

Water Management

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Objectives

- To highlight present processes, trends and approaches in developing water resources and describe strengths and weaknesses in managing water for sustainable development of watersheds
- To describe the issues and complexities of water management problems in the present context of development
- To develop an appropriate strategy for water management in participatory integrated watershed management

What is water management?

Water management develops the physical and institutional control mechanisms necessary to make the water available for a specific purpose. Now, with increased competition for a given limited supply, the emphasis is shifting towards multiple purposes and sequential uses with the growing concern for water quality, pollution and the environmental system.

Definition

- 'Water management is the space-time-quantity-quality alteration of the water resource in and between various uses to meet societal goals.' Within this definition, all aspects of water development and use can be included. Both what is done with and to water influence the quality of life and the environment. There are five major levels of management: international, national, state, local and user.

What are the major users of water?

Nature

Nature is without doubt the largest consumer of water for only a small portion of the water falling as precipi-

tation reaches the rivers or other manageable surface or subsurface supplies. Nature uses water to maintain all life and natural processes such as energy transfer, mineral deposits, climate, etc.

Culinary

Water used for drinking, bathing, washing, cooking and other household uses. Probably these would have priority over all of humanity's other uses.

Agriculture

This is, and undoubtedly will remain, the largest consumer of water managed by man. Evapotranspiration from lands with growing crop averages more than 50 t/ha/day. From 500 to as much as 5,000 t of water are required per ton of crops.

Other users

- Industry
- Energy
- Navigation
- Transportation
- Flood control
- Municipal
- Recreation
- Mining
- Aquaculture
- Land building
- Pollution and quality control
- Aesthetics

Water management problems are complex. Physical, economical, legal, sociological, biological, chemical, political, ecological, emotional or religious components occur at all levels of management for any of the major uses. During the 1980s, the public became increasingly aware that demands for fresh water and unchecked pollution of rivers and aquifers were putting many catchments and their dependent inhabitants in peril. Diver-

sity of mountain environments and a lack of understanding make the search for solutions a challenging task.

What is a farmer-managed irrigation system (FMIS)?

In Nepal, FMISs exist traditionally on a self-help basis. They have contributed to the evolution and development of irrigated agricultural systems in Nepal. Two important characteristics of these FMIS are that they are developed and operated in a demand-driven mode, and they have assured participation of users at every stage. Many of these FMIS are performing satisfactorily, although some do not operate optimally. There may be several reasons for this.

What are the principles of the participatory approach?

The participatory approach embraces the principle of involving users at all stages of development and management: project identification, planning, design, construction, and operation and maintenance.

Major elements of the participatory approach include fostering feelings of ownership; decentralised joint decision-making; transparency in budgeting, planning and expenditure; user group empowerment; joint responsibility and accountability; sustainability through local resource mobilisation; and improved operation and maintenance by water users.

As a successful model for a turn over and joint management programme, the Irrigation Management Project (IMP) began in 1986 under USAID financing (Figure 1).

The implementation process for participatory irrigation management (PIM) has three phases (Figure 2).

Phase I: Initial organization: Establishment of an *ad hoc* WUA

Baseline assessment: Initial baseline characteristics of the system to be studied.

Formation of WUA: Water users are organized into multi-level organizations with con-

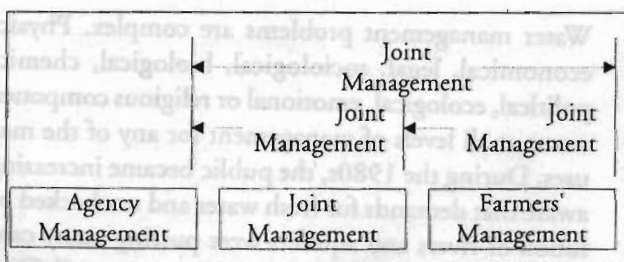


Figure 1: Joint management and turn over in the management transfer continuum (Laitos and Rana 1992)

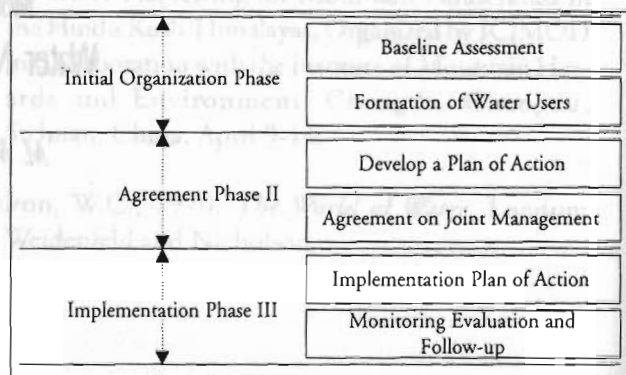


Figure 2: Framework for joint management and turn over

stitutions, elections, and legally registered associations.

Phase II: Joint agreement between WUA and the agency

Joint development of action plan

Agreement of joint management activities: who does what and when ?

Phase III: Implementation of programme (three to five years).

Implementation of plan of action

Monitoring, evaluation and feedback developed and implemented by both WUA and agency

The incentives to be provided to farmers to assume management responsibilities sustainably are as follow.

- Extending the right to fix and collect service fees — including incentives on prepayments and collection rates
- Access to information and participation in decision-making processes on systems' operation and maintenance
- Explicit water rights for the WUAs
- Transfer of required government machinery and assets to WUAs
- Programme, budget and outcomes transparent to WUAs
- Involvement of WUAs in all the stages of development
- Technical advisory services provided by the agency
- Training of WUAs and farmers

Examples of farmer-managed irrigation system

Case studies of the Chhattis Mauja Irrigation System and Pithuwa Irrigation System

While the Chhattis Mauja Irrigation System was initiated by farmers, the Pithuwa Irrigation Scheme was originally developed by the Department of Irrigation (DOI). Subsequently users took over the operation and management of the system.

Membership defined by property rights: The FMISs in most cases are found to exercise some kind of property right in defining membership and irrigation access. In Chhattis Mauja, membership in the system is defined by *kulara* (one person-day of labour for canal maintenance) entitlement. The resource mobilisation, obligations and participation in decision-making are also tied to irrigation entitlement. In Pithuwa, the size of the branch canal outlet has been the basis for irrigation allocation and resource mobilisation. Such a link has been the basis for collective obligations and compliance to the rules in use.

Local control of institutional innovation: In FMIS the rights, roles and duties are entirely under local control with users themselves defining the roles and duties for

operation and management. The rules and roles of the users are tailored to local needs and the interests of the users. They are not rigid. They are developed, modified and tried again, matching the system dynamism and changing the needs and preferences of users.

Prompt decision-making and effective enforcement: Prompt decision-making and effective communication of decisions ensure a higher degree of compliance to the decisions. In Chhattis Mauja, the *mukhtiyars* and messengers (officials of the village-level organization elected for a fixed term by villagers) at different levels of the system have the responsibility for communicating decisions. In Pithuwa, the communication of decisions is through the functionaries of the WUA at the main and branch canal levels. Also, the mechanism of irrigators being pressured by neighbours to comply with rules in both these systems has led to the evolution of collective obligation on the part of users. The enforcement of the rules is backed by a system of penalties that match the severity of the defaults.

Equity in resource mobilisation and irrigation access: Equity in resource mobilisation and irrigation access has been the basis for prompt and assured mobilisation of resources and compliance to rules. Users are assured of a share of water in return for their investment of time,

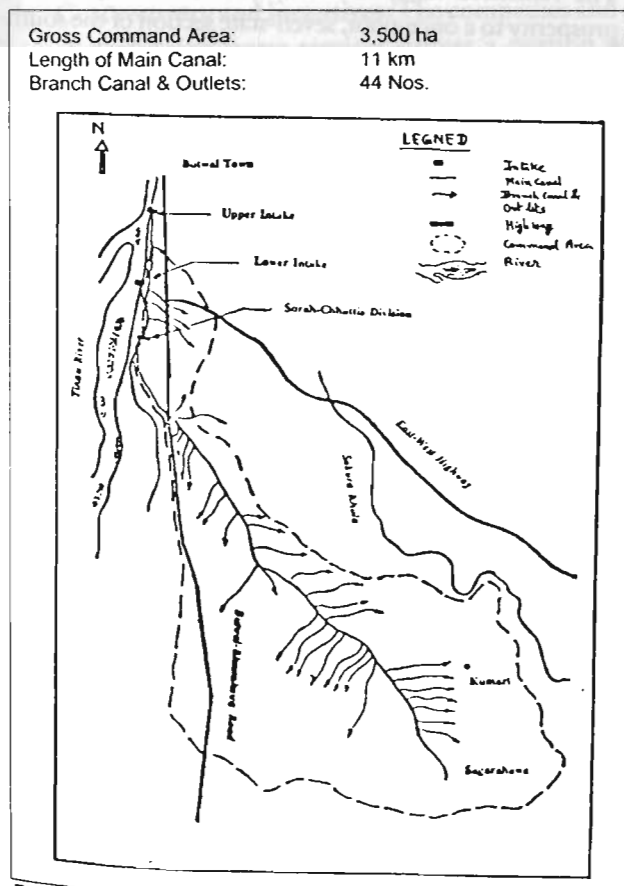


Figure 3: Chhattis Mauja Irrigation System

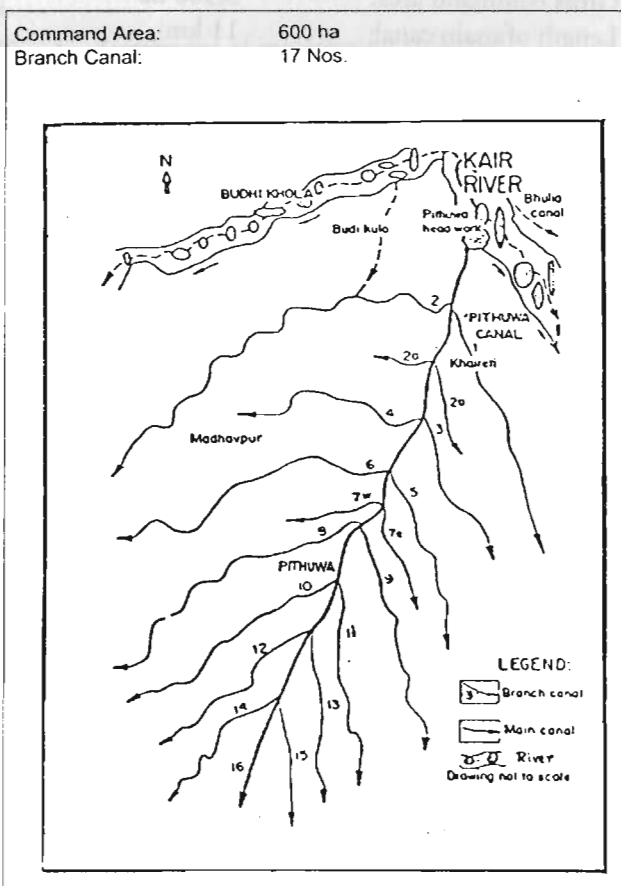


Figure 4: Pithuwa Irrigation System

labour and money during construction, operation and maintenance of the system. In Chhattis Mauja and Pithuwa, water allocation in each branch canal and therefore irrigation entitlement is determined by the size of the branch canal inlet. The inlet size is also used as a basis for cash and labour resource mobilisation during repair and maintenance. Within the branch canal, timed rotation of irrigation delivery ensures equitable distribution. Equity in both the systems is also ensured by regular monitoring of branch canal inlets. The inlet openings are adjusted to ensure equitable allocation. Regular monitoring of outlets eliminates the chance of free riding. Rotation among the branches is the usual practice of ensuring equity in water delivery between head and tail reaches during the period of diminishing water supplies.

Transparency and accountability: The FMISs maintain transparency in rules and regulations, accounts and book-keeping. The functionaries of the WUA are accountable to the users and therefore the chances of favouritism and fraudulent behaviour are minimised. In Chhattis Mauja and Pithuwa, the general assembly of the users provides an open forum to expose problems. Any functionary may be questioned if his/her function and performance are inconsistent.

Gross command area:	3,500 ha
Length of main canal:	11 km
Branch canal & outlets:	44
Command area:	600 ha
Branch canals:	17

What are the principal failures in agency-managed water resource systems?

Fragmentation between sectors and institutions: Water management within an agency system is fragmented among sectors and institutions with different agencies developing the same water source for different uses.

Heavy dependence on centralised administration: The agencies charged with water management are severely over-extended and have limited technical capacity to provide quality services. They take the leading role in participation and in managing water resources. The result is unreliable projects that produce services that do not meet consumers' needs and for which they are unwilling to pay.

Water is not treated as an economic good: Most countries do not treat water as an economic good. The absence of financial discipline has an especially negative impact on the incentives and accountability of public

authorities to provide high-quality services; water has the least cost recovery (World Bank 1994).

Water is not linked to health, the environment and economic development: Environmental degradation of water resources causes human suffering and burdens future generations with the cost of remedial actions. Integrated water management based on the perception of water not just as a basic human need, but also as an integral part of the ecosystem, a natural resource, and a social and economic good.

The new approach calls for policies that take into account the interdependencies among sectors and protect aquatic ecosystems. Incentives for financial accountability and improved performance should be created through greater use of pricing, decentralisation of administration and services, financial autonomy, user participation, private sector investment, consistent rules and regulations, and co-ordination among agencies responsible for water services.

How to manage water in multiple jurisdictions?

Managing water in multiple jurisdictions with an integrated approach (large-scale development)

The Tennessee Valley Authority (TVA) has helped bring prosperity to a once-poor, seven-state section of the southern United States. The TVA has promoted the linkage of land and multipurpose, real-time water management in an integrated manner as a way to conserve natural resources and improve water resources' management and restore the basin's ecosystem. The TVA serves as a facilitator to co-ordinate fragmented interagency actions and encourage local co-operation to improve the co-ordination of separate land management programmes. In conjunction with the new approach, TVA is facilitating interagency co-operation, on a federal, state and local government level to co-ordinate management of land and water resources. Through this programme, which is operated by an interagency steering committee, water pollution and environmental impacts caused by agricultural, mining, forestry and urban development are being reduced.

France's 'Model' System

The French system of water resources' management, adopted after many years of study and debate, includes many excellent features that could serve as models to help industrial and developing countries as they look for the best way to put a comprehensive approach into action (World Bank 1993). There are several key elements.

Well-defined laws and regulations: The Water Acts of 1964 and 1992 are the foundation of the French system. The earlier law describes specific quality objectives and regulations for pollution control, while the latter act is designed in part to meet stricter European directives on water management.

Hydrographic basin management: The system is organized around six major hydrographic basins, with appropriate national policy direction. These correspond to the country's four main catchment areas and to two areas of dense population and intense industrial activity.

Comprehensive management decentralisation and participation: Each of the six basins has a basin committee and a corresponding executing agency, a water board. The basin committee also known as a 'Water Parliament', because of its representation and powers, reflects regional rather than central government control and is designed to promote the role and responsibility of different interest groups in the basin. The water boards, while executing the committee's directives, are also responsible to the central government for certain technical matters (such as upholding national standards). Water and sewerage services are provided by either public or private firms (increasingly through competitive bidding) and are chosen by communities.

Cost recovery and incentives: The companies and entities operating water services deliver a portion of the charges they collect to the basin agencies. In addition, a 'pollution fee' (a penalty) is collected by the basin agency. Most of these revenues are reinvested into the system to provide technical assistance and to help the public or private sector ensure that water is safe and purified.

Supporting research: About 14 per cent of the water boards' expenditures in 1992-1996 were budgeted for research and development.

Managing water resources with a new approach (small-scale appropriate technology development)

Greater private sector and user participation offers an effective means to decentralise water resources' management and increase the responsibility of users for managing and financing water resource projects.

Four different approaches to introducing private sector incentives as are follow.

- Forming water users associations
- Transferring management functions from government authorities to water users' associations

- Introducing irrigation service fees
- Developing private wells

Some important concepts in achieving the above tasks are as follow.

- People's participation
- Poverty alleviation
- Strengthening policies on land use and management
- Water conservation technology
- Low-cost technology for protecting against disaster

BASIN approach planning in a comprehensive framework for PIWM

The adoption of a comprehensive framework for analysing policies and options would help guide decisions about managing water resources throughout a basin. The framework would facilitate the consideration of relationships between the ecosystem and socioeconomic activities in the watershed (Figure 5).

- Basin-wise information collection
- Assessment of information collected
- Strategy formation
- Integration, control, and implementation of strategy
- Network development for dissemination
- Network development

B: Basin-wise information collection
A: Assessment of information
S: Strategy formation
I: Integration of strategy
N: Network development

Conclusion and recommendations

- Project planners should carefully assess water resources within a comprehensive framework before the design and implementation stage.
- More detailed guidelines, training and information should be provided to the implementor, especially

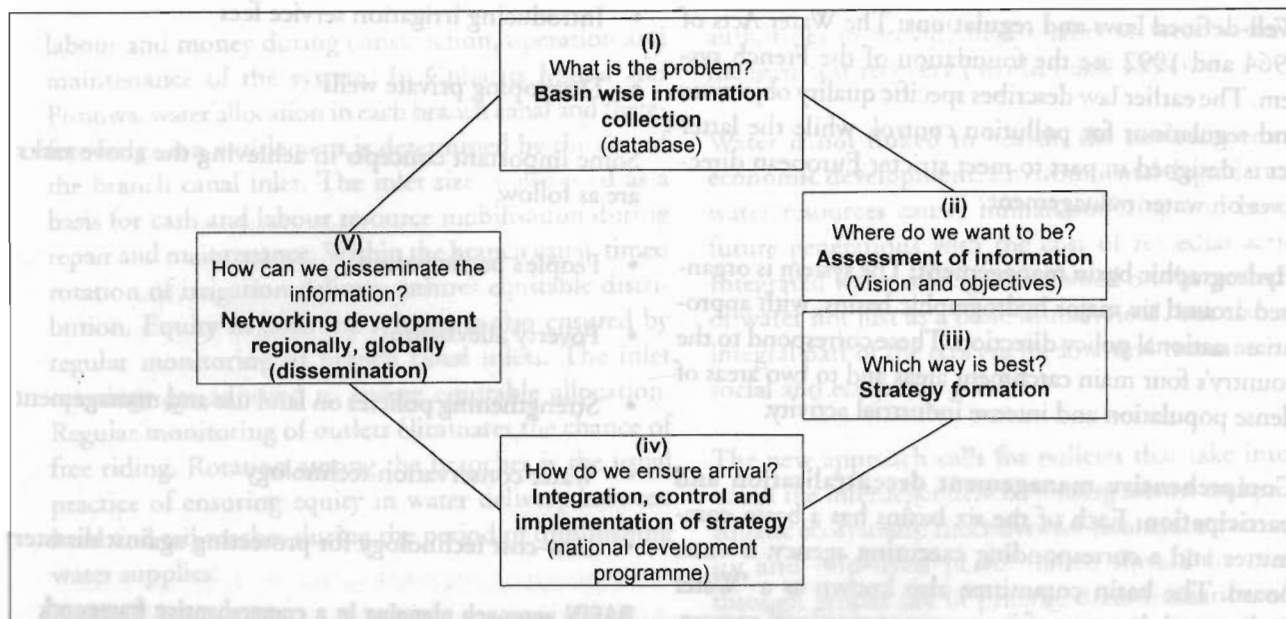


Figure 5: Participatory integrated watershed management (PIWM) BASIN – Approach Planning

for co-ordinating intersectoral water resources' management, designing and administering fee structures, and monitoring project performance.

- Poverty relief should be a project goal at the design stage.
- Water users should be given more responsibilities for managing water. In addition, where feasible, emphasis should be given to private pumping and small-scale systems managed by users.
- To protect the environment, drainage networks should be an integral part of the basic design of all irrigation systems, the water table should be continuously monitored for operating irrigation projects, and erosion control and reforestation programmes should be an integral part of the project design for reservoir catchment areas.
- The following recommendations are relevant in promoting participatory irrigation management (PIM).
- Commitment at the political and management level
- Improved policy and legal frameworks to support the programme to fit the local conditions
- Improved management environment in the agency with a clear vision and commitment
- Sufficient training programmes to be developed to further orient and train agency staff and WUAs to cope with emergency situations in the field

- Adequate provision for financial support for institutional development should be part and parcel of the programme.
- To reap the long-term, full benefits of increasing agricultural production, PIM should be accompanied by support activities, input supply, credit, marketing, land reform, etc.
- Users' participation is to be encouraged, making programmes, budget and outcomes transparent.
- WUAs must be administratively, technologically and financially capable before their irrigation systems are completely turned over.
- Guidelines for implementation issued by the centre should have uniformity in approach.

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