudimalkapur	30
	Nilikal	30
	Gudiwada	24
	Valala	28
	Total	172
	Grand Total	542

<sup>2</sup> These are households that have purportedly received some advantage for WSD programs

The questionnaire covered basic features of the households, agricultural and natural resource features, the watershed activities taken up, and the respondents' assessment of the activity level evident within the different institutional functionaries. Respondents were also asked a carefully designed set of questions that could later be used to enumerate the various constructs within the theoretical framework. The intention was to use factor analysis to collapse the Likert rankings<sup>3</sup> of the various elements of institutions into a useful empirical measure. The performance of the institutions was recorded in terms of parameters such as changes in the depth of water table, changes in irrigated area and changes in the cropping pattern. Respondents were also asked to rate the overall success of WSD institutions on a five point rating scale, as well as performance in terms of overcoming scarcity, equity, environmental and financial soundness.

### **Analysis of higher-level institutional performance**

This phase of the work was undertaken by researchers from the International Water Management Institute, based in Hyderabad. The higher level institutions are engaged in functions such as planning, priority setting, program design, policy, strategy, coordination, resource allocation and control. Important bodies involved in these activities were identified as follows:

- State Watershed Program Implementation and Review Committee
- Department of Rural Development
- District Water Management Agency,
- District Watershed Development Advisory Committee

In addition, other functions such as credit, agriculture, horticulture, forestry, major irrigation, marketing and power pricing also affect the performance of WSD activity. Coordination across these dimensions is critical and often needs to be addressed by the higher level institutions.

Two approaches were initially proposed to tackle the analysis of higher level institutions. First, the technique developed Pagan (2007) was to be deployed. This approach traces the cognition and behaviour of key institutional actors in order to understand perceptions at different levels in the institutional hierarchy. The data from this exercise was expected to reveal if there were inconsistencies in the responsibilities perceived by different actors/ policy making and implementation bodies, and thus impact on performance.

Second, it was initially intended that the structural equation modelling (SEM) approach used by Saleth and Dinar's (2008) could be used to captures the impact pathways of different initiatives at the higher level. The SEM model allows the researcher to analyse the linkages between related activities or actions and to then test the impacts of each linkage on specific goals or outcomes. Whilst attractive on some fronts, SEM also requires large sets of data in order to develop statistically robust models.

Using these two approaches as a starting point, this part of the study subsequently combined quantitative and qualitative methods for data collection and analysis. First, a survey was conducted across 50 Andhra Pradesh respondents involved in project implementation. Participants were drawn from government agencies and nongovernment organizations (NGO), the government and NGO project implementing agency (PIA), district water management agency (DWMA) and the state level nodal agency (SLNA). The survey explored the perceptions of these four groups of respondents on Integrated Water Management Programs and focused on five of the seven guiding principles defined in the Common Guidelines. More specifically, the survey investigated 'equity and gender sensitivity', 'decentralization', 'centrality of community participation', 'capacity building' and

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<sup>3</sup> Likert scales are used when respondents rate an item between discrete levels (e.g. a 5 point scale between 'always' and 'never'; or between 'strongly agree' and 'strongly disagree').

'monitoring, evaluation and learning'. The two other principles articulated in the Guidelines, namely 'facilitating agencies' and 'organizational restructuring', were considered less relevant in the context of this part of the project.

Second, a series of semi-structured interviews was conducted from May to September 2011 with around 40 informants, including senior government officers at the central level (Planning Commission, Department of Land Resources (DOLR), National Rain-fed Area Authority (NRAA)), at the state level: Department of Rural Development (DRD), Forest Department and Department of Agriculture) and at the district level, the district water management agency was also involved. Informants again included non-government and government project implementing agencies along with 4 scientists, civil servants and government-contracted project staff posted in three separate districts in Andhra Pradesh. The structure of the data gathering for analysing high level institutions is detailed in Table 4, below:

Table 4: Structure of interviews to inform higher level institutional analysis

Decision making unit	IWMP implementing agencies	Others	Number of informants
Project	Government project implementing agencies		Group interviews in 2 districts
	NGO project implementing agencies		4
District	District water management agency, cluster livelihood resource centre		8 across 3 districts
State	DRD, Andhra Pradesh academy of rural development (APARD)	Forest Department, Department of agriculture, Key informants previously involved in WSD programs at DRD	9
	NGO project implementing agencies		5
		Research organisations	3
National	National DoLR, NRAA	Planning Commission, Department of Agricultural Cooperation	9

Primary data was complemented by a review of secondary data, including scientific reports, journal articles, government circulars, presentations and minutes of the meetings

of the national level steering committee. The analysis of qualitative data was supported by the software ATLAS Ti, which is useful in managing, coding and analysing large amounts of text.

### **Sensitising, training and engagement**

The project commenced in earnest in 2009 and, given the objective of enhancing institutional design, it was deemed critical to engage with core Indian agencies during the inception phase. Key staff within the Department of Rural Development assisted in the selection of case studies, with the research team ensuring a wide representation of performance and outcomes was included.

Regular meetings and briefing were also scheduled throughout the project and opportunities for information exchange via email and phone were taken up. In many instances the research team were accompanied in the field by government and non-government functionaries and this provided a vehicle for building collaborative links with the Indian researchers and the Australian participants.

Initial exposure visits centred on the research team and this allowed for the presentation of early results at conferences like the Australian Agricultural and Resource Economics Society annual conference. A symposium on WSD was also convened to coincide with this conference in 2010, and additional presentation followed in subsequent years, including a presentation by the Special Commissioner for Rural Development to the Australian Agricultural and Resource Economics Society.

As the project developed, opportunities were also taken to tap the expertise of high-ranking Australian officials, like Dr Jane Doolan from the Victorian Department of Sustainability and Environment. The intention here was to involve state officials of similar standings to foster a dialogue that could then potentially challenge the institutional status quo. The two-way communication on the topic of institutional success and failure was enhanced by formal workshops in Australia and India. These were accompanied by less formal interactions in the field in both countries.

## 6 Achievements against activities and outputs/milestones

**Objective 1: To map, understand and evaluate the institutional relationships involved in WSD programme design and implementation in Andhra Pradesh.**

No.	Activity	Outputs/ milestones	Completion date	Comments
1.1	Mapping and studying the current arrangements for managing WSD activity and groundwater in rainfed areas of Andhra Pradesh using state-of-the-art approaches such as new institutional economics and management/organizational design frameworks	Develop and document an understanding of the WSD activity, the institutional environment, and issues in the setting (PC).	May 2009	Completed.
		Produce a review/study of the latest conceptual and relevant empirical literature (A, PC)	May 2009	Completed
		Publish a customised framework applicable to the study (A, PC).	May 2009	Completed. Several insights from an Australian perspective were published in a special edition of <i>Economic Papers</i> in June 2011, including an award winning article by Crase, O'Keefe and Dollery. The expanded institutional framework for Indian WSD programs is primarily attributable to Gandhi and was initially presented at a workshop convened by the NRAA in 2010. The conceptual model used to articulate different forms of rationality has now been presented at numerous research forums and has received general support. In addition, the work has been published as an IIMA Working Paper (IIMA WP 1010-11-04) and again in Gandhi, V. P. (2011), "Reforming Institutions in Natural Resource Management" in Suresh, Pal (ed.) <i>Agriculture for Inclusive Growth</i> Indian Agricultural Research Institute, New Delhi.
		Identification of a set of appropriate locations and local institutions for case studies and survey (PC).	May 2009	Completed. This occurred using an iterative process involving exchange between APDRD and the research team from IIM.
		Document the outputs from the conduct of the case studies (PC)	September 2009	Completed in two rounds in 2009-10. The findings were published in Bhamoriya and Gandhi (2011).



1.2	Identifying institutional strengths and weaknesses in the current setting, and relating them to performance – specifically addressing the dimensions of efficiency, equity, sustainability and viability	Beta version of survey questionnaires developed (A, PC).	May 2009	Completed
		Finalise outline for the questionnaire covering the various information needs (A, PC).	June 2009	Completed
		Production of the actual survey instrument/s (PC).	July 2009	Completed
		Test the survey instrument/s and produce report on method (PC).	August 2009	Completed
		Finalization of the sample size, sampling procedure, locations, institutions, and other subjects (A, PC).	October 2009	Completed
		Training of the survey team (PC).	October 2009	Completed
		Survey data assembled (PC).	January 2010	Completed. The data set comprised over 500 beneficiary households and covers 18 villages and 3 districts.  It is worth noting that a Doctoral student from IIM chose to interrogate one element of the theoretical framework more fully and collected a separate large data set for his purposes.
		Compilation and preliminary processing of the data (A, PC).	May 2010	Completed
		Documented analysis of the data to address the various objectives of the research (A, PC).	August 2010	Completed. Empirical models have been developed and run. Models fit well and the findings are useful. Additional modelling is proposed beyond the timeframe of the project. More specifically, the research team has commenced using SEM to further interrogate the data. This is beyond the scope of this project and results are to be published in due course.

		Compiled a report capturing preliminary discussion and outline for writing-up of the findings (A, PC).	September 2010	Completed. Reports on the different parts of the work were prepared. In February 2012 all related papers were presented at AARRES. A decision was also taken at that point to instigate an internal review of the main elements of the work. The review prompted further refinement and several publications are under review.
1.3	Drawing upon the findings of clustered ACIAR projects that focus primarily on the technical dimensions of WSD and an understanding of NRM policies in Victoria, develop an integrated model for enhancing institutional performance	An analysis that integrates the preliminary findings on institutional performance with findings on the technical dimensions and insights from analysis of NRM delivery in Australia (A, PC).	October 2010	A process was instigated by ACIAR to consolidate, synthesise and harmonise the findings across related WSD projects. The outputs from this project were provided to support that process. Independent dissemination works is also occurring via the links with APDRD and the like.

*PC = partner country, A = Australia*

**Objective 2: To understand higher level institutional arrangements and suggest optimal institutional design for enhancing land and water resource management through WSD, and explore transition arrangements**

No.	Activity	Outputs/ milestones	Completion date	Comments
2.1	Integrating findings from the real life experience of end users with lessons from empirical analysis of institutional performance	Workshop with NGOs and WSD implementers on their experience in WSD implementation (A, PC).	April 2009	Completed May 2009
		Documented report on the higher level institutional hierarchy and the benefits and conditions for a more integrated approach (PC).	December 2009	Completed in 2011-12
		A published framework for higher level institutional design (PC).	May 2010	Completed in 2011.-2
		A survey of higher level officials within the institutional structure that embeds dimensions and preliminary findings of objective 1 (A, PC).	August 2010	Completed in 2011-12
		A detailed data set that captures the institutional relationships and perceptions of institutional actors across the entire decision making hierarchy (PC).	January 2011	Completed in 2011-12
		A data set that describes the impacts of indirectly related activities/interventions specified in models (PC).	January 2011	Analysis of the survey data has been undertaken. The internal review identified the need for additional refinements which was undertaken prior to the work being submitted for external review and publication.

		Documented data analysis using Structural Equation Models that explain institutional linkages (PC).	May 2010	The SEM approach was not feasible with the data set on hand. A variety of alternative analytical tools were deployed.
2.2	Harnessing the findings of related work and experience in Australia to inform institutional design and policy formulation	Indian partners familiarised with NRM decision tools and functioning of MBIs in Australia (A)	May 2011	Completed in 2011. In addition, a visit by Indian research partners and stakeholders took place in Feb 2012. The location was WA where the challenge of groundwater management across competing sectors was explored. This was undertaken with the assistance of staff from CSIRO, UWA and state agencies. The outcomes were highly beneficial.  National and AP officials visited Australia in April 2013. This provided an opportunity for in-depth meetings with state and federal bureaucrats in Australia.
		Documented outputs from testing the compliance modelling approach in Victoria setting (A)	May 2011	The extant data on compliance with the AP legislation showed insufficient variation to develop useful models.
		Documented outputs from testing the Private: Public Benefit Framework in an AP setting (PC, A)	May 2011	The series of publications that appeared in <i>Economic Papers</i> in June 2011 included analysis of the private:public benefits that attend different decision making processes in Australia. The research team has subsequently published additional work dealing with private and public interests in water.
2.3	Identifying the benefits and costs of transition, including the costs of closing off future alternatives	Develop alternative models of desirable/ optimal institutional structures (A, PC).  Workshop proceedings that detail the alternative approaches and the benefits and cost of alternatives and transition (A, PC)	May 2011  September 2011	The empirical models based on WSD deployment at the lower level are now indicating clear alternatives for reform and the findings have been embraced by DRD. Findings from the higher level analysis are currently under review for a widely read scholarly outlet. IIM policy briefs have also been circulated with the aim of promoting some reforms.  A workshop was held with key stakeholders in Australia in February 2012. Another workshop was held in Hyderabad in February 2013 and a finale workshop conducted in Australia in April 2013

PC = partner country, A = Australia

**Objective 3: To provide a vehicle for sensitization and capacity building within various Indian agencies to improve institutional design for watershed development and other resource management activities.**

No.	Activity	Outputs/ milestones	Completion date	Comments
3.1	Training activities to assist lower tier organisations to drive grassroots institutional change	NGO and grassroots officials engagement, orientation and trained in institutional needs and design (A, PC)	May 2011	The findings from the two phases have been tested on several occasions with DRD officials at several levels. Grassroots officials have also been involved from the inception of the project, to ensure familiarity with the context and ownership of the results.
		Indian partners familiarised with new NRM decision tools and functioning of MBIs in Australia (A)	May 2011	A field visit was conducted in Feb 2010, including site visits where MBIs have been deployed along the Murray River. Another field visit was conducted in February 2012. This included analysis of incentive structures in NRM in Western Australia. An additional field visit occurred in April 2013. The success of BushTender in Victoria was one of several case studies used, along with field visits and interaction with state officials. The vegetation offset program was also examined.
		Documented process for ground-truthing empirical findings by testing with agencies, NGOs and stakeholders (PC, A)	July 2011	A workshop was held with key stakeholders in Australia in February 2012.
		Workshop proceeding that analyse alternative policy approaches with Australian and Indian participants (A, PC)	January 2012	Several papers were delivered as part of the AARES national conference in Australia in Feb 2012. Papers are publicly available via AARES.

3.2	Engagement of district, state and national policy makers and administrators in a process to explain and assist transition	Policy maker/ administrator input into sampling, survey design and data collection completed (PC, A)	May 2009	Completed as component of inception meetings and field visits.
		Indian partners familiarised with new NRM decision tools and functioning of MBIs in Australia (A)	May 2011	A field visit was conducted in Feb 2010, including site visits where MBIs have been deployed along the Murray River. In addition, a visit by Indian research partners and stakeholders took place in Feb 2012. The location was WA where the challenge of groundwater management across competing sectors was explored. This was undertaken with the assistance of staff from CSIRO, UWA and state agencies. The outcomes were highly beneficial. An additional field visit occurred in April 2013. The success of BushTender in Victoria was one of several case studies used, along with field visits and interaction with state officials. The vegetation offset program was also examined.
		Ground-truth empirical findings by testing with agencies, NGOs and stakeholders (PC, A)	September 2011	A workshop was held with key stakeholders in Australia in February 2012.
		Workshop proceedings detailing alternative policy approaches with Australian and Indian participants (A, PC)	January 2012	Several papers were delivered as part of the AARES national conference in Australia in Feb 2012. Papers are publicly available via AARES.
		Documentation of the outcomes from testing the Private: Public Benefit Framework in an AP setting (PC, A)	May 2011	The series of publications that appeared in <i>Economic Papers</i> in June 2011 included analysis of the private:public benefits that attend water management decisions in Australia. The research team has subsequently published additional work dealing with private and public interests in water (see below).
		Project review workshop (PC, A)	May 2012	A decision was reached in Feb 2012 to undertake an initial internal review of the two main components of the work. This resulted in some revision of the empirical work. An external review was undertaken in February 2013. The reviewers offered strong support for the project and found no substantive gaps in the work. An ACIAR follow-up to the review was provided to the research team and a response from the team provided in May 2013.

PC = partner country, A = Australia

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## 7 Key results and discussion

We report the results of the project using the bifurcation between lower-level institutional analysis and interrogation of higher-level institutions in WSD. Comments relating to sensitisation, training and engagement are reserved for section 8.

### **Lower-level institutional analysis**

#### *Conceptual framework*

As noted in section 5, there was a requirement to first develop a customised theoretical framework to underpin the institutional analysis of WSD programs. This commenced with the framework buttressed by New Institutional Economics and developed by Crase and Gandhi (2009) and Pagan (2009) for an earlier ACIAR project.

In New Institutional Economics, 'institutions' are considered to be humanly devised constraints that structure human interaction (North 1990). New Institutional Economics offers different approaches to understand the nature of institutions, including transaction costs and property rights (North 1997; Drobak and Nye 1997). A basic premise in New Institutional Economics is that economic activity is attended by transformation costs and transaction costs. Transformation costs relate to the production of goods and services whilst transaction costs directly relate to facilitating exchange, and are thus incurred in realising the value from production. The notion of transaction costs has been broadened to include the costs of creating and maintaining the institutions necessary for exchange to occur.

Transaction costs are often overlooked in conventional economic analysis, and yet their presence can substantially influence the incentives for exchange. When large, transaction costs can stifle exchange, thus reducing the prospect of generating value/benefits. In a market setting high transaction costs can mean that buyers and sellers do not trade at all. In the case of community and/or government-sponsored activities (like WSD), high transaction costs can reduce the benefits generated by the programs for which those organisations are responsible.

Good institutions thus limit transaction costs and the challenge is to promote those institutions where: (1) transaction costs are minimized, and (2) the incentives favour co-operative solutions, where cumulative experiences and collective learning are best utilised (North 1997).

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) identified key characteristics that should be expected in effective institutions. These are:

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 a capacity to modify over time.
4. **Appropriateness of Scale**: Good institutions are of an appropriate size and scope.
5. **Compliance Ability**: Good institutions can 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 also address at least three important rationalities:

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

2. Organizational Rationality: Division of labour, specialization and coordination.
3. Political Rationality: Capable of addressing perceptions of fairness and justice.

These five institutional features and three rationalities formed the starting point of the theoretical framework for assessing the performance of WSD institutions. Whilst this approach has some appeal, the case studies covering different WSD programs revealed the need to expand the theoretical framework. This is explained, in part, by the expansion of WSD over time, such that the program now aims to deliver multiple benefits. There is also an emphasis within WSD to facilitate a convergence of government effort to alleviate poverty. The five institutional features were regarded as appropriate but the 'rationalities' were refined and expanded to reflect the findings from the case analysis.

The expanded and refined list of 'rationalities' is summarised below:

1. Technical Rationality: 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. Economic Rationality: Consideration of overall 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. Environmental Rationality: Consideration of the environment in the selection of methods and activities, conservation of water, land and natural vegetation, externalities, sustainability.
4. Social Rationality: Consider the social context, seeking the acceptance and cooperation of the different social groups, participation, distribution of the support and benefits.
5. Political Rationality: 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. Organizational Rationality: 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. Financial Rationality: Discipline and care in proper handling of financial resources, procedures, responsibility and accounting systems, checks and monitoring, preventing misuse, government sanctions.
8. Government Rationality: 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.

This expanded conceptual framework is depicted in the Figure 2. Here the five institutional features form the core of the framework (as depicted within the pentagon) with the related rationalities circumscribing that core. Collectively, these elements are expected to shape overall institutional performance.



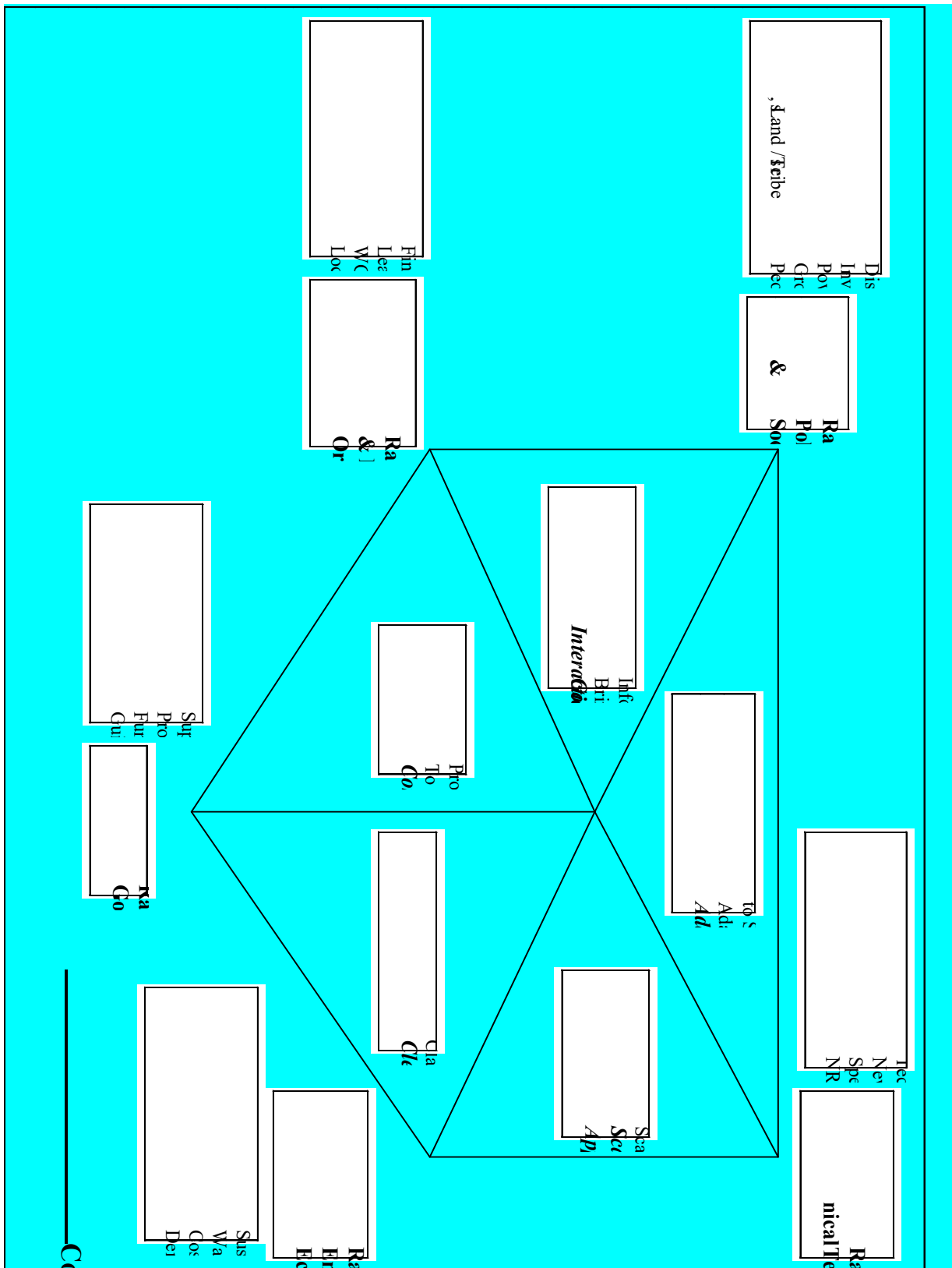


Figure 2: Conceptual framework for considering WSD

Source: Gandhi, V. P. (2011), "Reforming Institutions in Natural Resource Management" in Suresh, Pal (ed.) *Agriculture for Inclusive Growth* Indian Agricultural Research Institute, New Delhi.

As noted in section 5, the conceptual framework was used to guide the development of a survey instrument that was subsequently administered across a stratified sample of households who purportedly benefit from WSD programs. Features of the sample are summarised in Table 5, below:

Table 5: Profile of the farmer sample for lower-level institutional analysis

<b>7.1.1 Reliance On/ Usefulness of WSD Institution</b>	
	Percent
Very substantial	15.5
Substantial	76.8
Some	7.2
Very little	.6
Total	100.0
<b>Participation In WSD Decisions/ Activities</b>	
	Percent
Very Active	14.2
Active	68.3
Passive	14.9
None	2.6
Total	100.0
<b>Total Land Owned</b>	
Acres <sup>4</sup>	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

<sup>4</sup> 1 acre = 0.405 hectares

About 77 per cent of the households sampled showed as substantial reliance on WSD activities, and it is very substantial for another 16 per cent. The data in the table also indicates that about 68 percent of the sample beneficiaries actively participated in the activities and decision making of the WSD organisation and about 14 per cent were categorised as being very active. With respect to land owned, about 50 per cent of respondents owned less than 5 acres of land and only about 11 per cent owned more than 10 acres. About 20 per cent of the sample is landless.

A large number and variety of WSD activities were reported in the survey, Table 6. Check dams were reported by 205 beneficiaries, percolation tanks by 70, mini percolation tanks by 47 and drip irrigation by 44 beneficiaries. Apart from these water-focussed activities, a large number of production enhancement activities such as distribution of fertilizers, new seeds, fruit trees and dairy animals were also reported. In addition, a large number of enterprise promotion activities were reported including tea shops, grocery shops, tailoring, clothing businesses and sheep and goat purchases.

There was much variation in the activity level of different groups and structures in relation to WSD institutions. The general body was regarded as active to very active in 53 per cent of cases and passive in 44 per cent of the cases. In contrast, the leader or head of the institution was reported as being active in about 90 per cent of cases. The landless were reported passive in 51 per cent of the cases and women were reported to be very active in 44 per cent of the cases.

The main purpose for which these data were assembled was to unbundle those elements of institutional design that were important in the context of WSD program performance. This was accomplished using a three-stage empirical analysis. First, we examined the perceived contribution of WSD activities. This was done by asking households to rank different performance components, such as the contribution to increasing water availability. Respondents were also given the opportunity to rate the overall performance of WSD in their village using a 4-point scale that spanned from 'very successful' to 'poor'. Second, factor analysis was undertaken to determine those elements of the theoretical framework that could be reliably measured within the data. This step was required as a large number of separate items were used to capture each element of the conceptual framework and reducing these to 'factors' offers a parsimonious approach to developing explanatory empirical models. Finally, a series of regression models were developed to establish those factors that impacted on performance. Since the performance indicators are range-bound with values from 1 to 5, OLS regression would be unsuitable and a limited dependent variable procedure is required. The TOBIT regression was selected and used for econometric estimation (see Madala 1983). Tests were also undertaken to establish the significance of those factors against the elements of performance (e.g. natural resource management versus increased agricultural productivity versus enterprise development) and across the different versions of WSD programs. Given the constraints of this report an incomplete summary of the three stages is provided here, with the aim of highlighting the approach taken and identifying key findings.

### Performance of WSD

The disaggregation of performance can occur along the lines of the three core objectives of WSD – improved natural resource management, enhanced agricultural productivity and enterprise promotion for those with limited access to agricultural land. Table 4 shows the rating of the usefulness of different on-ground activities in the context of NRM with statistically significant items highlighted. Clearly, check dams, farm ponds, the use of sprinkler irrigation and land levelling were adjudged to have greatest impact on usefulness in this context.

<b>Tale 6: Usefulness of Natural Resource Management (NRM) Activities</b>					
	Number of Respondents	Usefulness (1=Poor to 5=Excellent)			
		Minimum	Maximum	Mean	Standard Deviation
Check Dams	205	1.00	5.00	4.10	0.745
Village Pond	4	3.00	5.00	3.75	0.96
Farm Pond	15	3.00	5.00	4.13	0.64
Percolation Tank	70	1.00	5.00	3.89	0.71
Mini Percolation Tanks	47	1.00	5.00	3.89	1.13
Sunken Pits	2	3.00	4.00	3.50	0.71
Gully Control	40	3.00	5.00	4.18	0.64
Rock Fill Dams	8	4.00	5.00	4.38	0.52
Drip Irrigation	44	1.00	5.00	4.23	0.77
Sprinkler Irrigation	39	3.00	5.00	4.49	0.60
Bunding	20	1.00	5.00	3.35	1.14
Levelling	4	4.00	5.00	4.75	0.50
Agro Forestry	8	1.00	4.00	1.75	1.39
Other Natural Vegetation Planted	1	1.00	1.00	1.00	0.00
Mango	5	4.00	5.00	4.60	0.55
Sweet Orange	2	4.00	5.00	4.50	0.71

Similarly, the assembled data allows us to consider the seasonal impacts of WSD activities and their relationship to crop production. Table 7, for example, shows the rated impact on water availability, its seasonal distribution, the impact on particular irrigation activities and crop production. There is strong support from these data that WSD are having a discernible impact on communities.

<b>Table 7: Impacts of WSD on Water Availability (%)</b>						
	<b>Large Increase =5</b>	<b>Increase =4</b>	<b>No Change =3</b>	<b>Decrease =2</b>	<b>Large Decrease =1</b>	<b>N</b>
Water Availability	4.2	64.8	30.8	0.2	0	542
<b>Water Table</b>						
Rainy season	15.2	73.2	9.9	1.7	0	355
Dry Season	3.1	69.6	23.1	4.2	0	355
<b>Improvement in Water Quality</b>	0.6	19.9	79	0.6	0	542
<b>Irrigation Status</b>						
Operational Open wells	0.6	24.7	72.1	2.6	0	154
Operational Tube wells	3.6	58.1	38.3	0	0	334
Area Irrigated total	12.2	65.9	21.6	0.3	0	361
No.of Irrigations/ year	13.7	80.3	6	0	0	117
<b>Crop Production</b>						
Kharif Production	6.4	34.3	57.9	0	0	140
Rabi Production	26.2	56.6	17.2	0	0	122
<b>Livestock Income</b>	15.7	41.3	26.2	14.5	2.3	344

In addition to modifying water availability, WSD programs have also sought to amend other elements of production in order to raise agricultural productivity. The results reported in Table 8 offer some encouragement on that front with substantial increases in the use of improved seeds, fertilizers and tractors linked to WSD activities.

Table 8: Input Use Changes related to WSD (%)						
	Large Increase =5	Increase=4	No Change=3	Decrease =2	Large Decrease =1	N
Seed HYV/Improved	15.5	70.9	11.2	2.3	0	430
Fertilizer	29.1	64.0	5.6	1.4	0	430
Pesticides	24.5	58.5	13.1	3.9	0	412
Farmyard Manure	3.3	30.5	40.8	20.7	4.7	213
Bullock Use	1.4	8.5	19.9	52.1	18	422
Tractor	32.9	59.2	5.2	2.7	0	404
Other Machine Use	23.1	46.2	30	0.6	0	160
Hired Labour	8.4	54.1	30.9	6.6	0	427
Enterprise Income	8.9	76.6	13.1	1.2	0.3	337

Notwithstanding these positive signs, the overall performance of WSD was considered mixed, as illustrated by the data presented in Table 9. Accounting for those variations in performance commenced with a factor analysis focussing on the elements of the institutional framework.

<b>Table 9: Overall assessment of the performance/success of the institution by the respondents</b>		
<b>Success</b>	<b>Rating</b>	<b>%</b>
Very successful	4	16.7
Successful	3	26.0
Satisfactory	2	44.9
Poor	1	12.4
Total		100.0

*Empirical verification of theoretical framework*

An exploratory factor analysis revealed that many of the elements of the theoretical framework were statistically verifiable with the extant data. For example, Table 10 reveals ten factors with an Eigenvalue in excess of 1. Eigenvalues are a measure of the extent to which a series of items (e.g. separate questions in a survey) consistently track together. The more consistent these items, the more likely the value will exceed 1. This supports the view that the factors derived from this analysis can provide a useful basis for helping to explain institutional performance.



Table 10: Factor Analysis: Rationalities: Total Variance Matrix			
Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	18.027	34.668	34.668
2	9.320	17.924	52.591
3	6.299	12.114	64.705
4	4.539	8.728	73.433
5	3.583	6.891	80.324
6	2.485	4.779	85.103
7	2.270	4.364	89.468
8	1.647	3.168	92.636
9	1.397	2.687	95.322
10	1.132	2.176	97.499
11	.839	1.613	99.112
12	.462	.888	100.000
13	1.918E-15	3.688E-15	100.000
14	1.152E-15	2.215E-15	100.000
15	9.776E-16	1.880E-15	100.000

*Empirical modelling of performance against the theoretical framework*

TOBIT regression models were developed using the various components of the theoretical framework, along with dummy variables to capture some of the variation attributable to differences across districts and the focus of particular programs (e.g. enterprise development and productivity enhancement). TOBIT regression is used in preference to OLS regression because many of the variables are in categorical form (i.e. not continuous). TOBIT regression generates results similar to linear regression where the coefficient estimates show the marginal change between categories within the variable. The statistical significance of variables in the model can be adjudged by the t value and the overall significance of the model can be assessed with reference to the value of Sigma (Sigma is analogous to the square root of the residual variance in OLS regression).

Table 11 summarises the results for the impact of the different rationalities on the overall assessment of performance whilst Table 12 summarises the impact of the different institutional components on overall performance.

Table 11: TOBIT Regression - Overall Success and Institutional Rationalities					
Variable	DF	Estimate	Standard Error	t Value	Approx Pr >  t
Intercept	1	1.314683	0.353316	3.72	0.0002
Technical Rationality	1	0.120102	0.038045	3.16	0.0016
Environment Rationality	1	0.107359	0.034144	3.14	0.0017
Economic Rationality	1	0.046004	0.071249	0.65	0.5185
Social Rationality	1	-0.08545	0.073342	-1.17	0.244
Political Rationality	1	-0.14348	0.054041	-2.66	0.0079
Organisational Rationality	1	0.161541	0.084666	1.91	0.0564
Financial Rationality	1	0.262168	0.075658	3.47	0.0005
Government Rationality	1	0.181416	0.091167	1.99	0.0466
DummyAnantapur	1	-0.15642	0.076004	-2.06	0.0396
DummyNalgonda	1	-0.06477	0.075322	-0.86	0.3898
PEDummy	1	0.096754	0.07001	1.38	0.167
EPDummy	1	0.263575	0.085667	3.08	0.0021
_Sigma	1	0.668534	0.021864	30.58	<.0001
N=542					

Table 12: TOBIT Regression - Overall Success and Institutional Features					
Variable	DF	Estimate	Standard Error	t Value	Approx Pr >  t
Intercept	1	1.395369	0.336661	4.14	<.0001
Clear Objectives	1	-0.01283	0.054992	-0.23	0.8155
Good Interaction	1	0.265812	0.061106	4.35	<.0001
Adaptiveness	1	0.208497	0.067505	3.09	0.002
Scale	1	0.119806	0.06759	1.77	0.0763
Compliance	1	0.076963	0.071462	1.08	0.2815
DummyAnantapur	1	-0.03386	0.076962	-0.44	0.66
DummyNalgonda	1	-0.08364	0.079596	-1.05	0.2934
PEDummy	1	0.010284	0.068514	0.15	0.8807
EPDummy	1	-0.01433	0.063447	-0.23	0.8213
_Sigma	1	0.678549	0.022231	30.52	<.0001
N=541					

Statistically significant items are highlighted in both tables. Technical, environmental, organisational, financial and government rationalities were all significantly and positively related to performance of WSD. Importantly, political rationality was significant but negatively related to performance. This supports the view that excessive effort to address political dimensions of WSD may be counterproductive in achieving the goals of WSD.

In the context of the institutional features of the theoretical framework, interaction, adaptiveness and scale issues were positively and significantly related to performance. Put differently, having organisation structures for WSD that can adapt, are at a scale that matches interests and objectives and which facilitate interaction between stakeholders are most conducive to successful outcomes from WSD.

We noted earlier that in the context of developing countries like India, overall institutional performance can be usefully unbundled against the objectives of dealing with scarcity, equity, environmental concerns and financial soundness. The data collected for the project can thus be modelled along those lines and sample results are summarised in Tables 13 and 14.

Table 13: TOBIT Regression - Scarcity and Institutional Rationalities					
Variable	DF	Estimate	Standard Error	t Value	Approx Pr >  t
Intercept	1	2.397505	0.187202	12.81	<.0001
Technical Rationality	1	0.073462	0.020581	3.57	0.0004
Environment Rationality	1	0.020214	0.018669	1.08	0.2789
Economic Rationality	1	0.083339	0.037852	2.20	0.0277
Social Rationality	1	0.015	0.03903	0.38	0.7007
Political Rationality	1	-0.10481	0.028698	-3.65	0.0003
Organisational Rationality	1	0.131331	0.045457	2.89	0.0039
Financial Rationality	1	0.027634	0.040905	0.68	0.4993
Government Rationality	1	0.0255	0.048592	0.52	0.5997
DummyAnantapur	1	-0.00767	0.040483	-0.19	0.8498
DummyNalgonda	1	-0.10537	0.040509	-2.60	0.0093
PEDummy	1	0.044934	0.037321	1.20	0.2286
EPDummy	1	0.040931	0.045592	0.90	0.3693
_Sigma	1	0.355661	0.011018	32.28	<.0001
N=521					

The results in Table 13 show that technical, economic and organisational rationality are significantly and positively related to dealing with scarcity, whilst political rationality is negatively related to the capacity to delivering on this objective.

Table 14: TOBIT Regression - Equity and Institutional Rationalities					
Variable	DF	Estimate	Standard Error	t Value	Approx Pr >  t
Intercept	1	1.350073	0.264115	5.11	<.0001
Technical Rationality	1	-0.0327	0.02856	-1.14	0.2523
Environment Rationality	1	0.137202	0.025614	5.36	<.0001
Economic Rationality	1	0.066298	0.053414	1.24	0.2145
Social Rationality	1	0.242598	0.05489	4.42	<.0001
Political Rationality	1	-0.05837	0.040402	-1.44	0.1485
Organisational Rationality	1	0.174289	0.063551	2.74	0.0061
Financial Rationality	1	0.156862	0.056941	2.75	0.0059
Government Rationality	1	-0.1093	0.068544	-1.59	0.1108
DummyAnantapur	1	-0.17295	0.057109	-3.03	0.0025
DummyNalgonda	1	-0.23857	0.056646	-4.21	<.0001
PEDummy	1	0.016496	0.052698	0.31	0.7543
EPDummy	1	0.054831	0.064367	0.85	0.3943
_Sigma	1	0.506313	0.015379	32.92	<.0001
N=542					

The results in Table 14 show that closer attention to financial, organisational, social and environmental rationalities is more inclined to deliver positive gains on the equity front.

Finally, the data can also be used to assess the impacts of the different versions of WSD used over time and the interplay between institutional features and the various WSD programs. Table 15 summarises the reported impact of WSD by the type of program used and socioeconomic features. Again, significant variables are indicated by highlighting.

Table 15: Impact of WSD by program and socioeconomic variables					
Impact mean	Program			F statistic	Significance
	DDP/DPAP	APRLP	HARIYALI		
Village as a whole	4.426	4.4764	4.456	0.417	0.659
Upper caste	3.8929	4.0419	4.2099	8.201	0
Backward caste	4.4852	4.4188	4.467	0.84	0.432
Schedule Caste	4.2071	4.2827	4.3242	1.878	0.154
Schedule Tribes	3.8472	3.6384	3.8383	2.271	0.104
Women	3.9112	4.7801	4.4451	73.842	0
Poor	3.6071	4.0159	3.8352	21.894	0
Middle Income	4.284	4.3158	4.2486	0.831	0.436
Upper Income	4.1429	4.0842	4.1923	1.032	0.357
Large/medium Farmers	4.284	4.1058	4.3039	6.67	0.001
Small/marginal Farmers	4.4702	4.4603	4.4365	0.174	0.84
Landless	3.4524	4.0262	3.7514	39.065	0
Labour/wage earners	3.9524	3.9791	3.8626	2.469	0.086
Upper reach Beneficiaries	4.284	4.3883	4.2155	2.166	0.116
Lower reach Beneficiaries	4.0355	4.0481	3.9056	3.365	0.035
Shop Owners	3.6369	4.1099	4.0385	33.158	0
Small Businesses	3.6805	4.3351	4.1593	57.563	0
Traders	3.4277	3.7135	3.6264	12.167	0

On the basis of these results there would appear to be a more even distribution of benefits under the Rural Livelihoods Program (APRLP) approach relative to the Hariyali version of WSD.

Finally, we turn attention to the relationship between the success of the different manifestations of WSD programs, the underlying institutional makeup of each program and its relative success, as reported by households. The results from this component of the lower-level institutional analysis are reported in Table 16.

Table 16: Institutional success drivers under different WSD programs					
	Program			F statistic	Significance
	DDP/DPAP	APRLP	HARIYALI		
Technical Rationality	3.74	3.16	3.32	15.340	.000
Environment Rationality	3.73	3.23	3.32	10.253	.000
Economic Rationality	3.04	3.19	3.07	4.631	.010
Social Rationality	3.47	3.90	3.63	22.847	.000
Political Rationality	3.18	3.12	3.31	4.269	.014
Organisational Rationality	3.38	3.82	3.59	27.965	.000
Financial Rationality	3.61	4.01	3.82	23.521	.000
Government Rationality	3.44	3.50	3.48	.586	.557
Clarity Of Objectives	3.69	3.94	3.92	6.827	.001
Good Interaction	3.41	3.90	3.83	27.895	.000
Adaptiveness	3.24	3.42	3.46	7.191	.001
Scale	3.02	3.14	3.10	1.908	.149
Compliance	3.53	3.69	3.62	2.894	.056



In terms of the DDP/DPAP version of WSD, key drivers of success, as indicated by significance in the above model, are technical and environmental rationality. A wider suite of institutional elements are important for the success of APRLP including institutional characteristics and rationalities. These cover social, organisation and financial rationality as well as having institutions with clear objectives, a capacity to bring compliance and a structure that result in good interaction. A narrow set of features drive performance under the Hariyali model, namely political rationality and adaptiveness.

### General findings on lower-level institutional analysis

The data collected for this part of the project clearly indicates that WSD is having a significant and generally positive impact in rural India. However, the performance of WSD is also clearly influenced by the institutional design that is used to deliver the program. An important feature of success is attention to technical rationality. Put simply, there are strong grounds for involving technical experts in the institutional setup to ensure that activities are effectively mapped, appropriately located and designed and to enable quality control.

Environmental soundness is also a key driver of success in WSD projects. Arguably, these elements of WSD need further attention in the development of guidelines and in securing planning approval for works. There are also some improvements in equity that can arise from greater environmental rationality, and this was evident within the data.

Organisational rationality is also strongly related to performance and this supports calls for ongoing investment in creating strong and well-trained local organisations to support WSD. Finally, the requirement for adequate control systems, including auditing, is emphasized with financial rationality being another key success driver for WSD activities.

On the institutional design front, the most successful entities in WSD appear to be those that foster good interaction between beneficiaries and between the beneficiaries and the institutional hierarchy. Ensuring there are appropriate vehicles for this interaction to occur (e.g. regular and open meetings) is a logical recommendation. The capacity of organisations to adapt was also an important driver of success. In this context it is important that national and state guidelines for WSD not be too rigid. Some degree of local autonomy would appear to be a requirement for improved performance.

When comparing across the various institutional architectures used for WSD it is clear that the different approaches have delivered very different outcomes. Overall, the APRLP institutional setup performs best and particularly in terms of improvements for the poor and women. The DPAP institutional setup is well suited to delivering improved natural resource management and generates more technical and environmental rationality than other models. The Hariyali institutional setup results in poorer outcomes on equity ground with most gains to upper castes and large farmers. Ideally, these findings will inform future revisions of WSD guidelines and result in the most efficacious delivery of WSD.

### **Higher-level institutional analysis**

The second phase of this project focused on higher-level institutions and how they set about shaping and influencing WSD programs. As noted at the outset, the manner in which individuals in higher-level institutions contemplate the delivery of WSD was expected to have some influence on the effectiveness of local delivery. It is also the case that there was evidence of a gap between the ambitions set out at higher levels and the on-ground outcomes. Notwithstanding that the lower-level institutional analysis (above) indicated practical mechanisms for dealing with this gap, understanding its causes at higher levels of authority was considered important. The analysis commenced with a reflection on the most recent version of WSD, often terms the 'Common Guidelines'.

The 2008 Common Guidelines were released after a relatively participatory and inclusive consultation process with multiple stakeholders all over the country. The survey administered as part of this project and the related interviews showed that most informants felt that the Common Guidelines represented a substantive improvement compared to previous approaches. Notably, survey respondents, overall, felt that the five guiding principles, although mentioned in previously arrangements, had been given more importance under Integrated Water Management Programs. In this respect, the guidelines marked an institutional change perceived as legitimate, relevant and effective.

However, during interviews, many informants expressed caution on how the guidelines would be translated on the ground:

*"When the guidelines were there, we had great hopes that the program would take off in a very influential and different state (...). Actually what happened, on the ground nothing has changed"* (interview Planning Commission, 2011);

*"There is always going to be gaps between policy and implementation"* (interview state level government officer, 2011).

Many informants described the notion of an 'implementation gap' and that this had little to do with poorly designed institutions/guidelines but was, rather, a function beyond the control of policy-makers:

*"All was planned meticulously, but there were many gaps"* (interview state level government officer, 2011).

Increasingly, institutional scholars have recognised that the way policy change is translated on the ground depends on multiple external factors, often loosely coined as 'context' (Clement and Amezaga 2013). The importance of context is particularly evident in India, where one can easily observe how different states follow different directions to implement the same WSD program. For instance, Indian states have different administrative systems for implementing IWMP with Orissa and Karnataka, for example, choosing to operated WSD using an exclusive watershed department whilst in Andhra Pradesh the tasks of WSD have been assigned to the broader portfolio of the Department of Rural Development.

To progress our understanding of the implementation gap additional theoretical underpinnings were explored and these are briefly summarized below.

### **Institutional change**

A great deal of scholarship exploring institutional performance assumes that the right policy will automatically lead to the right outcomes by providing the right set of incentives to those implementing the program. This approach tends to focus on policy objectives without acknowledging the broader social reality in which institutions function. Recent discussions on the types of contextual factors affecting institutional change highlights the important role of the political-economic context in shaping power distribution and the

interests of various 'actors' and the discourse that dominates policy (Clement 2010; Clement and Amezaga 2013).

Discourse implies "[a] specific ensemble of ideas, concepts, and categorizations that is produced, reproduced, and transformed in a particular set of practices and through which meaning is given to physical and social realities" (Hajer 1995: 60). Discourses frame and define environmental problems and their solutions in specific ways (Hajer 1995). For instance, discourses on water productivity herald 'efficiency' as the main goal and, as a result, related interventions have often disregarded issues of equity (Venot and Clement in press), let alone the longer term commercial viability that is demanded by global markets (see, for example, Crase 2012). Discourses plays an important role by providing or undermining the legitimacy of institutional change. Finally, institutions are transformed in order to achieve organizational objectives described by discourse.

### Theoretical Framework

The framework of analysis for this component of the study shares some features with that used to underpin the lower-level analysis, but has been configured to builds directly on the Institutional Analysis and Development (IAD) framework (Kiser and Ostrom 1982; Ostrom, Gardner et al. 1994; Ostrom 1999). The IAD framework was recently modified to include the role of context (Clement and Amezaga 2013) and has been further modified by representing the actors embedded within organizations (Figure 3).

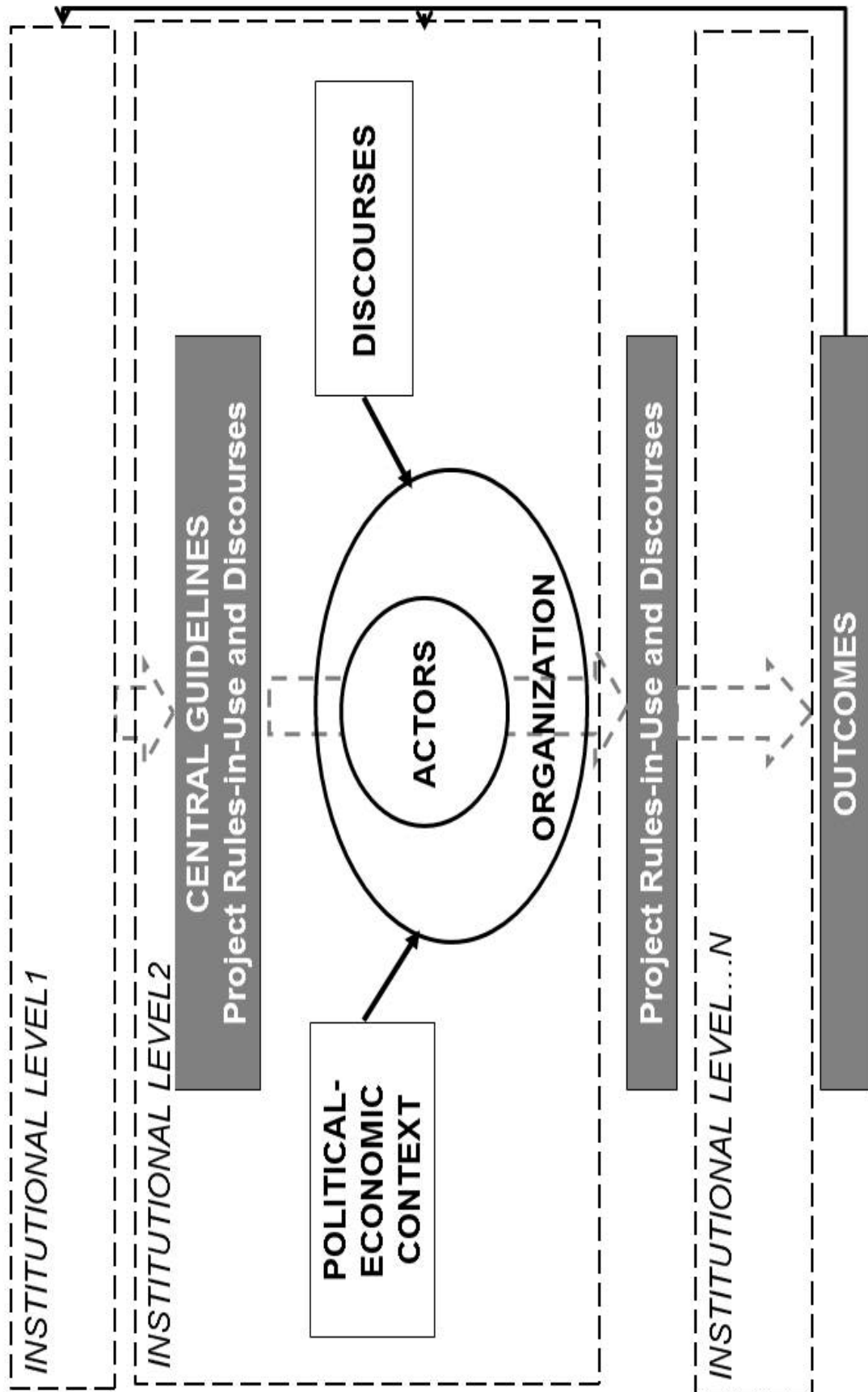


Figure 3: Framework for considering higher-level institutions

In this framework the 'actors' form the core analytical component at each institutional level. Their decisions are affected by three variables: organization, discourses and the political-economic context. The framework includes multiple levels of decision-making, called 'institutional levels'. This approach facilitates the analysis of decisions that 'cascade' from higher to lower levels of authority. For simplicity only three levels are shown here.

Each variable can be decomposed into sub-variables. For instance, the variable 'actors' (or at least their activities and responses) can be unpacked into: beliefs, values, interests, power and capacity. Some of these sub-variables are shaped by external factors: for instance, discourses directly affect actors' beliefs and power and the political-economic context affects actors' interests and power. Similarly, the variable 'organization' can be decomposed into: beliefs, capacity, interests, institutions, power and values. The latter are also affected by external factors.

What distinguishes the organization from the actor is that organizations have their own institutions (i.e. sets of rules). Of particular interest in this study are the rules and norms prevailing within the bureaucratic system.

We chose the Common Guidelines of 2008 as the policy intervention of interest. The Guidelines are a set of institutions and discourses which aim at providing the right incentives and vision for guiding actors' decisions for the implementation of IWMP. This analytical framework was used to track how the Common Guidelines were translated from the central level to the project level in Andhra Pradesh and which processes have contributed to the implementation gap.

### Defining failures and successes

To analyse the gaps between policy intentions and outcomes, we need first to define what is a 'success' and a 'failure'. Research Mosse (2005), amongst others, suggest that two key elements apply: 1) assessing success and failure requires integrating perspectives from different stakeholders and social groups; and 2) measuring outputs and indicators needs to be complemented by a thorough understanding of the social processes that have led to observed outcomes.

Under IWMP, the national monitoring and information system defines five categories of outcomes: employment, water, vegetation/crop, livelihood and marketing related outcomes. Those outcomes are to be measured through a pre-defined format to be filled in by the district Watershed Cell cum Data Centre with little room for understanding how these have been reached. Scant attention is given to the social processes that have led to the observed data (e.g. migration before/after the project) and/or the secondary impacts of WSD intervention.

One barometer of Andhra Pradesh's 'success' in WSD at a national level has been the ability of the state to attract and spend the largest budget on WSD and to implement the greatest number of projects that cover the largest area. In addition to the scale at which the government of Andhra Pradesh has implemented WSD programs, the state has also been recognised as one of the most progressive in implementing the WSD guidelines and in challenging the status quo. The development and implementation of the Andhra Pradesh Rural Livelihoods Program (APRLP) is a case in point. Although APRLP has been completed and government officers have changed, many of the learnings from the program were institutionalized leaving a legacy of success:

*"if we compare AP with other states, it is much better in terms of understanding of productivity enhancement and entry point activities"* (interview NGO, May 2011).

Despite this relative success, respondents from both non-government and government agencies underlined the limitations of previous programs, particularly the lack of sustainability of interventions:

*“NGOs are not satisfied with the impact (of previous WSD programs). Because post maintenance, nothing is happening. People have lifted all the stones from most structures. All the check dams are broken down...”* (interview NGO, July 2011);

*“One thing where I find probably there are gaps is in mobilising the community effort in sustaining the structures”* (interview government officer Department of Rural Development AP, June 2011).

The next section focuses on the factors that have enabled institutional innovation in the way Andhra Pradesh has implemented WSD programs.

### Understanding institutional innovation in AP

#### *Organizations*

Andhra Pradesh enjoyed some institutional freedom to adapt the guidelines for WSD and adopt a more livelihood oriented objective. For instance, in terms of institutional creativity, Andhra Pradesh was the first state to set up (in 2001) a dedicated agencies for WSD project implementation at the district level, called district water management agencies – a feature which was later acknowledged as instrumental in the delivery of WSD programs. Institutional innovation was facilitated by the distance the Government of Andhra Pradesh had maintained with the central government, particularly under the Telugu Desam Party (Baumann 1998). Innovation was also possible on the ground thanks to the interest of local NGOs seeking to participate in WSD projects and work together with the government (Baumann 1998).

Institutional innovation and the livelihood focus were also fostered by foreign aid, notably from the World Bank and DFID, which supported the integration of new ideas and the emergence of new projects, such as APRLP. Andhra Pradesh was again unique in being able to directly attract large amounts of foreign aid at that time, which some observers attribute to the relative openness of the Government of Andhra Pradesh to new ideas (Reddy, et al. 2009). Foreign aid also contributed to pressure on the performance of the bureaucracy and to support the governance reforms initiated by Chief Minister Naidu who was in power from 1996 to 2004 (Manor 2007).

#### *Actors*

The political leadership and vision of the Chief Minister are also said to have played a role in the performance of WSD institutions (Rao 2004). According to some scholars, his reforms enhanced the transparency and accountability of the bureaucracy, resulting in relatively good governance and effective administration (Baumann 1998). Political leadership also supported the recruitment of skilled professionals by granting relative freedom to line departments in their selection processes. Good relationships between the different levels of the bureaucracy assisted with the flow of funds and information.

#### *Discourses*

Policy discourses in Andhra Pradesh emphasised water scarcity as a key policy issue and supported a strong political commitment to improve water management. Discourses therefore largely legitimised the rationale for WSD and provided political support to bureaucrats at the state and district levels.

#### *Political-economic context*

Finally, the political context was an important factor affecting the implementation of WSD programs in Andhra Pradesh, particularly from 1996 to 2004 under the Telugu Desam Party. Manor (2007) has argued that the government of AP was more hostile to decentralisation than any other state government in India at that time. Panchayati raj institutions were indeed substantially disempowered in Andhra Pradesh during the mid-

1990s at the expense of community-based organizations and notably women's self-help groups (Manor 2007).

In sum, the combination of political leadership, with a particular vision of development, and a relatively accountable bureaucracy contributed to institutional innovation and the development of new ideas and vision within WSD programs in Andhra Pradesh. There was also a rapid uptake of central funds. With this historical context in mind, we now turn to the implementation of the 2008 Common Guidelines and IWMP in Andhra Pradesh.

### *Understanding higher level interactions – the case of building social capital*

#### *Central to state interaction*

The Common Guidelines embody many different aspects and our interest was to understand how these were transformed from higher-level entities to lower-level bodies involved in WSD. To make the analytical task manageable within the space of this report, we have focussed on one element of the Common Guidelines – i.e. the commitment within the guidelines to build social capital as part of IWMP.

Building social capital was identified in the national study commanded in 2006 by the Parthasarathy Committee as a major factor that differentiated successful and failed projects (interview Planning Commission, 2011). Social capital is also view in the academic literature as a key ingredient that supports sustainability. The Common Guidelines allocate specific time and funds for a project implementing agency in order to establish trust with communities. An overall period of one to two years was reserved for this preparatory phase to conduct entry point activities and to prepare a detailed project report (DPR) as the main output. How the preparation of the DPR has been translated from the central level to the project level in Andhra Pradesh is particularly instructive in understanding the relationship between higher-level agencies and lower-level agencies.

#### *Discourses*

The first gap that occurred in translating the Guidelines is largely a discursive gap between the vision of the DPR, as a process to build social capital, and the understanding and discourses of the DOLR. The DOLR has perceived the DPR as a technical and an administrative exercise with fixed and predefined targets:

*“These states are performing well: they are preparing the DPR very scientifically”* (interview DOLR, Sept. 2011).

For the DOLR, the DPR is also a requirement that indicates whether they can release funds to the State level nodal agency:

*“We just check that the DPR is prepared as per the guidelines. If it is conforms, then we release the funds”* (interview DOLR, Sept. 2011).

Such a vision and related discourses tend to focus attention on the measurable outputs of the DPR (i.e., the technical and administrative requirements) rather than on the processes that led to the DPR (building social capital).

#### *Actors*

Second, even if the DOLR staff had an in-depth understanding of the processes required to build social capital, their organizational capacity did not allow them to go beyond purely administrative management. This is partly because the Central Nodal Level Agency (CLNA) that was originally envisioned has not been established, hence the same staff who have been working on earlier WSD programs had to add IWMP to their set of duties. In total, only three program officers and one joint secretary are in charge of overseeing national implementation.

Even if many responsibilities had been delegated to the states, the limited capacity at the central level affected the quality of the strategy and monitoring, e.g. in terms of assessing

the capabilities of state implementation and fund absorption. The DOLR acts more as a policeman by putting pressure for incurring expenditure, asking for proposals for the next releases or for progress reports, as opposed to playing a supportive role. The central government could advise or facilitate interaction among states in order to share experiences, but this has generally not occurred. Furthermore, present arrangements do not favour flexible, context sensitive and adaptive management.

*Organizations: the DOLR and NRAA*

Third, from an institutional perspective, administrative management is, in any case, the role that has been assigned to the DOLR officers. Two other organizations could play the role of an advisory, supportive and coordinating body: the NRAA and the National Level Steering Committee. However, their influence is limited. NRAA's role vis-a-vis the DOLR is not clear and according to our interviews, the organic link between these two organizations is not sufficiently strong to build synergies. Interviews also revealed that the NRAA has very little power – in the sense of influence – over the decisions of the DOLR. In addition, the NRAA is composed of natural scientists and has only limited expertise on activities related to community participation and building social capital.

*Central guidelines: rules-in-use*

The Guidelines, however, do play an important role in defining the way IWMP is implemented by assigning roles and responsibilities to different organizations and in defining the relationship between national level organizations and the State level nodal agencies. The National Level Steering Committee is largely controlled by the DOLR and includes representatives of the civil society and social activists, notwithstanding that some of the latter feel they do not have a voice (personal communication, Sept. 2011). Current institutional arrangements considerably hinder the exchange of views and ideas between the DOLR and other bodies and the advisory role those bodies could play to support program implementation.

There is also no institutional mechanism that supports socially-sensitive feedback on field-level implementation: every piece of information transmitted from the State to the DOLR and to the National Level Steering Committee comes in a specific format, predefined by the NRAA/DOLR. Whereas norms are undoubtedly necessary for compiling and synthesizing information, other communication which leaves space to convey context-sensitive information, is also necessary for 'intelligent learning'. Yet the meetings of the National Level Steering Committee are driven by administrative objectives, dominated by the DOLR and do not provide a forum to share knowledge and experiences (interviews, May and Sept. 2011).

In sum, the set of discourses and institutions generated at the central level follows a technocratic approach, driven by the DOLR's capacity and by the current institutional arrangements that have been set-up to manage and supervise the program at the central level. After exploring the action arena at the central level, we examine how the types of discourse and rules so generated have been translated in Andhra Pradesh. We also consider the impact of different factors affecting decisions at the state level.

*From state to project level*

*Central guidelines: rules-in-use*

A driving factor in how incentives translate at the state level is the type of interaction between the DOLR and the states. Although much decision-making has been decentralized to the states, the DOLR controls the release of funds and, together with the NRAA, is responsible for policy change at the national level. Therefore, the DOLR holds considerable power and established the constraints around the implementation of IWMP by the states.

*Political-economic context*



Within this institutional framework, relationships between the DOLR and the states do, however, largely vary depending on the historical and political and economic context. In the case of Andhra Pradesh, the Department of Rural Development has developed a particular relationship with the DOLR thanks, in part, to the range of political-economic factors presented earlier. Compared with other states, the Department of Rural Development in AP has enjoyed more freedom to deviate and experiment, on the proviso that the DOLR's requirements regarding physical and financial progress are still met (interview government officer, June 2011). The Department of Rural Development has gained a degree of legitimacy through the leadership demonstrated in earlier WSD programs.

According to informants, this leadership has itself resulted partly from progressive individuals at the higher level of the state bureaucracy and privileged individual connections between the DOLR and Andhra Pradesh during earlier programs. The Andhra Pradesh government also differed from some other state governments by accepting the practice of channelling funds directly from the central government to the district agencies (interview government officer, June 2011).

The State level nodal agency initially requested that project implementing agencies prepare the DPRs in a relatively short time. However, when some NGOs explained the requirement for more time, the State level nodal agency considered their request positively. This outcome could be unique to Andhra Pradesh because of multiple interrelated factors. First, AP is characterized by a strong civil society with which the Department of Rural Development has developed good relations. Notably the experience with APRLP has left a legacy that has assisted on this front. Second, NGO respondents appreciated the capacity of the higher level officials from the Department of Rural Development and Commission of Rural Development to '*understand the situation*', and *the willingness to be 'solution oriented'* and hold '*certain values such as commitment*' (interviews June 2011). Thirdly, it is possible that the State level nodal agency in AP might feel less pressure from the DOLR to deliver the DPRs than other States. Again this is explained by preceding successes and thus emphasises the importance of context.

#### Important findings

The factors that have influenced the understanding and transposition of the DPR from the national Guidelines to the project level are likely to differ across states. Whereas the involvement of the civil society in the implementation of IWMP has had a significant influence on the project outcomes, it does not mean that every state should involve NGOs in program implementation. For instance, in some cases there might not be NGOs with sufficient capacity to implement the program, or NGOs might be subject to more political intervention than has been in the case explore here.

Institutional scholars have recently warned against the design and implementation of blueprints and institutional panaceas or "overly simplified institutional prescriptions" (Ostrom and Cox 2011). Similarly, the guidelines need to be adopted in a way that best fits a state's requirement, existing administrative strengths or weaknesses and the political, socio-economic and cultural context.

What is most remarkable in Andhra Pradesh's experience is probably that the state has treated the national watershed guidelines as an overarching framework which has subsequently been tailored to meeting the interests and demands specific to the State. Being innovative, however, might come to a cost, especially if innovation is not encouraged and acknowledged by centralized funders. Involving NGOs in WSD programs has also added a non-trivial administrative cost for the Department of Rural Development. There is also evidence that NGO project implementing agencies have overall failed to meet the physical and financial targets required by the DOLR. There have also been difficulties experienced in meeting the work activities as proposed in project DPRs. This arises from the coexistence and differences in distinct organizational norms in

NGOs and the bureaucracy, as was pointing out be one of the NGO project implementing agencies:

*“Our staff is working for five days a week whereas district agencies are working round the week, hence we are not able to submit required reports to them on time especially when asked during weekends”.*

NGOs also tend give more weight to processes and have to meet their own organizational targets regarding monitoring and evaluation. Third, the high staff turnover among NGO project implementing agencies has also adversely affected the progress of project implementation. Lastly, some NGOs are not well accepted by local communities, with concerns expressed about control over project implementation. Giving space to NGOs in the implementation of IWMP has therefore required extra efforts on the part of the Commissioner for Rural Development as well as a constant justification to the DOLR and high level state government officers on relatively slow administrative progress.

The need to understand institutional performance of WSD projects in a broader political, social, economic and environmental context has been underlined by a few scholars earlier (Baumann 1998; Baviskar 2004; Reddy, et al. 2009). This part of the project aimed at further contributing to this debate by unravelling the various factors and processes that create gaps between the national WSD Guidelines and local practices. This analysis has underlined the importance of the role of the central level organizations which are coordinating, monitoring and evaluating IWMP. It is important to understand that national level agencies must not only provide the right vision and incentives to the States, but also allow lower level decision making for program implementation. Devolution of decision making such that it acknowledges the different capacities of the States to implement programs and by rewarding efforts to innovate appeared as consistent themes in this analysis.

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## 8 Impacts

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### 8.1 Scientific impacts – now and in 5 years

There is mounting evidence of the importance of institutional analysis as a discrete research endeavour. Recent formal recognition of the seminal contributions of Ostrom, Williamson, Coase and others is illustrative of this trend. This study has provided the opportunity to reflect on the theoretical frameworks that can guide the development of institutions, such that they operate with lower transaction costs. One of the key outputs from the project has been a conceptual model that brings together strands of literature from New Institutional Economics and management theory of organizational design and governance.

Importantly, the survey items used to measure the constructs in this model have been verified by the empirical work that was undertaken for the lower-level institutional analysis. This is significant because there are relatively few published items for measuring the dimensions of institutions. Thus, it is now possible to deploy these items across different settings, or to use them as the starting point for reshaping surveys that examine institutional and governance structures. This will substantially reduce the cost of undertaking research work of this form in the future.

The scientific concepts that have been used to underpin this work have been presented at numerous forums attended by policy and administration practitioners. The aim of this approach has been to make the outputs grounded and to ensure that the usefulness of the work is not limited to academic research.

Several publications have resulted from the project and others are planned to follow. Some of these publications have appeared in high-impact journals, such as *Ecological Economics*, and another is currently under review for the *Journal of Hydrology*. The notoriety of these outlets bodes well in terms of the scientific impacts of the project over the next 5 years.

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### 8.2 Capacity impacts – now and in 5 years

The project has yielded benefits in developing an understanding of and capacity for building better institutions. This capacity is not limited to the government bodies involved in the work, such as the District Water Management Agency (DWMA), the State Level Nodal Agency (SLNA), and NRAA. Two doctoral students, a research associate, six student field investigators, a young faculty member, and a large number of other faculty members from agricultural universities throughout the country have gained exposure to the concepts and practices used in this research. For instance, lectures and presentations have been given at training programs for faculty members of agricultural universities at the Indian Agricultural Research Institute, New Delhi.

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### 8.3 Community impacts – now and in 5 years

A project of this form aims to influence the efficient delivery of an important government program, namely WSD. There is some evidence that the findings from this project are already gaining traction with various arms of government involved in WSD administration. If reforms are followed though we predict that there will be significant community gains via the improved efficacy of program delivery.

### 8.3.1 Economic impacts

Throughout this project there has been close collaboration and sharing of information with the Department of Rural Development in Andhra Pradesh. Accordingly, many of the findings pertaining to lower-level institutions have already been adopted within the new Integrated Watershed Management Program. This includes an emphasis on creating a separate Watershed Committee at the village level and attention to the involvement of NGOs. Increased support for including enterprise promotion and production enhancement activities has also emerged from this research project. Within DRD there is now a substantial recruitment effort for securing technically qualified personnel as project officers, which again has been supported and encouraged by the empirical work undertaken in this project. We anticipate that these initiatives will have an immediate impact on the efficacy of WSD delivery and thus give rise to substantial improvements in cost effectiveness.

We noted earlier that relatively conservative estimates based on earlier experience, suggest that farmer incomes in Andhra Pradesh could be raised by about Rs. 18200 million or US \$ 460 million annually as a result of improving the efficacy of WSD. We are thus confident that this project will have enduring impacts on the well-being of farmers in Andhra Pradesh.

Outside Andhra Pradesh the research team has maintained links with the National Rainfed Area Authority (NRAA) which formulates policies and guidelines for WSD at a national level. Researchers have also participated and contributed to national meetings organized by the NRAA. The upshot is that the basic messages from this project about measures to improve program delivery are now embedded in the refinements that are occurring to WSD at the national level. We expect these changes to improve WSD at a national scale over the next 5 years.

### 8.3.2 Social impacts

WSD in its most recent form has the potential to significantly improve conditions for some of the most disadvantaged groups in rural India. One of the important contributions from this project has been the ability to empirically verify the overall success of WSD and to demonstrate the distribution of benefits under different manifestations of the program. As we noted in section 7 and as shown in Table 15, some institutional arrangements for WSD are better suited to delivering positive outcomes for the poor, landless and women. In particular we found strong evidence of the benefits of the APRLP approach for these cohorts. Encouragingly, some of the elements of APRLP have been transposed into the new national guidelines and the empirical data assembled for this project has assisted in progressing that approach. The flow-on effects for the poor, the landless and other disadvantaged groups are presently occurring and should become even more evident in the next 5 years.

### 8.3.3 Environmental impacts

The analysis undertaken in this project has also highlighted the governance arrangements within WSD that offer the greatest prospect of delivering positive outcomes on the environmental front. More specifically we found that the DPAP version of WSD programs offered most promise for improved environmental management and that this approach to WSD was reliant on adequate technical capacity, amongst others. We have noted above that the DRP in Andhra Pradesh has already commenced a recruitment program to garner additional technical expertise within WSD at the project level. Given the relationships identified by this research we are confident that there will be gains on the environmental front as WSD becomes increasingly influenced by these personnel.

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## 8.4 Communication and dissemination activities

Since its inception this project has been conducted with close communication between representatives of the Government of Andhra Pradesh and the research team. There have been formalised processes to ensure that the communication links were not impacted by potential changes to personnel, although the less formal processes for communication have worked well and been a hallmark of this project. Some of these informal communication and dissemination activities were described in section 5 and included regular meetings between government officials and the research team, involvement of both groups in the selection of case study sites, joint participation in field visits and informal feedback on results.

Formal communication and dissemination included:

- Major workshops in India attended by the Australian research team and representatives of Australian state government agencies in May 2009; November-December 2010; February 2011; February 2013.
- Presentations at national conferences and symposiums in Australia attended by the Indian researchers and government representatives from Andhra Pradesh and the national level in February-March 2010; June-July 2012; February 2012; April 2013.

In addition to conference papers, symposium contributions and workshop presentations the project resulted in several working paper, book chapters and journal articles listed in section 10. Some technical elements of the finalised modelling work are presently being subjected to additional peer-review. Once complete, the intention is to simplify the messages from the work and make them accessible to wider audiences. This includes making the work accessible from websites and publication in outlets regularly sourced by policy makers. This is expected to be achieved by November 2013, given the time taken to receive reviews via scholarly outlets.

One major achievement of the project was the ability to engage with influential administrators and policy makers. The visit to Australia by the Principal Secretary for Rural Development in Andhra Pradesh and his colleagues, along with the contribution of the Deputy Director General (NRM), Indian Council of Agricultural Research, is illustrative of the achievements on this front. In addition it is worth noting that Mr Reddy Subrahmanyam is scheduled to be appointed as Joint Secretary for Rural Development for the Government of India later in 2013. This provides an exciting opportunity to leverage the findings from this work and deepen the relationship between ACIAR projects and the Government of India.

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## 9 Conclusions and recommendations

The project has been a success. WSD in Andhra Pradesh is a substantial program and the findings from this work are applicable more broadly. Institutional analysis has been applied in an important area of policy and one where substantial funds are presently committed. Improvements in the efficacy of WSD programs have already started to emerge from this work and more should follow. The training and experience gained in earlier ACIAR work along these lines has been reinforced and good quality publications have been prepared and there will be more to come. The policy implications of the project will further strengthen local WSD institutions. As noted earlier, reforms have already been adopted in Andhra Pradesh to build additional local capacity to support WSD. At the national level there is also potential to use this work to shape a reform agenda with local champions of this work holding influence over the future direction of WSD.

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### 9.1 Conclusions

This project was effectively about two separate sorts of questions. Whether new institutional economics and organisational theories used in the management sciences could be used to analyse institutions in WSD? This has proven to be the case.

Also, was WSD successful in achieving its objectives, technical and distributional? This again has proven to be the case and areas for further refinements have been identified. Consequently, the project has made contributions in development economics and the literature in management economics.

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### 9.2 Recommendations

There are no plans for the ACIAR component of this research to continue, although a sister project dealing with WSD in Andhra Pradesh is yet to be finalised. The findings from this project have been well-received by the Indian officials involved and the good-will developed by this project will ideally be leveraged into the other WSD studies.

The research team has sufficient working capital to continue to collaborate in the medium term. This will deliver additional publications and a series of more accessible works and thus support other WSD projects by ACIAR. We thus recommend that ACIAR encourage the continuation of that collaboration.

Whilst the carriage of the policy conclusions rests in Indian hands, this project has forged valuable links with key personnel. The empirical work that clearly points to the need to combine the technical expertise that resides in government with the interactive and less formal approaches to WSD by NGOs has resonated with influential decision makers. We recommend that this be pursued to ensure better technical rationality and improved equity impacts.

Overall, WSD is now proving relatively successful in Andhra Pradesh but the performance in other states is less impressive. The links established by this project should be used to assist in promoting institutional changes in states that are lagging behind Andhra Pradesh. In this context Indian officials at the national level have expressed enthusiasm for ongoing collaboration between ACIAR and the research team. The aim is to improve the outcomes of WSD in states outside Andhra Pradesh, especially in east India. We would welcome and encourage further dialogue on potential follow-up work in east India. Similarly, we would recommend and support a follow-up study in 3 years to establish the extent to which the findings from this research have left an enduring mark on policy and practice.

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## 10 References

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### 10.1 References cited in report

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

Baumann, P (1998): "Panchayati Raj and Watershed Management in India: Constraints and opportunities" (London: Overseas Development Institute (ODI))

Baviskar, A (2004): "Between Micro-Politics and Administrative Imperatives: Decentralisation and the Watershed Mission in Madhya Pradesh, India", *European Journal of Development Research* 16(1): 26-40.

Clement, F (2010): "Analysing Decentralised Natural Resource Governance: Proposition for a "politicised" IAD framework", *Policy Sciences* 43(2): 129-156.

Clement, F and J M Amezaga (2013): "Conceptualising Context in Institutional Reforms of Land and Natural Resource Management: The case of Vietnam", *International Journal of the Commons* 7(1): 140-163.

Cruse, 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.

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

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.

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

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.

Hajer, M J (1995). *The Politics of Environmental Discourse: Ecological modernization and the policy process* (Oxford, UK: Oxford University Press).

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

Kiser, L and E Ostrom (1982): "The Three Words of Action: A metatheoretical synthesis of institutional approaches" in E Ostrom (ed) *Strategies of Political Inquiry* (Beverly Hills (CA), Sage): 179-222.

Manor, J (2007): "Successful Governance Reforms in Two Indian States: Karnataka and Andhra Pradesh", *Commonwealth and Comparative Politics* 45(4): 425-451.

Mosse, D (2005): *Cultivating Development. An ethnography of aid policy and practice* (New Delhi, Vistaar Publications).

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

- 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.
- Nystrom, Paul C. and Starbuck, William H. (Ed), (1981). "Handbook of Organizational Design", Oxford University Press.
- Ostrom, Elinor (1992). *Crafting Institutions for Self-Governing Irrigation Systems*, ICS Pres, San Francisco.
- Ostrom, E (1999): "Institutional Rational Choice. An assessment of the institutional analysis and development framework" in P A Sabatier (ed) *Theories of the Policy Process* (Boulder, Colorado: Westview Press) 35-71.
- Ostrom, E and M Cox (2011): "Moving beyond Panaceas: A multitiered Diagnostic Approach for Social-Ecological Analysis", *Environmental Conservation* 37(4): 451-463.
- Ostrom, E, R Gardner, and J Walker (1994): *Rules, Games & Common-Pool Resources* (Ann Rao, B (2004): "Book Review: Andhra Pradesh Development: Economic Reforms and Challenges Ahead", *South Asia Economic Journal* 5(2): 344-348.
- 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
- Reddy, V R, Y V Malla Reddy, J Soussan and D Frans (2004): "Water and Poverty: A Case of Watershed Development in Andhra Pradesh, India", *Water Nepal* 11(1): 51-73.
- Reddy, V R, M G Reddy and J Soussan (2009): *Political Economy of Watershed Management. Policies, institutions, implementation and livelihoods* (Hyderabad: Rawat Publications).
- Venot, J-P and F Clement (in press): "Justice in development? An analysis of water interventions in the rural South." *Natural Resources Forum*, <http://dx.doi.org/10.1111/1477-8947.12002>

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## 10.2 List of publications produced by project

### Books

Gandhi, Vasant P. and N.V. Namboodiri (2011), "Improving Irrigation Management in India: A Study of Participatory Irrigation Management in the States of Andhra Pradesh, Gujarat and Maharashtra", Indian Institute of Management, Ahmedabad, Allied Publishers: New Delhi

### Chapters in Books

Ananda, J. 2012. Institutional Design Perspective, Capacity Constraints and Participatory Irrigation Management, In Prakash, A., Singh, S., Goodrich, C.G. and Janakarajan, S. (eds.) *Water Resources Policies in South Asia*, New Delhi: Routledge India, pp. 99-115.

Ananda, J. 2012. Watershed Development, Decentralization and Institutional Competition, In Herath, G (ed.) *Institutional Aspects of Water Management*, New York: Nova Science Publishers, pp. 93-108.

Ananda, J. 2013. Watershed Development, Decentralisation and Institutional Change: Insights from the Mechanism Design Theory, In: R. Muradian and L. Rival (eds.) *Governing the Provision of Environmental Services*, Studies in Ecological Economics, Vol. 4, Springer, pp.135-149



Bhamoriya, Vaibhav and Vasant P. Gandhi (2011), "Water Management Institutions for Enhancing Water and Food Security: Designing for Better Adaptiveness", in "India Infrastructure Report 2011", Oxford University Press, New Delhi.

O'Keefe, S. And Crase, L. "New Institutions in Australian Water Management: How the Environmental Water Reserve Changes the Game "in Gamini Herath ed., *Institutional Aspects of Water Management: Evaluating the Experience*, Nova Science Publishers: New York, pp 215-240.

Gandhi Vasant P. and Vaibhav Bhamoriya (2011), "Groundwater Irrigation in India: Growth, Challenges and Risks", in "India Infrastructure Report 2011", Oxford University Press, New Delhi.

Gandhi Vasant P. and Vaibhav Bhamoriya (2011), "Rainwater Harvesting for Irrigation in India: Potential, Action and Performance", in "India Infrastructure Report 2011", Oxford University Press, New Delhi.

Gandhi, V. P. (2011), "Reforming Institutions in Natural Resource Management" in Suresh, Pal (ed.) *Agriculture for Inclusive Growth* Indian Agricultural Research Institute, New Delhi.

Gandhi, Vasant P. 2012, "Participatory Irrigation Management in India (Andhra Pradesh, Gujarat and Maharashtra)", in Gamini Herath ed., *Institutional Aspects of Water Management: Evaluating the Experience*, Nova Science Publishers: New York, pp 215-240.

### **Papers in Peer Reviewed Journals**

Ananda, J. and Proctor, W. 2013. 'Collaborative Approaches to Water Management and Planning: An Institutional Perspective' *Ecological Economics* 86: 97-106.

Cruse, L., 2012 "The Murray-Darling Basin Plan – An Adaptive Response to Ongoing Challenges?", *Economic Papers*, Vol 31, No 3, pp. 318-326.

Cruse, L. & O'Keefe, S. 2012, "Water Economics: Getting the Local Questions Right", *Public Policy*, Special Issue: Local Government and Regional Governance in Australia: History, Theory and Policy, Vol 7, No 1, pp 97-106.

Cruse, L., O'Keefe, S. & Kinoshota, Y. (Forthcoming) "Enhancing Agri-Environmental Outcomes: Market-Based Approaches to Water in Australia's Murray-Darling Basin", *Water Resources Research*.

Cruse, L., 2012, "How holistic should economic measurement be? A cautionary note on valuing ecosystem services as part of the Murray-Darling Basin Plan", *Economic Papers*. Vol. 31, No 2, pp. 182-191.

Cruse, L., O'Keefe, S. & Dollery, B. 2012, "Presumptions of Linearity and Faith in the Power of Centralised Decision-Making: Two Challenges to the Efficient Management of Environmental Water in Australia", *Australian Journal of Agricultural and Resource Economics*, Vol 56, No 3 pp. 426-437.

Cruse, L., O'Keefe, S. & Dollery, B. 2011, "Some Observations about the Reactionary Rhetoric Circumscribing the Guide to the Murray-Darling Basin Plan", *Economic Papers*, Vol. 30, No 2, pp. 195-207.

Cruse, L. & Gawne, B. 2011, "Coarse-Coloured Glasses and Rights Bundling: Why the initial specification of water rights in volumetric terms matters", *Economic Papers*, Vol. 30, No 2, pp. 135-146.

Cruse, L, Dollery, B. & O'Keefe, S. 2011, "Managing Environmental Water: Lessons in crafting efficient governance arrangements", *Economic Papers*, Vol. 30, No 2, pp. 122-134.

Cruse, L. 2011, "The Fallout to the Guide to the Proposed Basin Plan", *Australian Journal of Public Administration*, Vol. 70, No 1, pp. 84-93.

Cruse, L. 2010, "A Cautionary Note on the Use of Socio-Economic Analyses in Water Planning", *Economic Papers*, Vol. 29, No. 1, pp. 41-47

Gandhi, Vasant P. and Varsha Khandker 2012, "Frontier Technologies in Agriculture - Biotechnology: The Promise and Performance of Bt Cotton in India" (Summary), *Indian Journal of Agricultural Economics*, Vol.67, No.3, July-Sept, 2012.

### **Seminars and Presentations**

Bhamoriya, Vaibhav and Vasant P. Gandhi 2013, "Lessons from the case studies", Presentation at the ACIAR Project Workshop on "Enhancing Institutional Performance in Watershed Management in Andhra Pradesh, India" February 19, 2013, Andhra Pradesh Academy of Rural Development (APARD), Hyderabad.

Bhamoriya, Vaibhav and Vasant P. Gandhi 2013, "Structural equation modeling", Presentation at the ACIAR Project Workshop on "Enhancing Institutional Performance in Watershed Management in Andhra Pradesh, India" February 19, 2013, Andhra Pradesh Academy of Rural Development (APARD), Hyderabad.

Clement, Floriane 2013 "Higher Level Institutions", Presentation at the ACIAR Project Workshop on "Enhancing Institutional Performance in Watershed Management in Andhra Pradesh, India" February 19, 2013, Andhra Pradesh Academy of Rural Development (APARD), Hyderabad.

Cruse, Lin and Vasant P. Gandhi 2013, "Theoretical foundations and research methodology of the project", Presentation at the ACIAR Project Workshop on "Enhancing Institutional Performance in Watershed Management in Andhra Pradesh, India" February 19, 2013, Andhra Pradesh Academy of Rural Development (APARD), Hyderabad.

Gandhi, Vasant P. 2012, "Designing Effective Institutions for Managing Natural Resources", Seminar at the School of Business, James Cook University, Townsville, Australia, June 8.

Gandhi, Vasant P. 2013, "Determinants of Institutional Performance in Watershed Management", Presentation at the Indo-Australia Workshop on "Utilization of leading edge ICT to enhance Australian and Indian groundwater and land resources under climate change scenarios", January 21-24 2013, at the International Water Management Institute, ICRISAT, Hyderabad.

Suvarna C and Vasant P. Gandhi 2013, "Welcome and Workshop Outline", Presentation at the ACIAR Project Workshop on "Enhancing Institutional Performance in Watershed Management in Andhra Pradesh, India" February 19, 2013, Andhra Pradesh Academy of Rural Development (APARD), Hyderabad.

Gandhi, Vasant P. 2013, "Conceptual framework and survey plan", Presentation at the ACIAR Project Workshop on "Enhancing Institutional Performance in Watershed Management in Andhra Pradesh, India" February 19, 2013, Andhra Pradesh Academy of Rural Development (APARD), Hyderabad.

Gandhi, Vasant P. 2013, "Empirical findings: Performance & impact, determinants & behavior", Presentation at the ACIAR Project Workshop on "Enhancing Institutional

Performance in Watershed Management in Andhra Pradesh, India” February 19, 2013, Andhra Pradesh Academy of Rural Development (APARD), Hyderabad.

Gandhi, Vasant P. 2013, “Improving Institutions in Natural Resource Management: Study of Water and Watershed Institutions in India”, Presentation at the “National Workshop on Water Science and Policy for Sustainable Development”, National Institute of Ecology (NIE), Raipur, March 22-23, 2013.

Gandhi, Vasant P. 2013, “Introduction and Background to the Project”, Presentation at the workshop meeting of the ACIAR Project LWR/2006/158 – Enhancing institutional performance in watershed management in Andhra Pradesh, Australian Centre for International Agricultural Research (ACIAR), ACIAR House, Canberra, Australia, April 22, 2013.

Gandhi, Vasant P. 2013, “Research Methodology, Conceptual Framework, Survey and Key Findings”, Presentation at the workshop meeting of the ACIAR Project LWR/2006/158 – Enhancing institutional performance in watershed management in Andhra Pradesh, Australian Centre for International Agricultural Research (ACIAR), ACIAR House, Canberra, Australia, April 22, 2013.

Jain, Dinesh and Vasant P. Gandhi 2013, “Institutional interaction” Presentation at the ACIAR Project Workshop on “Enhancing Institutional Performance in Watershed Management in Andhra Pradesh, India” February 19, 2013, Andhra Pradesh Academy of Rural Development (APARD), Hyderabad.

Philip, Anil and Floriane Clement 2013, “Perceptions of IWMP-Results from the Survey”, Presentation at the ACIAR Project Workshop on “Enhancing Institutional Performance in Watershed Management in Andhra Pradesh, India” February 19, 2013, Andhra Pradesh Academy of Rural Development (APARD), Hyderabad

Philip, Anil and Floriane Clement 2013, “Perception Based Analysis of Watershed Guidelines”, Presentation at the workshop meeting of the ACIAR Project LWR/2006/158 – Enhancing institutional performance in watershed management in Andhra Pradesh, Australian Centre for International Agricultural Research (ACIAR), ACIAR House, Canberra, Australia, April 22, 2013.

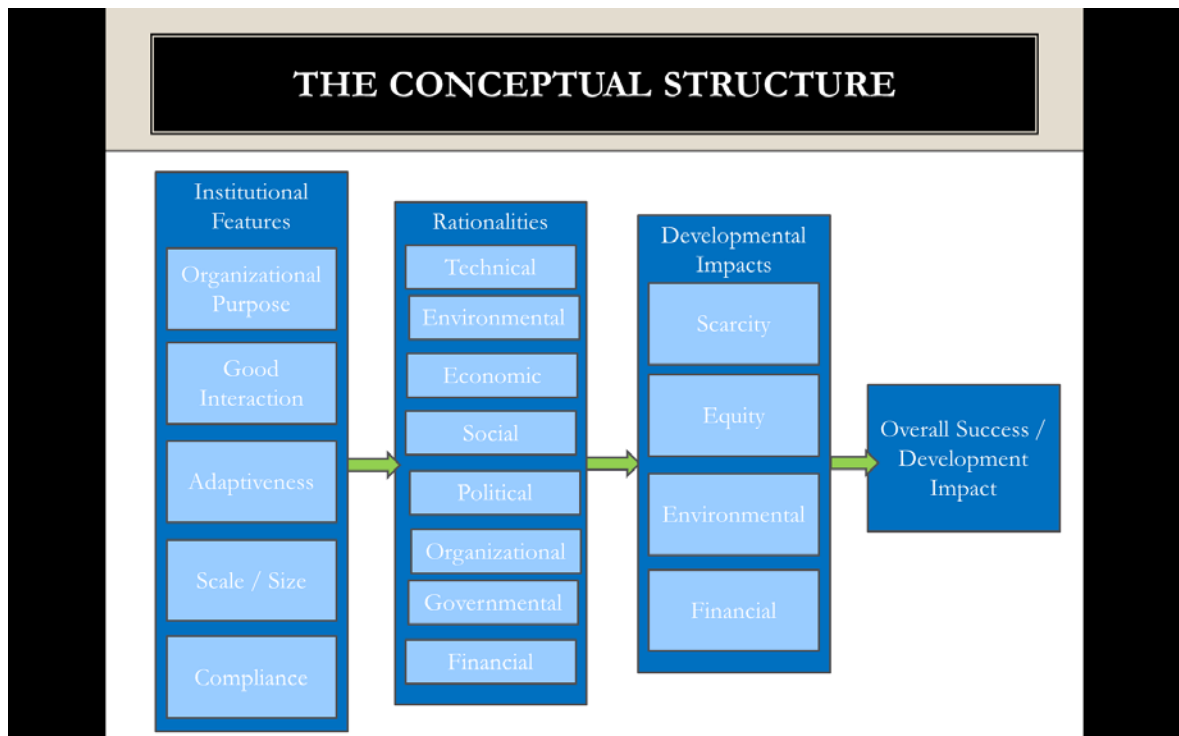
## 11 Appendixes

### 11.1 Appendix 1: Structural Equation Modelling

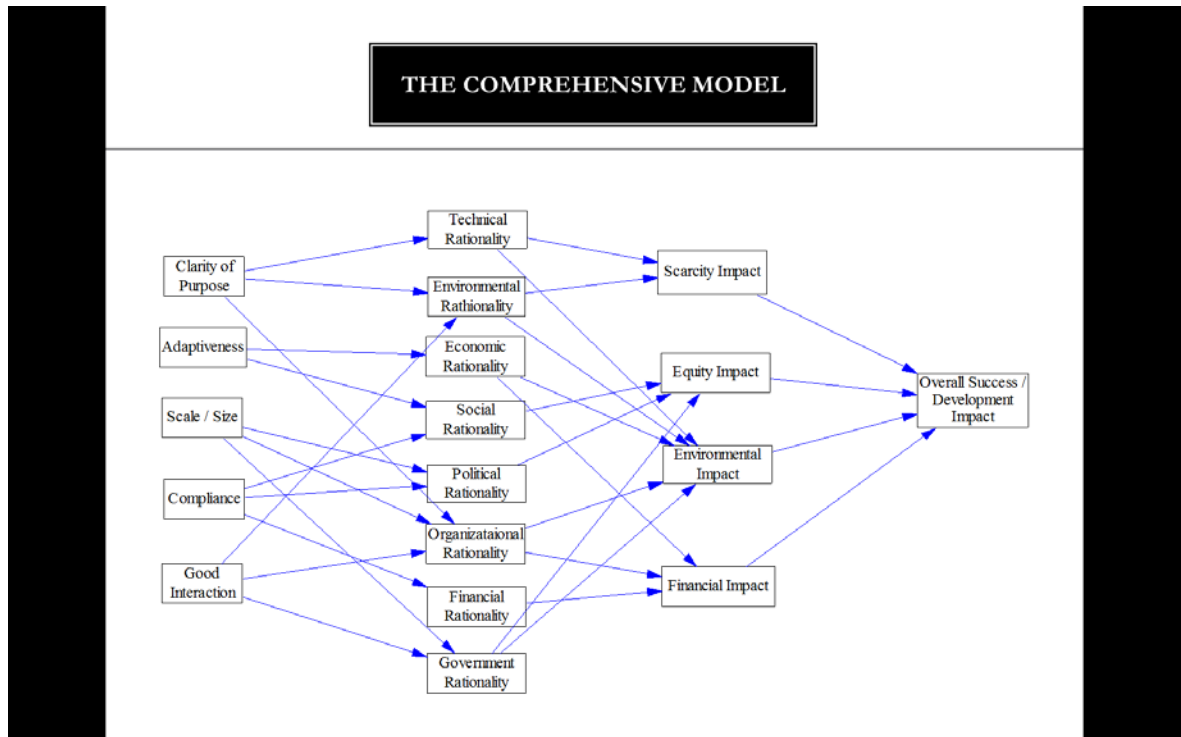
The empirical data on lower-level institutions has hitherto been interrogated using TOBIT regression techniques. One of the limitations with this approach is its capacity to deal with multi-collinearity. Multi-collinearity problems arise when the regression approach assumes that each variable impacting on the performance of a WSD program relatively independently. For example, this approach requires that the impacts of technical rationality are separable from organisational rationality, or the underlying institutional structure.

An alternative approach that is somewhat less constrained is known as Structural Equation Modelling (SEM). SEM allows the researcher to explore alternative 'pathways' that lead to improved performance. For example, under SEM it might be that a particular institutional characteristic (e.g. clear objectives) influences an element of rationality (e.g. organisational rationality) and this, in turn, impacts on performance.

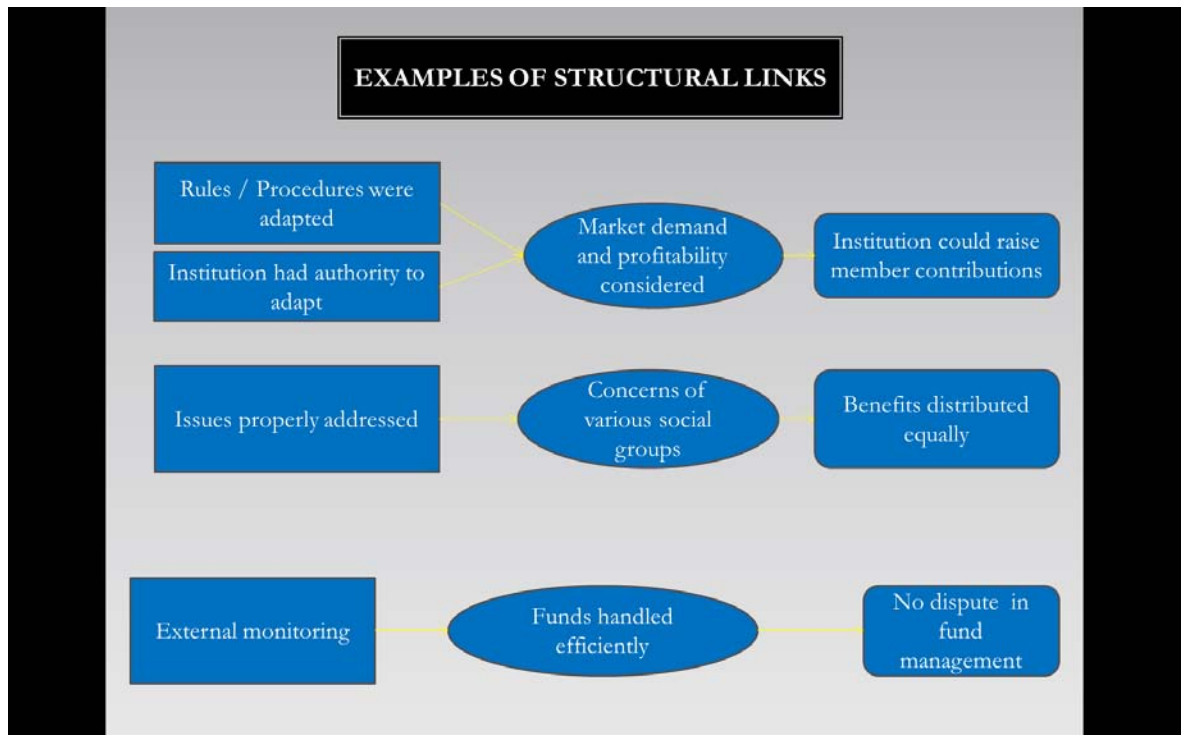
An illustration of one conceptual approach to this issue appears below:



The research team is continuing to explore the data collected for this project using this approach. This work is beyond the original project brief but likely to yield useful scientific outputs. Illustrative of the complexity of this approach is the comprehensive model represented below:



Illustrated below is an example of specific structural links that can be empirically investigated with this approach.



Results for this work are to be published, with acknowledgement of ACIAR support, in the coming months.