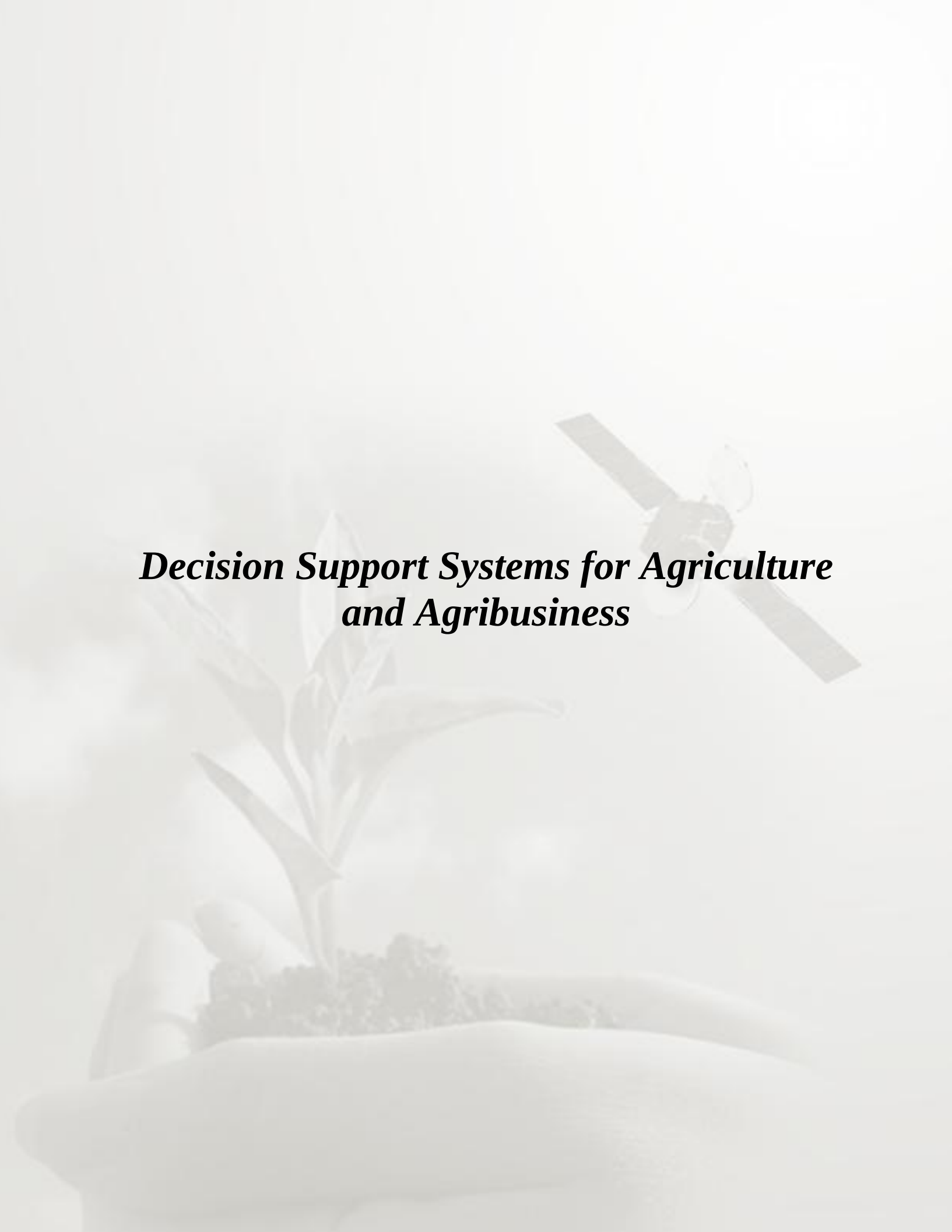

Decision Support Systems for Agriculture and Agribusiness

Management Information System for Watershed Development Programmes in India

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Abstract - Improving productivity and incomes in rainfed areas is a major challenge in India and many other parts of the world. A key to achieving this is improving the use of natural resources, particularly land and water which are major constraints in these areas. A major initiative through which this is pursued is watershed development (WSD) programmes which have been taken up under different schemes of the Government of India and the state governments. Since poverty is particularly acute in the rainfed areas, large expenditures are being made on WSD programmes. WSD programmes have gone beyond natural resource management to include production enhancement and enterprise promotion activities in the recent years. A complex institutional hierarchy of government and other agencies is involved in the planning and implementation of WSD programmes. However, WSD projects often have unsatisfactory outcomes and often fall short of their objectives. In numerous cases this has been found to be due to weak institutional arrangements including weak linkages among institutional structures and operational systems leading to high transaction costs, poor participation and poor decision-making. A major reason behind this is poor information flows. The paper develops the design of an effective management information system to improve the performance of WSD programmes. This requires the identification of institutional performance indicators to address the objectives and strategy of WSD programmes. Based on these, elements of a specific information system are outlined which would directly help in more effective problem identification and decision-making. Computers and internet would play a major role and the information system could help enhance the performance of WSD programmes.

Keywords: Natural Resources, water, information System

I. INTRODUCTION: WATERSHED DEVELOPMENT PROGRAMMES IN INDIA

Improving productivity and incomes in rainfed areas is a major challenge in India. A key to achieving this is improving the use of natural resources – particularly land and water which are major constraints in these areas. A major initiative through which this is pursued in India is Watershed Development (WSD) programs which have been taken up under different schemes of the Government of India and the state governments. Since over 60-70 per cent of the country's population relies on agriculture, directly or indirectly, for income and employment, including the majority of the poor, and since poverty is particularly acute in the rainfed areas, very large expenditures are being made on WSD programs. Watershed development is also seen as an important measure for mitigating drought impact and reducing vulnerability of the large poor populations in the dry regions.

A watershed is considered, in principle, a geo-hydrological unit or an area that drains to a common point. Practical definitions have varied over the years but for government project purposes a watershed has been typically identified as an area of approximate 500 hectares in a village. In watershed development programs, given the objective of improving land and water management, scientists and engineers have developed a variety of technologies which offer solutions to difficult watershed conditions. The solutions include interventions ranging from simple check-dams to large percolation and irrigation tanks, from vegetative barriers to contour bunds, and changes in agricultural practice e.g. in-situ soil and moisture conservation, agro-forestry, pasture development, horticulture and silvipasture. A hierarchy of complex institutional arrangements of the government and other agencies undertakes the planning and implementation of WSD, see Figure 1. At the micro level, a project implementation agency is usually designated and it may handle one or more watersheds, see

Figure 2. A major institutional constraint facing the adoption and impact of WSD is the difficulty of moving from the state delivery of watershed infrastructure/ technologies to community management and ownership. The current system frequently involves state funding and implementation of WSD activities and then simply withdrawing, and leaving assets, structures and initiatives to be managed by communities. Some models of devolution have emerged but substantial challenges remain. In many cases there is no mechanism for formalising rules for the community management of WSD once the state withdraws.

Andhra Pradesh, the focus area of the study, is the largest state in the southern plateau region of India and since it is over 50 percent rainfed, it provides a very good setting for WSD work. There have been many water and land management initiatives in the state. Andhra Pradesh has the highest number of watershed projects among the states in the country (over 9000), which are at different stages of implementation. WSD projects have been taken up in Andhra Pradesh through various programmes/ schemes primarily supported by the Government of India in cooperation with state governments. These include the Drought Prone Area Programme (DPAP), the Desert Development Programme (DDP), the Integrated Wasteland Development Projects scheme (IWDP) (under the Dept. of Wastelands Development, Ministry of Rural Development), and the National Watershed Development Programme in Rainfed Area (NWDP) (Ministry of Agriculture). In addition, Andhra Pradesh also had WSD projects under the Andhra Pradesh Rural Livelihoods Project (APRLP). While these programmes/ schemes differ somewhat, the common aim has been to improve land and water resource management for sustainable production and incomes in the rural areas by focusing on activities within a defined watershed. Initially, the WSD included only natural resource management (NRM) activities, but later for increasing and widening the impact, following various evaluations and reviews, they have come to include production enhancement (PE) activities, and enterprise promotion (EP) activities in many areas/ states. The older projects did not have these components. The planning and implementation has been structured through different guidelines and institutional frameworks which have evolved through experience and reviews, and these have changed nationally and in the states over the years.

The community based management of natural resources framework in watershed programs was accepted in 1994 after the Hanumatha Rao Committee report. Andhra Pradesh which has led the country in terms of the number of watershed development projects has also been at the forefront of the approach of strengthening of participatory processes in watershed development.

Watershed development projects in Andhra Pradesh have been implemented under many different guidelines/ programmes including DPAP, APRLP and Hariyali. Under the Hariyali guidelines, the local self government body of the Village Panchayat (Gram Panchayat) is the implementing agency at the village level. The natural resource management (NRM) activities are implemented directly by the Village Panchayat, and the production enhancement (PE) and enterprise promotion (EP) activities are implemented through the Village Organization (VO) which is a collective of the village's self help groups (SHGs).

II. APPLICATION OF NEW INSTITUTIONAL ECONOMICS AND GOVERNANCE CONCEPTS

According to North 1997, institutions are of great importance in economic development and the two major objectives that they achieve are reducing transaction costs and promoting cooperative solutions in which collective learning is effectively used. Economic activities have two major kinds of costs, namely transformation costs and transaction costs. Typically the focus is on transformation costs, and transaction costs are ignored. However, transaction costs are often very large and seriously reduced the performance of economic activities. Good institutions result in substantially lower transaction costs and as a result greatly improved performance.

In the context of watershed development, diverse kinds of economic activities are involved including creation of natural resource management structures, promotion of water and soil conservation, planting of water saving high value crops, devices for efficient use of water and the promotion of livelihood enhancing activities for the landless. In each of these

activities, apart from material and financial inputs, a substantial amount of human interaction is involved. This includes structures, processes and governance in formal and informal institutions. A good institutional framework becomes very important for reducing transaction costs and promoting cooperative solutions. Without this the outcomes are poor and the benefits are not durable. Thus the application of new institutional economics fundamentals would be very important in the study and design of watershed development programmes.

Experience of watershed development in Andhra Pradesh seen in the case studies, and theories of good governance seem to show that watershed development institutions must address the following kinds of rationalities:

- Technical & Economic Rationality
- Social Rationality
- Organizational & Financial Rationality
- Political Rationality
- Government Rationality

A. Technical & Economic Rationality

Technical Rationality deals with technical efficiency. Good institutions are able to achieve efficient conversion of inputs into outputs. This requires the use of good and appropriate technology and operational procedures which lead to high productive efficiency. The achievement of technical rationality often requires involvement of technically skilled people from the necessary disciplines. Without technical rationality the inputs and resources used are not converted to benefits in line with the possible potential.

B. Social Rationality

In the rural setting where much of the watershed development activities take place, a large number of social groups usually exist. This may be caste groups, tribes, farmers of different sizes and the landless, different professions, men-women and more. The watersheds may cover lands belonging to different social groups and also the activities and outcomes of watershed development may affect various social groups differently. Achieving the acceptance and cooperation from different social groups usually becomes necessary for effective implementation of watershed projects. In the absence of this, difficulties arise and performance and equitable distribution suffer.

C. Organizational & Financial Rationality

Organizational Rationality deals with the problem of coordination. Specialization and division of labour which are necessary for efficiency lead to the creation of a large number of separate activities and functions. The effective coordination across these activities becomes crucial for the overall performance. This often requires supervisory and managerial skills. Discipline in the use of the project finances is also very important. In the absence of these, individual activities or functions may perform well but overall performance is affected due to lack of congruence, discipline and dove-tailing.

D. Political Rationality

Political Rationality deals with the concept of justice. Most large activities require substantial human involvement and people interaction. In this setting, perceptions and issues of fairness and justice become very important for smooth and sustainable functioning. This requires the formulation of acceptable rules and their implementation with the settlement of any disputes that may arise. It may require the balancing of different needs and concerns. In the absence of this, the contribution and cooperation required from the participants becomes difficult to sustain.

E. Government Rationality

The financial resources required for watershed development largely come from government sources. These depend on the guidelines and policies, and appropriate, adequate and timely availability of the resources depend significantly on government bureaucratic structures and procedures. The release of these resources also depends substantially on the knowledge, skills and initiative of the concerned government functionaries in negotiating the structures and procedures of the government. In the absence of this, resources do not flow when, where and to the extent required, resulting in poor performance and outcomes. The incorporation of these aspects through knowledge, leadership and commitment becomes of great importance.

III. INFORMATION SYSTEMS - CONCEPTUAL APPROACH

The approach for designing a good market or technology information system for farmers can follow the conceptual methodology for designing a modern management information systems for an organization. To bring out the historical contrast, in the old systems, information was a by-product of the operations and events, and was generated and transmitted routinely or randomly, producing benefits only by chance. Under the modern approach for designing information systems, the crux is the identification of key tasks that need to be undertaken given the strategy and objectives of the organization. This is followed by the identification of key decisions that need to be made for successfully performing these tasks. Next is the identification of key information requirements for effectively making these key decisions. A tailor-made information system is then designed which squarely addresses the information needs of the key decisions and tasks. The result is an information system which is focused and which directly contributes to better decision-making and performance (Laudon and Laudon 2002, Zani 1970, Gandhi 2004).

The revolution in information technology is creating enormous stress in traditional organizations. As information volume grows exponentially, and as its useful life shortens, organizations are being challenged to learn faster. This means absorbing more information, making sense of it quickly, and sharing new insights so that decision-makers can act well and in time. Information needs to be acquired, given meaning through interpretation, and then either acted upon immediately or properly stored in memory for later use, see Figure 3 (Day and Glazer 1994). The process is initiated by the acquisition of information through field sourcing, scanning, internet, experimentation, and market inquiries. The extent of learning depends on how well the information is pieced together and how widely it is distributed so that it can be used. Before the information can be acted upon, it has to be interpreted to reveal meaningful patterns and relationships, so as to be able to facilitate decision-making.

IV. INFORMATION SYSTEM DESIGN AND FEATURES

An internet enabled information system is described. As indicated in the conceptual framework, information must be useful for decision-making and therefore it is important to identify performance parameters and major decisions and where they need to be made. A centralized information system is proposed consistent with the leading role played by the government, the extensive involvement of the govt. staff in implementation and handling of information, as well as the nature of the information. The information would be collected from the grass-roots level through the internet or through formats to cover the kind of detail required. This would include financial, physical and qualitative information, see Table 1 and 2. It would be compiled at the District Water Management Agency (DWMA) for the district level, and the Office of the Commissioner of Rural Development at the state level. The collected information would be processed using computers and specially developed programs. This will then be disseminated through the internet, formats and reports appropriately across the institutional setup to help effective monitoring, review and decision-making.

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Table 1: Format on Targets and Achievements - Quarterly
(To be prepared for each Watershed, Mandal, Cluster, District, and for State)

		Physical Units		Financial Units	
		Target	Actual	Budget	Actual
1	Sunken Pits				
2	Loose Boulder Structures (LBS)				
3	Rock Fill Dams (RFD)				
4	Dug-out Ponds				
5	Mini Percolation Tank (MPT)				
6	Percolation Tank (PT)				
7	Check Dams (CD)				
9	Improvement to RWS				
11	Repairs to Bushana Katla				
14	Construction of percolation pond				
15	Farm Ponds				
16	Improvements to Kummara Kunta				
17	Construction of mini percolation pond				
18	Establishment of vermi compost units				
19	Raising of Avenue Plantation				
20	Raising of Dryland Horticulture				
21	Raising of Block plantation				
22	Production Enhancement				
23	Enterprise Promotion				

Table 2: Format for collecting information for performance on rationalities
(Use the rating scale below to answer these questions)

Strongly Agree (Yes)	Agree (Yes)	Partially Agree / Disagree	Disagree (No)	Strongly Disagree (No)
5	**4**	**3**	**2**	**1**

	5	**4**	**3**	**2**	**1**
Technical & Economic Rationality					
Location of structures such as check dams, percolation tanks and gully control has been done with technical expertise.					
Location of contour bunds, agro forestry, and other conservation measures has been done with technical expertise.					
Constructions/creation of structures such as check dams, percolation tanks and gully control has been done with technical expertise.					
Constructions/creation of contour bunds, agro forestry, and other conservation measures has been done with technical expertise.					
Technical experts from the government/NGOs played a major role in natural resource management activities.					
Natural resource management activities were not heavily influenced by village, political and social pressures.					
The NRM measures are greatly helping water conservation.					
The NRM measures are greatly helping soil conservation.					
The decisions on crops and varieties to plant were taken with technical expertise.					
The NRM activities have been so selected that they would have the best economic impact.					
The production enhancement activities have been so selected that they would have the best economic impact.					
The enterprise promotion activities have been so selected that they would have the best					

economic impact.					
There is adequate market for the new and increased production emerging from WSD activities.					
Adequate marketing arrangements have been made for the increased production from WSD activities.					
The prices and profitability is good for the additional production arising from WSD activities.					
The decisions on irrigation technology were done with technical expertise.					
Social Rationality					
The kind of NRM activities were determined with participation of all social groups.					
The location of NRM activities were determined with participation of all social groups.					
The production enhancement activities were decided with participation of all social groups.					
The enterprise promotion activities were determined with participation of all social groups.					
Small and marginal farmers have benefited from WSD activities.					
The landless households have benefited from WSD activities.					
The women have benefited from WSD activities.					
The WSD activities have taken the beliefs and customs of various social and religious groups into account.					
Political Rationality					
Various village leaders were involved at the start of the WSD activities.					
Various village leaders were involved in the implementation of WSD activities.					
WSD leaders were able to balance the pressures from various village powers and groups.					
WSD leaders were able to take the needs and interests of various village groups into account.					
There were no major political conflicts in the WSD implementation.					
Necessary village meetings were held to take different views into account for WSD.					
WSD leaders were able to settle any major disputes among the villagers on WSD.					
Organizational & Financial Rationality					
A local organization was created to implement WSD.					
The local organization for WSD was special for WSD planning and implementation.					
Planning for NRM activities was carefully carried out.					
Planning for production enhancement activities was carefully carried out.					
Planning for enterprise promotion activities was carefully carried out.					
Implementation of NRM activities was well coordinated and managed.					
Implementation of production enhancement activities was well coordinated and managed.					
Implementation of enterprise promotion activities was well coordinated and managed.					
The WSD leaders/staff were competent in planning and implementation.					
The WSD leaders/staff were competent in handling finance.					
Overall the planning and implementation of WSD activities was well managed.					
Government Rationality					
The government staff took keen interest and provided good guidance in WSD activities.					
The government staff adequately helped in planning of WSD activities.					
The government staff helped in meeting the procedural requirements for WSD.					
The government staff helped in speedily obtaining approval and funds for WSD activities.					
The government staffs were knowledgeable about the guidelines and procedures.					
The government staff received good cooperation from the higher offices.					
The government staff helped in mobilizing village people for WSD activities.					
The government staff helped in the creation of the local organization for WSD activities.					
The government staff helped in resolving disputes, problems and delays.					
The nature of government funding was suitable for WSD in the village.					
The design of WSD programme was suitable for WSD in the village.					

Figure 1: Overall Institutional Setup for Watershed Development

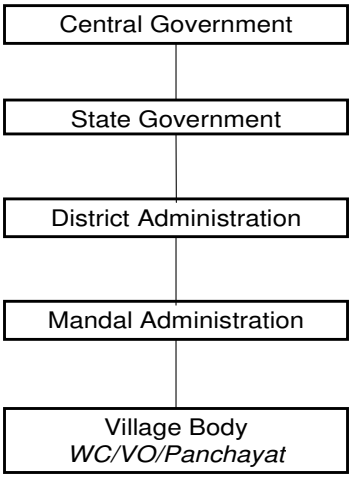

Figure 2: State Institutional Setup for Watershed Development

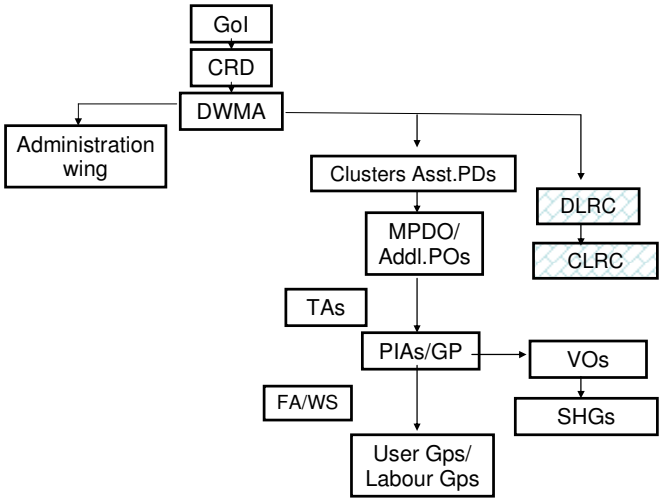

Figure 3: Effective Acquisition and Use of Information in an Organization