



United Nations  
Educational, Scientific and  
Cultural Organization



International  
Hydrological Programme  
of UNESCO



World Water  
Assessment Programme  
A contribution to the United  
Nations World Water Assessment  
Programme



Network of Asian River Basin Organizations

# IWRM GUIDELINES

at **River Basin Level**

**PART 2-3**

INVITATION TO IWRM

FOR IRRIGATION PRACTITIONERS





## MESSAGE FOR YOU

This booklet is an invitation to irrigation practitioners interested in IWRM.

Why should irrigation practitioners be interested in IWRM?

When you (as an irrigation practitioner) prepare an irrigation plan for your water basin, you are required to think about the other water users in the basin. Moreover, by thinking about other water users you improve your irrigation plan, which will bring you enormous benefits.

This booklet clearly illustrates the points you need to carefully consider in your irrigation plan, which affect water resources in the basin. As the person responsible for planning, designing and implementing irrigation plans, start by using this booklet to make your own keys. If so required, we recommend that you later explore other parts of the guidelines such as Part 1– Principles, Part 2-1 – The Guidelines for IWRM Coordination, and Part 2-2 – The Guidelines for Flood Management.

Through your efforts, your irrigation plan will be more successful, not only for you but for all the stakeholders that share your basin.

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# I. Features and Structure of the Guidelines

The ‘Invitation to IWRM for Irrigation Practitioners’ (herein after ‘the Invitation’) is intended for IWRM practitioners tackling irrigation planning.

IWRM is a step-by-step process and takes time. By responding to changing social, economic and environmental needs or impacts, one can gradually achieve better and sustainable water resources management as if moving up a spiral, through such means as progressively developing water resources in the basin, building a more integrated institutional framework, or improving environmental sustainability. This set of Guidelines illustrates the dynamic and evolving process of IWRM in a river basin using a conceptual ‘WRM Spiral’ model as shown in Fig. I.1.

One turn of the spiral is equal to typical implementation of an IWRM approach: the ‘IWRM Process’. One moves up the spiral by implementing the IWRM process in the basin.

Detailed descriptions of the IWRM Spiral and the IWRM Process is provided in Chapter 4, Part 2-1 of the guidelines, which can be referred to at any time. The Invitation consists of three parts: 1) sectoral perspectives, 2) key for success, and 3) IWRM process.

## Chapter 2/Sectoral Perspectives in IWRM

This section illustrates the principles of actions and interests of water-related sectors in water management and IWRM. Each sector values water and interacts with water differently. This section provides

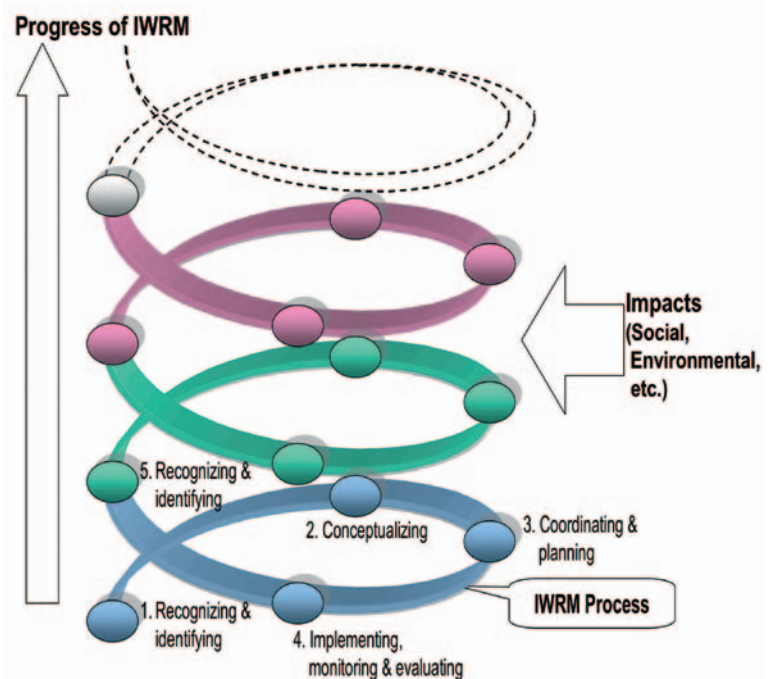


Fig. I.1 IWRM spiral

information on how individual water-related sectors tend to think and act, how these sectors typically relate to water management and IWRM, and what they might want to convey to other sectors.

### Chapter 3/Key for Success in Implementing IWRM

A 'Key for Success' is a key that can be used in practice to help make IWRM succeed. It is a key to enable breakthroughs in challenging situations, opening the door to better IWRM. Many of them have already demonstrated their worth in practice. Some are generic, i.e. they apply to every successful examples of IWRM, others may apply only to specific situations, and some may not be in place as yet. It helps to find the key appropriate for the given circumstances of your basin's IWRM process.

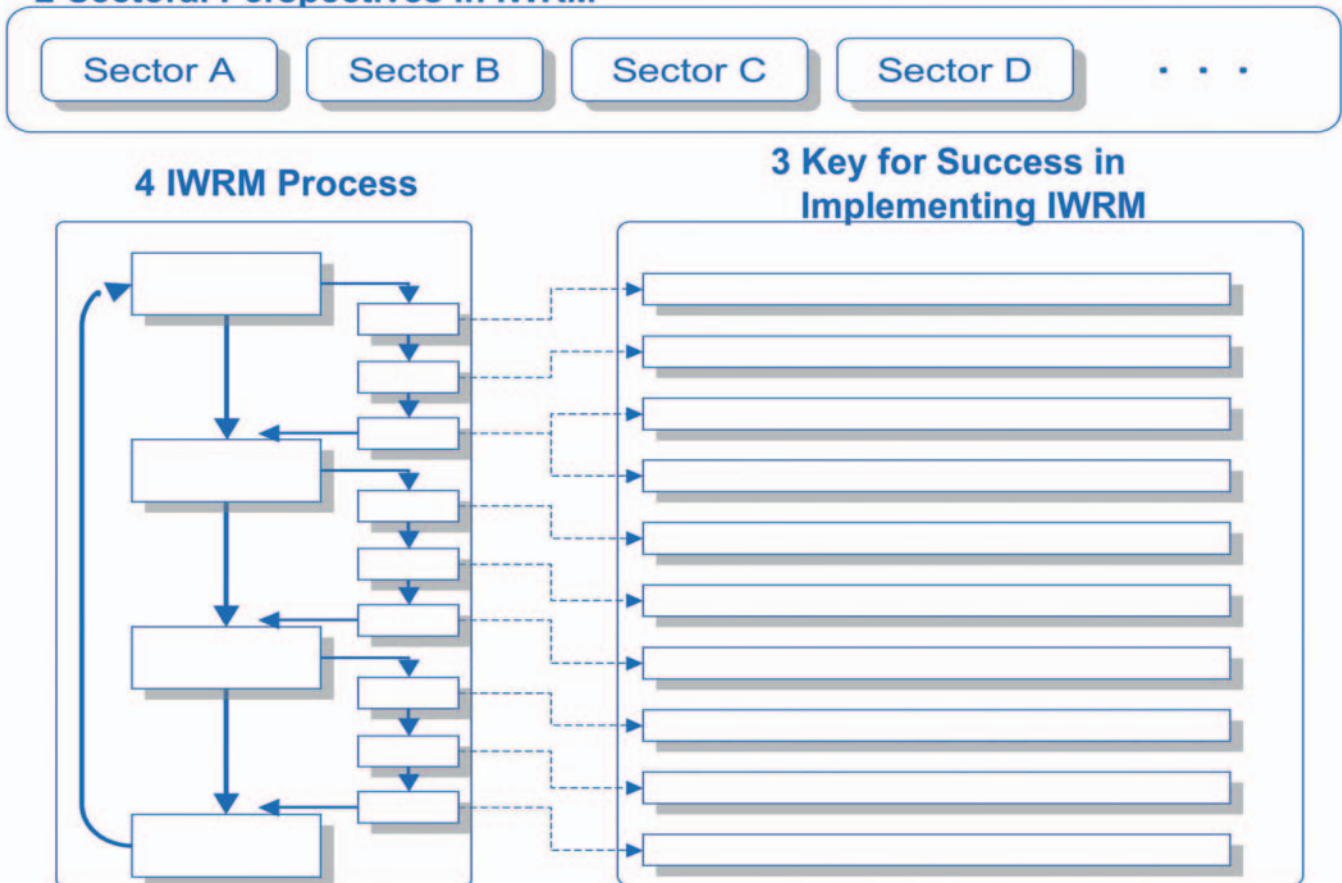
### Chapter 4/IWRM Process

'IWRM Process' describes a typical process for IWRM implementation. It also illustrates keys for success relevant to each phase or step of the process. These help you to orient yourself through the process and serve as a map for finding directions or the correct 'key' for enhancing water resources management.

### IMPORTANT NOTE

You do not have to read the entire document. This set of Guidelines is designed to enable you to skip to specific sections depending on your needs.

## 2 Sectoral Perspectives in IWRM



■ Fig. 1.2 Structure of the Invitation

## 2. Sectoral Perspectives in IWRM

This chapter illustrates some of the typical perspectives of water-related sectors. The perspectives included here are not complete, however, they cover much of the information useful for IWRM coordination.

This chapter provides information on how individual water-related sectors tend to think and act, how the sector relates to water management and IWRM, and what the sector wants to convey to other sectors and the organization or person responsible for coordinating IWRM efforts.

It is important to know the perspectives of other sectors when implementing IWRM. The same 1 m<sup>3</sup> of water is valued differently depending on the sector because each sector treats and uses water in different own ways. Water is also valued differently depending on when and where it can be obtained, and at what quality.

### 2.1 GOOD UNDERSTANDING OF SECTORAL PERSPECTIVES AND THEIR RELATIONSHIPS IS KEY FOR IWRM

Implementation of IWRM means proposing a plan to individual sectors – who tend to think of their own benefits as their first priority – that is close to their ideal plans, and obtain compromises by making proposals that present advantages to them. It is also

important that as many sectors as possible are satisfied with the plan before a consensus is reached.

For this, managers in charge of coordination should not force his/her story on the sectors but should take a horizontal approach to obtain the perspectives of the coordinated sectors, so as to deepen their level of understanding. The coordinators must understand the goals of the activities undertaken by the sectors or stakeholders, and how they relate to water resources and the basin in order to appropriately implement IWRM. Furthermore, good understanding by the coordinators on the benefits of IWRM to the individual sectors will facilitate efficient, appropriate and socially justifiable consensus-building. Thus, it is important to establish a good understanding of ‘sectoral perspectives’ in implementing IWRM.

## 2.2 WATER USERS’ PERSPECTIVES

### 2.2.1 Agricultural sector

- Primary concern is food production. Water is just an instrument.

#### 1. Interests of the agricultural sector

(Water for agricultural production)

Water, together with land, is only an instrument for agricultural production. The production outputs are food and ultimately revenues for the farmers. For farmers, water is a means of ensuring their living on their land.

(Sense of entitlement as a precedence user)

Agricultural sector has a history of investing and acquiring water before the concept of 'water management' even existed. Thus, there is a strong sense of entitlement that they can use their water exclusively.

(From close water sources to far water sources)

Agricultural water supplies used to acquire water from close-by water sources; however, they eventually began to search for other water sources further from the farmland, which led to water resources development through dam-building.

In the monsoon regions of Asia, the amount of rainfall varies greatly during the wet season. Thus, in order to prepare for sudden droughts, they utilize groundwater, reservoirs or nearby rivers, and if they need more water they build dams upstream of the river. In arid and semi-arid regions, there is always a need for more water, but the search always begins with nearby water sources before seeking further away as water demand increases.

Thus, nearby water sources are utilized in most developing countries, but as development proceeds in the basin, larger infrastructures such as wide-area water transfers become necessary for obtaining adequate agricultural water.

(Agriculture as the fundamental industry of the country)

The agricultural sector contributes to national security through food production. The agricultural managers of the country and the region consider providing a stable supply of food the region's most important objective. In developing countries, some consider that agriculture should be promoted in order to secure jobs and revenues in rural regions and prevent population concentration in urban cities. This cannot be realized without securing the water necessary for agriculture. The agricultural sector is also strongly influenced by national policies. Thus, it must be kept in mind that local coordination is sometimes not enough.

## **2. How other sectors may impact the agricultural sector**

(Impacts by other water users)

- There is the possibility that irrigation users may not be able to obtain sufficient water if other water users draw water upstream. If a structure, such as an intake weir, is to be constructed by another water user upstream, that user will have physical advantages in drawing water, and thus the irrigation user will be opposed to such action.

(Impacts by flood management)

- When there is a risk of flooding due to an increase in river discharge, drainage from agricultural land may be regulated, and prolonged inundation of the fields may cause damage to the crops. The scale of anticipated damage is dependent on the duration of inundation, land use and type of crops. Coordination of drainage operation rules accounting for such factors will be necessary.
- When floodwater is temporarily stored in a reservoir to lower the flood discharge level, turbidity of water may persist even after the flood has subsided, depending on the nature of upstream sediment. If river water is used as irrigation water immediately after a flood event it may impact water use.

(Impacts by the environmental sector)

- The environmental sector demands that the agricultural sector minimize the impacts of agricultural production activity to the environment or requests alternate measures. For example, concrete channels for irrigation are conventionally designed in ways that are efficient from the economic standpoint. However, the environmental sector demands channels using more natural materials such as soil, rocks and wood. Considering environmental conservation may increase costs or maintenance needs.

(Impacts by the hydropower sector)

- Hydropower generation using dams discharges water according to electricity demands. Thus, it

may cause large fluctuations in river flow downstream of the dam. It can also impact the stable intake or water quality of irrigation water.

### 3. Agricultural sector in relation to IWRM and the advantages of IWRM

- If the agricultural sector wishes to conduct a large infrastructure development, there is the possibility of significant cost reduction if the venture is jointly implemented with other sectors. Furthermore, the agricultural sector may gain forms of compensation if it reaches compromise with other sectors regarding the securing of water resources.
- By compromising on making decisions regarding water resources the agricultural sector may be able to receive compensation in another form, with the possibility of covering potential losses. Thus, it is important to issue proposals regarding agricultural production from a comprehensive standpoint.
- By uniting individual organizations or individuals in the agriculture sector, the sector can represent a significant amount of water resources. It can, therefore, facilitate the consensus-building process for IWRM implementation and enhance the benefits achieved by the entire agricultural sector.

#### 2.2.2 Domestic water supply sector

- Requires water quality on top of water quantity

##### 1. Interests of the domestic water supply sector (Sanitation and domestic water supply)

Domestic water supply provides clean water to people in a stable manner and is highly public in its nature. Provision of safe drinking water may be normal in developed countries or cities but it is still a fundamental demand for sustaining the lives of people in developing countries and rural areas. Furthermore, water supply in these areas will lead to improvements in the social environment, such as less time fetching water, etc.

Provision of water supply in cities was originally developed from the viewpoint of crisis management in order to prevent water-related diseases. Supplied

water may be 'drinkable' or 'not appropriate for drinking'. It is rare that water is 'drinkable' but in order to meet the needs of improving the sanitary environment, the provision of water that is not necessarily drinkable can be sufficient.

(No alternative for domestic water supply utility)

Current domestic water supply in cities does not provide an opportunity for users to choose their service. People have to use the only available water supply in the area. There is probably no region where multiple water supply utilities compete (or a user can choose the water service).

Water pricing to collect initial investment and operation and maintenance costs depends on the area or utility; however, the water source available is often limited and regional differences in water pricing are inevitable and of little interest to the water supply sector. However, this issue is a primary concern for most water users.

(Privatization and water supply)

In the past there were movements to privatize water utilities to enhance profits. However, such movements have been revised to balance the public aspect of water utilities in meeting the social needs together with the business aspect of operation effectiveness and cost reduction.

(Water treatment technology and water source/ water quality)

Before water treatment technology was developed to its current level, an important consideration for water sources for domestic water use was not only 'quantity', but 'quality'. Thus, groundwater was often utilized. River water was used if groundwater alone could not meet the demand. Before treatment technology was developed to its current level, the sector sought better quality water upstream of rivers. This often induced conflicts with existing water users downstream, but for the water sector it was important that good quality water was obtained as a water source. Furthermore, conventional water treatment by rapid filtration cannot treat dissolved substances.



In recent years – however – with advances in treatment technologies, water quality is no longer a major issue. It has now become possible to create drinking water from treated wastewater.

## 2. How other sectors may impact the domestic water supply sector

(Impacts by other water users)

- There is the possibility that a domestic water supplier may not be able to obtain sufficient water if other water users draw water upstream. If a structure, such as an intake weir, is to be constructed by another water user upstream, that user will have physical advantages in drawing water, and thus the domestic water supplier will be opposed to such action.

(Impacts by flood management)

- When floodwater is temporarily stored in a reservoir to lower the flood discharge level, turbidity of water may persist even after the flood has subsided, depending on the nature of upstream sediment. If river water is used for irrigation water immediately after a flood event it may impact water use.

(Impacts by the sewerage and drainage sector)

- A domestic water supplier will be affected if a drainage channel is connected, or effluent from a wastewater treatment plant is discharged close to the intake location.
- Discharge water is often contaminated, thus the domestic water supplier sector would demand that any such discharge facility for drainage or a wastewater treatment plant be situated downstream of the intake location.
- Treated wastewater could in some cases be recycled and utilized for domestic water supply.

## 3. Domestic water supply sector in relation to IWRM and the advantages of IWRM

- When demands for water supply increase due to the development of a new city, population growth or a change in social situation, the domestic water

supply sector will have to locate new water sources, and be faced with the need to implement IWRM.

- When introducing IWRM, conformity with plans by other municipalities or water use sectors can be ensured by accounting for upstream and downstream, right and left banks, and coordination among municipalities or water utilities. Furthermore, infrastructure such as dams, intake weirs and treatment plants can be jointly developed and a joint management framework can be established. These can present substantial advantages to the domestic water supply sector.
- If there is shortage of water due to population growth or rapid urbanization, water transfers from other uses, particularly the agriculture sector, can become an option, together with the development of new water resources infrastructure such as dams.

### [New technologies and domestic water supply]

With the advancement of water treatment technologies such as membranes, the cost of water treatment is decreasing. With advanced and affordable technologies becoming newly available, water supply systems in developing countries now have the possibility of taking completely different approaches compared to developed countries where water resources have typically been secured through the construction of storage in upstream regions, etc

### 2.2.3 Industrial water sector

- Primary deciding factor is cost

#### 1. Interests of the industrial water sector

(Low-cost water and industrial water)

The primary concern of the industrial water sector is how to obtain and provide low-cost water and discharge wastewater in the least expensive way. Cost is the primary deciding factor.

Compared to the domestic water supply sector, which does not provide an alternative option for

users, the industrial water sector is much more sensitive to the demand for cost-effectiveness. The industries themselves are greatly influenced by aspects other than water (logistics, employment, environment, etc.), thus, it is difficult to develop long-term demand projections compared to domestic water supply.

(Groundwater utilization and industrial water)  
Industrial water in earlier days was abstracted mostly from groundwater. This is because groundwater was a cheap and stable water source with high water quality. Drawing water from rivers requires water use rights, infrastructure development and water quality adjustment (treatment), thus, the use of river water for industrial use is discouraged if possible.

Excessive abstraction of groundwater in alluvial plains may induce ground subsidence or groundwater salination, resulting in deterioration of groundwater quality. Users of industrial water are mostly private entities, and thus such problems are likely to occur if there is no adequate regulation.

(Water quantity, water quality and industrial water)  
Industries that use large amounts of water such as steel, oil, chemical or paper industries select locations with easy access to water. Industrial water, unlike domestic water, demands varying levels of water quantity or quality depending on the usage. For example, advanced IT-related companies purify water themselves and thus the industrial water supplier may only need to provide raw water.

Discharging used industrial water directly into the river may cause severe contamination downstream. Industrial water users understand this but generally consider it only necessary to meet the regulatory standards for industrial water discharge.

## 2. How other sectors may impact the industrial water sector

(Impacts by other water users)

- There is the possibility that an industrial water user/supplier may not be able to obtain sufficient water if other water users abstract water upstream.

If a structure, such as an intake weir, is to be constructed by another water user upstream, that user will have physical advantages in drawing water, and thus the industrial water user/supplier will oppose to such action.

## 3. Industrial water sector in relation to IWRM and the advantages of IWRM

- If the industrial water sector wishes to conduct a large infrastructure development there could be a possibility of significant cost reduction if it is jointly implemented with other sectors.

### 2.2.4 Hydropower sector

- How to generate the maximum amount of energy from water

#### 1. Interests of the hydropower sector

Electricity is indispensable for the development of the region and the country, and both the private sector and governments have promoted power generation projects. Power development generally implemented over a wide area has high added value. It contributes to industrial development and creates employment, and thus often forms a primary focus for developing countries as the foundation for regional industrial activities and people's lives.

(Characteristics of electricity)

- Electricity cannot be stored, thus facility capacity generally exceeds demand peak.
- The same can be said for instant supply and demand, and lack of flexibility in supply often leads to inefficient operation.
- There is often no alternative service for power supply and thus the price of power has a public utility cost.
- Infrastructure investment and cost collection plans are long-term.
- It can be distributed over a wider area, compared to water (and is possible to transmit long-distance).

Generally, hydropower generation in its early stages was used to provide power for local consumption, such as factories. Although usually commencing in the form of

private projects, it soon expands to general implementation in combination with other electricity sources to provide economic and efficient electricity supply nationwide. In many countries hydropower development began before irrigation water development.

Hydropower generation often has lower running costs than thermal power generation, thus generating more electricity through hydropower and less through thermal power is ideal. Hydropower generation does not consume water as compared to other water-use sectors. However, hydropower generation upstream of a river harnesses the potential energy of water to its maximum extent. The hydropower sector plans to exploit this potential energy by utilizing as much water as possible, and building multiple power generation facilities. Its priority is efficient power generation; if that causes rivers to run dry, that is considered an inevitable cost.

Hydropower generation uses dams to generate power depending on demand, and thus the discharged water quantity fluctuates. This also influences water temperature. Thus, consideration for other sectors and environment would be necessary. The hydropower sector may take measures to reduce its influence downstream by controlling discharges, but the sector is not proactive in this regard without the effect of investment.

Thus, the hydropower sector considers investment and the efficiency of power generation among its priorities, and river flow and the environment are only considered when required, through environmental assessments, etc.

## 2. How other sectors may impact the hydropower sector

(Impacts by other water users)

- If other water users increase their water intake upstream of a hydropower plant, the water available for hydropower generation will be reduced. This will also reduce the power generation capacity of the plant. Power generation is directly linked to the revenue of the hydropower sector, thus the sector

will oppose any newly permitted forms of abstraction by new water users or otherwise may seek compensation.

## 3. Hydropower sector in relation to IWRM and the advantages of IWRM

- In developed countries where public awareness on environmental conservation is high and there is a high level of public participation, it is difficult to plan new hydropower projects without overall coordination. If the hydropower sector actively participates in IWRM and facilitates consensus building with relevant stakeholders with a special focus on environmental conservation, this will facilitate project planning and implementation, and will become an advantage for the sector.

### [Hydropower planning and management]

[High priority on investment efficiency in hydropower project planning]

When a hydropower project is planned, investment efficiency (profit) is the obvious factor in decision-making.

[Hydropower management]

Hydropower practitioners secure funding needed for water through the collection of electricity charges. Hydropower facilities are mechanical and can manage discharge relatively precisely by measuring the electricity generated.

### 2.2.5 Sewerage (sanitation)/drainage sector

- How to collect wastewater efficiently and where to discharge it

#### I. Interests of the sewerage/drainage sector

(Maintaining sanitary environment and crisis management)

Providing access to sanitation is as important as a safe water supply in maintaining public hygiene and providing a sanitary environment. For example, the sewerage system must account for stormwater otherwise urban areas can flood due to a lack of

stormwater discharge capacity and lead to backflow of sewage or wastewater causing extremely unsanitary conditions. This could cause the spreading of water-related diseases.

If wastewater is discharged upstream of a river due to an underdeveloped sewerage system, the downstream river becomes inappropriate as a water source for domestic water supply. In many regions of the world large cities are often situated downstream of large rivers. Wastewater disposal upstream can bring about a crisis situation in such cities.

For a city, development of a sewerage system in the upstream region of a river that flows down through a city is a crisis management issue.

(Recycling of wastewater)

Wastewater, if treated to an appropriate level, can be effectively reused for water-use purposes. A sewerage system is thus very important in order to recycle wastewater and to utilize it as a water resource.

(Urban drainage)

Drainage facilities in urban cities are sometimes not developed fast enough and heavy rains can cause inundations in the lowlands of cities resulting in severe damage to underground spaces. Garbage thrown into drainage channels often prevents drainage and intensifies the damage caused by inundations.

(Public nature)

Sewerage and drainage systems are highly public in nature. The efficient collection of wastewater, treated to the level requested by society, then discharged downstream as quickly as possible are of paramount importance.

## 2. How other sectors may impact the sewerage/drainage sector

(Impacts by other water users)

- National and regional managers in the sewerage or drainage sector have to decide upon the discharge location by negotiating with other water-use sectors and the environmental sector. If the discharge loca-

tion is set immediately upstream of the water-intake location of a water-use sector, it can cause a conflict. From the economic perspective, to be able to discharge at the closest location possible is ideal, but from the water users' perspectives it is necessary to discharge downstream or in another river. The bypassing of water using a wide-area sewerage network also raises questions.

(Impacts by environmental sector)

- Water quality is also an important issue for consideration. It is technically possible to treat wastewater to the appropriate level. This also presents the advantage of reusing water for other purposes. On the other hand, it costs more, as the treatment level gets higher. The issue of who covers this cost is of great interest to this sector.

(Impacts by flood management)

- Rapid drainage of stormwater into rivers may cause an increase of river flow and may intensify flood risks downstream. Flood managers will, thus, demand coordinated implementation of drainage operations and flood control.

## 3. Sewerage and drainage sector in relation to IWRM and the advantages of IWRM

- The drainage location and drainage water quality are the important aspects that need coordination and consensus building with other sectors. Furthermore, participating in IWRM from the aspect of securing water quantity will enhance interaction with stakeholders. By improving drainage water quality, one may be able to set a closer drainage location. It can lead to overall economic benefits, ensuring adequate river flow and recycling of wastewater, etc.

## 2.3 ENVIRONMENTAL SECTOR'S PERSPECTIVE

- Ensuring ecological diversity and social consensus

### 1. Interests of the environmental sector

(Maintenance of sustainable environment)

The principal interest of environmental managers is to

ensure a sustainable environment over a long-term perspective. They prevent excessive, shortsighted development and call for the restoration of the natural environment. They demand and display requests to other water-related sectors. If these demands are social demands the coordinator will have to determine if social consensus can be attained for such demands including its cost allocation.

(Maintaining the natural ecological state)

The environmental sector pursues the maintenance of the environment in its natural ecological state, striving for the preservation of forests or rivers without human influence.

From their perspective, over-extraction of water or drainage from and to rivers causing insufficient water for the environment, or dams or weirs changing flow-variability in rivers, are considered to be problems.

(Environmental conservation in harmony with human activities)

In areas where communities developed slowly around irrigation agriculture, environmental ecology has established within the interaction between nature and human activities. Such an environment is not without human influence but a harmony or a balance exists between human activities and nature. There are opinions that such environments with some level of human influences should be conserved in their present state.

For example, shallow riparian waters, tributaries and streams, or networks of irrigation channels and the surrounding agricultural land can be considered as forms of ecological habitats for fauna and flora.

(Added value of the environment)

In recent years focus on the added value of the environment has increased through the concept of ecosystem services. It is in the interest of the environmental sector to raise the overall value of the environment in a basin-wide manner, together with eco-tourism and environmental education.

## 2. How other sectors may impact the environment

Environmental conservation is an important objective of IWRM for developing a sustainable society. Environmental perspectives should exist in every sector and should be coordinated within the water-related sectors in order to realize IWRM.

(Impacts by water-use sectors)

- Abstraction of water from rivers impacts the environment downstream of the intake location. Excessive water abstraction, for example for rice cultivation or hydropower generation will prevent the river downstream from receiving adequate amounts of water flow, which may cause drying up of the river or worsening of water quality, leading to deterioration of the aquatic environment. Discharge of wastewater or used water into rivers will increase flow quantity but may deteriorate river water quality.
- Over-abstraction of groundwater by water-use sectors will lead to ground subsidence, groundwater salination or changes in groundwater quality.
- Structures placed in rivers for water-use purposes may impact the environment, for example, by directly disrupting the surrounding environment, preventing fish passing, or reducing the river flow downstream. Construction of large-scale structures such as dams or intake weirs, in particular, will alter the natural environment significantly. The environmental sector demands that all water-use sectors minimize their impacts to the environment or implement alternate measures. For example, installation of an intake weir for water uses will prevent fish species from moving upstream or downstream. The environmental sector will demand the installation of fish ladders, or ensure that passage of fish is adequately secured.
- Overuse or improper use of pesticides and fertilizers in agricultural practices may negatively impact water quality or ecological habitats.

### 3. The environment in relation to IWRM and the advantages of IWRM

- IWRM cannot exist without the introduction of environmental perspectives, thus, the implementation of IWRM is a definite advantage for the environmental sector. However, the economic perspective is also important in gaining the consensus of relevant sectors, thus the importance of the environment has to be prioritized in social demands.

## 2.4 FLOOD MANAGEMENT SECTOR'S PERSPECTIVES

- Protecting the lives and properties of residents living in the river basin

### 1. Interests of the flood management sector

(Minimizing flood damage)

The primary concern for flood managers is to protect people and their properties in the river basin from floods and to minimize damage in a basin-wide manner. Promptly realizing the benefits of flood control measures is the priority of flood managers. In this regard, flood managers consider it necessary to collaborate closely with managers responsible for IWRM in order to ensure complete coordination with other sectors and stakeholders as efficiently as possible.

### 2. How other sectors may impact flood management

(Impacts by water use sectors)

- In withdrawing water from rivers, water-use sectors want their water-intake facilities and locations to enable efficient water diversion.
  - Water intake structures may block floodwater flow. Fewer and smaller structures are desired.
- When developing multi-purpose water storage facilities such as dams, water-use sectors want to secure as much capacity as possible for water utilization.
  - Due to the limitations of dam capacity, this may interfere with flood-control capacity and efficient flood control operations.
- During flood events, the agricultural sector tries to drain stormwater from their agricultural land as early as possible in order to avoid prolonged flooding of crops and resulting negative impacts to agricultural production.
  - The timing and quantity of drainage needs to be controlled taking into account river water levels.
- When a structure that crosses a river channel (such as a distribution line for domestic, industrial or agricultural water) is being planned or designed by a water-use sector, they would normally try to find a location, direction or structural design for their structure (bridge, siphon or tunnel) that can distribute water in the most economical way.
  - In order to prevent such structures from blocking flood flow or negatively impacting flood control facilities such as levees, the water-use sector plan regarding the location/direction of the structure needs to be changed accounting for levels of impacts such as flood-flow interference or impacts on flood control facilities, etc. It should also account for river improvement/construction plans for levees, facilities, water courses, etc.

(Impacts by the drainage and sewerage sector)

- Drainage and sewerage sectors want their drainage facilities and locations to enable fast and efficient stormwater drainage into rivers via urban or sewer drainage systems in order to prevent inland flooding.
  - In areas where drainage facilities for inland flood control are extensively developed, but the river channel does not have adequate flood control measures implemented, drainage activities or construction of further drainage facilities could cause the flood discharge capacity of the river to be exceeded. Prohibiting or restricting drainage operations/activities during flood events should be discussed with flood managers. It is necessary to set drainage locations in a manner that minimizes flood risk of the basin by accounting for areas that need to be protected or are vulnerable to flood risks.

(Impacts by the environmental sector)

- The environmental sector is concerned about the environmental impacts of constructing or improving flood control infrastructure.
  - There could be total opposition from the environmental sector, as well as requests for revising plans, further implementation of environmental impact reduction measures, or detailed investigations and reassessments based on the findings of investigations, etc. These could lead to delays in the realization of benefits from flood control measures.
- The environmental sector considers it desirable that habitats for fauna and flora be maintained in their natural condition. They consider that native vegetation species including trees in river channels should be conserved.
  - Tree growth in river channels can interfere with flood discharge, or negatively impact flood control facilities such as levees and gates.

(Impacts by municipalities and developers)

- Local municipalities may consider developing housing and industries in the basin with public convenience, and industry as their priorities.
  - Such developments will increase flood risks and could interfere with river improvement projects.
- They may seek to make effective use of available land by promoting the development of natural and unused land.
  - This will reduce the infiltration and water retention capacities of the basin areas, resulting in higher basin runoff and higher risk of flooding.
- Local municipalities and developers may wish to utilize and develop land in the basin to optimize use of the land resources.
  - Increased usage of waterfront areas will increase flooding risks. It may also interfere with river channel improvement. Develop-

ment in the basin reduces stormwater permeability and the storage capacities of the basin. Flood runoff increases and heightens flood risks in the area.

- Local municipalities and developers may wish to utilize the waterfront area of rivers and lakes and promote the use of facilities situated in such areas, such as sports facilities, parks, promenades, etc. They may wish to promote greater uses of the river and water recreational spaces.
  - More use of waterfront areas of river and lakes during flood events increases flood risks in the area. Locating facilities along the waterfront will also increase flood risks.

(Relevance to society as a whole)

- Society recognizes the threats of floods and the importance of flood risk management when hit by a large flood disaster, but as time passes that awareness fades. This is particularly prominent in areas where people do not suffer directly from floods.
  - Flood managers are concerned by this and want society to remain alert to potential flood risks as these can occur at any time.

(Impacts by other sectors)

- Fisheries are dependent on the existing environment of rivers. The fishery sector will oppose destruction of fish habitats for flood management. They will also wish to be able to make use of their vessels and construct infrastructure, such as ports, in locations efficient for their business.
  - Flood control measures that cause significant river and basin alteration may be restricted from the standpoint of fisheries conservation. Fisheries infrastructure may interfere with flood flow or flood control facility construction. Furthermore, decreasing normal flow will also interfere with their navigation.
- When a structure that crosses a river channel (such as roads, railways and lifeline infrastructure) is being planned or designed by other sectors, they

would normally try to find a location, direction or structural design for their structure that is most efficient and economical.

- In order to prevent such structures from blocking flood flow or negatively impacting flood control facilities such as levees, coordination is necessary with other sectors regarding the location/direction of the structure and levels of impacts such as flood-flow interference or impacts on flood control facilities, etc. It should also account for river improvement/construction plans for levees, facilities, water courses, etc.
- Navigation sectors or those who transport goods and people using boats may try to construct docks or mooring facilities in a convenient location and try to moor on water for efficient transport. They may also dredge channels in order to ensure adequate navigable space and the preferred route for navigation.
  - Such activities may interfere with flood flow. The facility locations and their size have to be accounted for and there must be coordination with their representative in order to prevent such impacts. Dredging may increase the discharge capacity of the channel but over-dredging or dredging close to structures could cause river flow to scour river facilities and cause negative impacts.
- People living in poverty may be living or cultivating on the flood channel plain of a river.
  - This increases flood risks. Coordination with other policy measures needs to be considered in order to prevent proliferation of new settlements into areas of flood risk and to facilitate the smooth relocation of existing inhabitants.
- Municipalities as well as residents. Flood managers are generally found on the coordination end of IWRM, with the relevant stakeholders and managers responsible for overall IWRM coordination.
- Flood risk management contributes to meeting overall IWRM objectives in the basin by preventing disastrous damage caused by floods, and hence enhancing the social and economic welfare of the basin. Its existing framework for negotiating with basin stakeholders can also be utilized for overall IWRM coordination, allowing for efficient stakeholder participation and coordination.
- Flood control not only mitigates flood disasters but also provides benefits for water-use sectors. Temporarily stored floodwater in facilities/reservoirs can be allocated for later water use. This can lead to cost-effective multi-sector collaboration, where flood managers as well as water-use sectors can all benefit from working together.
- Firmly positioning flood risk management as part of IWRM objectives ensures enhancement of prevention and preparedness capacities of the basin against future flood risks.
- Flood managers can also benefit from the overall IWRM arrangement in implementing flood risk management projects by utilizing the overall participatory/coordination framework. This facilitates the gaining of consensus from relevant stakeholders and enables project objectives to be achieved in an efficient manner.
- Floods may bring benefits to the basin in terms of fertile soil suitable for cultivation or by supporting the ecological functions of floodplains or wetlands.

### 3. Flood management in relation to IWRM and the advantages of IWRM

- The management of flood risks needs to be implemented through the involvement of various basin stakeholders, including development sectors,



## 2.5 OVERALL COORDINATION PERSPECTIVES

- Are stakeholders convinced? Is it socially justifiable?

The last part of this chapter describes how managers in charge of coordinating IWRM in the basin (such as in a river basin organizations) think and act.

IWRM is a process that (1) promotes coordinated management of water resources among all stakeholders, (2) integrates management of water and land resources, and (3) facilitates information-sharing and participation among the people involved.

Managers coordinating the IWRM effort understand the necessity for IWRM and seek to make progress. However, that requires a firm understanding of the interests and concerns of other water-user sectors, environmental managers, and flood managers.

The manager leading the coordination may not be aware of the history of water use or flood control efforts in the basin, or may set unrealistic goals from the beginning, or rush to reach a consensus without sufficient assessment or consultations. In these cases, individual sectors will make their opposition and case known to the coordinator. It is important that such opinions are well understood by those leading the coordination process in order to ensure that it proceeds smoothly and efficiently.

Coordinators can sometimes be influenced by the supporting organization or opinions of political decision-makers, but unjust coordination will cause problems later on. For example, if a stakeholder thinks that he/she suffered from a disadvantage in coordination when developing an infrastructure, it will become extremely difficult to obtain his/her consensus when the infrastructure ages and needs to be rehabilitated/improved.

It is also important that the coordinator is socially trusted, and that the content of the IWRM coordination is justifiable to all relevant stakeholders and society. Thus, ensuring transparency through proactive information dissemination is one of the coordinator's most important responsibilities.

Moreover, collaboration with sectors other than those related to water could enhance IWRM coordination. Land-use management is a good example. For example, land and water resources can be utilized more efficiently by ensuring consistency in river improvement through urban or agricultural land-use planning, and developing roads or agricultural infrastructure simultaneously. By establishing the possibility of coordination with sectors other than water sectors, the coordinator will be able to gain the trust of other water users.

# 3. Key for Success in Implementing IWRM

## - Practical Guidelines for Irrigation Practitioners

A 'Key for Success' is a key that can be used in practice to help make IWRM succeed. It is a key to establishing breakthroughs in potentially challenging situations or to opening the door to better IWRM. It provides tips and clues for making progress in the IWRM process.

Many of the keys for success have been proven in practice. Some are generic, in other words, apply to successful example of IWRM; others may apply only to specific situations, and some may not be in place as yet.

IWRM planning and its implementation, whether regarding development of an infrastructure or the establishment of an institutional or legislative framework, typically follow the process indicated below. Readers can either follow the process, or jump directly to the phase that concerns them to identify specific solutions to problems or issues.

Although this chapter chiefly concerns irrigation, it also mentions drainage issues in relation to irrigation.

It is recommended that the keys for success detailed in Part 2.1 of 'The Guidelines for IWRM Coordination' be referred to in situations where the agricultural sector needs to play a leading role in implementing a new IWRM.

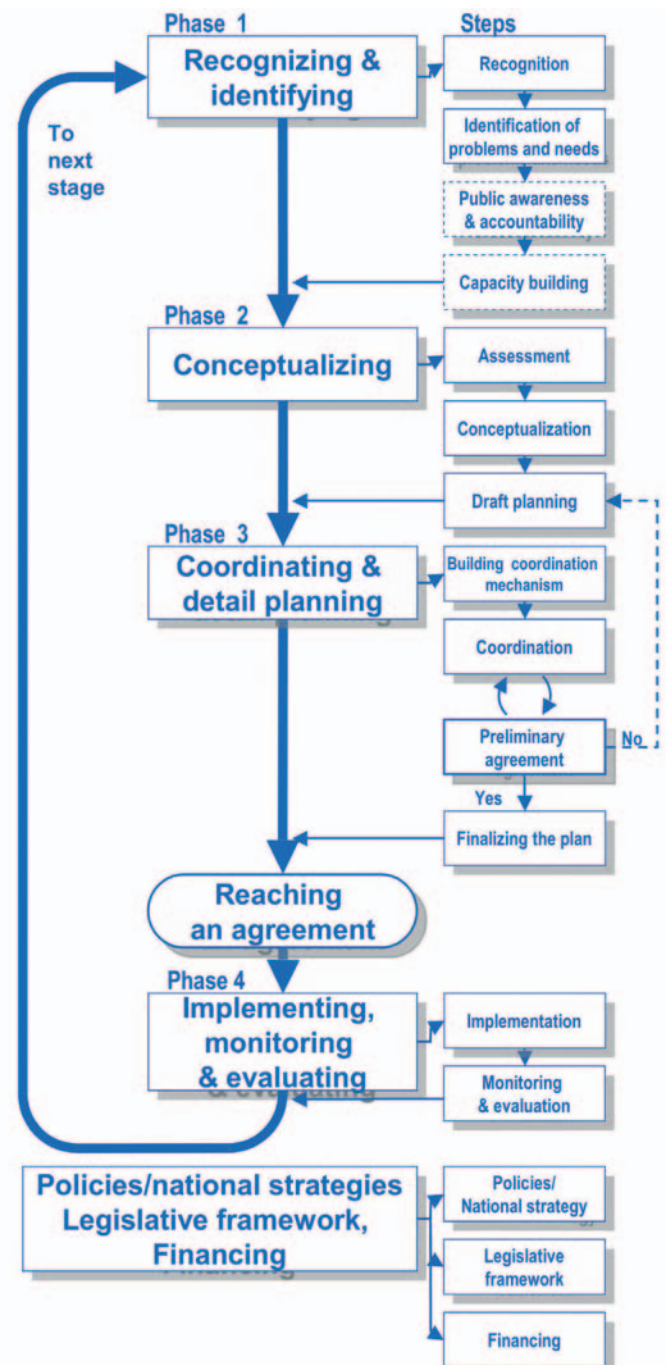


Fig. 3.1 Typical IWRM Process

## 3.1 RECOGNIZING AND IDENTIFYING

The important part of this phase is to ‘recognize’ the need for IWRM and to grasp the overall picture of existing issues in the basin. Things to note in this phase are:

- Do you understand the needs and problems? Are you in need of IWRM?
- Are you aware of past evaluation results and the current situation?

### 3.1.1 Recognition

#### 1.1.1

Be aware that your agricultural water use is related to water resources in the basin, and increase of your water use influences the overall balance of relationships among water users in the basin.

If the scale of your agricultural water use is relatively small, then it may only depend upon water resources in the limited local area. However, if water use exceeds a certain level, then it will affect the water resources in the basin in some manner.

At a larger scale, approaches have been developed to change the amount of water used in basins in response to farmers’ demands to resolve water shortages, and new agricultural national policies intended to increase food production. These approaches – additional water resources/newly constructed water intakes etc. – represent the same relationship to water resources in the basin. The situation is also the same when agricultural water use is scaled down.

If the agricultural sector depends too much on river water, there are consequent impacts on other farmers downstream/water uses or intakes of other sectors, the ecology of habitats and the river environment, and water quality in the river downstream. In

the case of dam construction, the impacts will affect all water users downstream of the dam to some extent.

Moreover, increase of agricultural water use brings about an increase of discharge from farmlands, in other words, an increase of water released into the downstream river. The resulting changes from these discharges also impact all downstream users.

Other farmers/sectors may point out the impacts caused by changes in agricultural water use, and call for resolution/mitigation of the problems.

Therefore, it is necessary to identify and quantify problems and analyse alternatives and compensation. It is also necessary to share information among project planners, beneficiaries (farmers), and the public administrations that will pay the cost.

#### 1.1.2

Be aware that water use by other sectors and other users in the agricultural sector in the basin will have an incidence on your agricultural activities. Change in water use by them will affect the balance in the relationship between your agricultural water use and the water resources.

Water use by other sectors and other agricultural users in the basin, whose use of water exceeds certain levels, will have already affected your agricultural water use in some way. Additional water use planned by other sectors, for example, newly developed water resources as a result of dam construction or newly

constructed intakes upstream, will change the relationship to the water resources in the basin. Commitment to new water resources management due to changes in the basin will therefore be an inevitable part of your agricultural water use.

### 1.1.3

Be aware of the necessity for coordination and cooperation with other sectors to solve conflicts resulting from an existing or changing water resources management framework in the basin.

Coordination in the basin is necessary as change occurs, whether or not this is your own initiative. It is important for the agricultural sector to recognize

that it can gain advantage or minimize disadvantage by actively cooperating and coordinating with the other sectors concerned.

## 3.1.2 Identification of problems and needs

### 1.2.1

Identify the problems to be coordinated with other sectors in the basin concerning your agricultural activities. A future view of agriculture in the whole basin should also be presented at the same time. Possibilities and issues for cooperation/competition over water utilities in the basin with others in the agricultural sector or other sectors should then be clarified.

Agricultural potential (resources) and the possibility for its improvement should be clearly identified with a focus on problems to be solved.

A survey should be conducted on the current condition of agriculture including farmland, water resources, meteorology, marketing, farm roads, and farming patterns, as well as abstract problems concerning water utility including maintenance and management. Water resources and a water use plan should also be considered. Problems relating to coordination with other sectors in the basin should then be extracted.

A future vision of agriculture in the whole basin should be foreseen with an associated analysis of the agricultural condition of the targeted and adjacent regions. It is important to consider whether effective agricultural activities can be achieved through the devel-

opment of facilities and introducing proper farming methods either jointly or in cooperation with such adjacent regions. Furthermore, taking social demand into account, reformation of water use involving other sectors – including harmonization of the natural environment – should be considered alongside an examination of effects and impacts on the water use system in the basin.

For example, in cases where there is an apparent conversion or degradation of cultivated/irrigated agricultural land in urban areas and suburbs, a severe demand for urban water, and the possibility of achieving more efficient water use in irrigation systems, a certain amount of agricultural water may be converted to urban water by functional improvements in the irrigation system.

### 1.2.2

Consider stakeholders, areas, and timing for coordination.

Stakeholders and areas for coordination should be identified by following the process mentioned above and identifying the scale of project. In the case of developing water resources through the construction of dams, a number of stakeholders including river administrators and other sectors should be involved.

A check should also be made to see if the plan matches higher-level agricultural strategies/plans and plans of other sectors. Moreover, such sectors should be involved at the earliest possible stage.

## 3.1.3 Public awareness and accountability

### 1.3.1

Consider whether or not problems to be coordinated with other sectors are shared within the organization, whether the principles to solve them are fully supported, and whether they are open to compromise to some extent.

Agricultural areas in which water management is implemented jointly may have in the past experienced water conflicts between villages, on opposite sides of river banks or between upstream and downstream users. These disputes may re-occur depending on the results of coordination. Before coordinating with other sectors, potential internal problems such as current water use conditions in the area, historical background, interests and rights and power struggles

inside the sector should be discussed and acknowledged by members in the sector.

Furthermore, it is important to discuss beforehand to what extent members in the sector can make compromises or how water value can be evaluated etc., in the event that compromise seems to be inevitable during the course of coordination.

### 1.3.2

Consider whether or not the problems and their solutions are considered to be socially fair and accepted by society.

Consider if the agricultural plans, and the problems pointed out by other stakeholders/sectors and their solutions/alternatives/compensations are justifiable and reasonable from the viewpoint of both the agricultural party and the third party, as well as in terms of legislation. Analyse reasonable sets of solutions in terms of equity.

It is necessary to create mutual understanding with other stakeholders by sharing information. Always try to disseminate concrete actions, such as how agricultural water is used and managed and how it contributes to the region. Otherwise, the agricultural sector may be criticized for being inflexible, and wasting its time on internal matters and domestic disputes.

### 3.1.4 Capacity development

#### 1.4.1

Develop the capacity of a leader who can recognize problems, find necessary solutions, and implement them.

- An irrigation practitioner as a coordinator among many stakeholders requires a leadership role. Leading a coordination effort requires a good understanding of the standpoints of individual stakeholder groups while keeping sight of the overall picture. One important ability of such a leader is the skill to recognize problems and find necessary solutions.
- When an agricultural sector coordinates with other sectors, the irrigation practitioner as a coordinator is required to have an appropriate understanding of the problems faced by each sector, and an extensive knowledge and understanding of the basin. However, knowledge alone is not enough. Ample experience, the ability to understand diverse perspectives, and the willingness to learn and gain wisdom backed by knowledge and experience are needed as well.
  - It is important to first learn as much as possible from previous examples, by visiting and studying basins that have experienced similar situations. Talking with people with a wealth of experience leads to greater knowledge and insight, turning those experiences into your own. This helps build quality as a leader.
  - Personnel exchanges between sectors to gain deeper knowledge and know-how of sectors operating in the basin or exchanges with other river basin organizations can also be effective ways of building capacity.
  - Training programmes should be hands-on and practical, enabling trainees to experience as many life-based situations as possible. On-the-job training can also prove useful.
  - Actively participating in related meetings and training is desirable as it broadens specialist knowledge.
  - Make use of international capacity development initiatives for river basin organizations.
- IWRM coordination is a human-intensive effort, and requires the capacities as well as the motivations of those involved. Thus, appropriate forms of incentives should be considered as part of a multi-faceted approach. It is important that the value of involvement in IWRM activities is recognized and that there is an accompanying sense of fulfillment or satisfaction.

## 3.2 CONCEPTUALIZING

The point of this phase is to understand the overall structure of the problem and conceptualize future actions. Things to note in this phase are:

- Is it in line with social demands?
- Is it well balanced?
- Do you understand the constraints, and are you exploring 'what you can do?'

### 3.2.1 Assessment

#### 2.1.1

Collect the information necessary to establish the relationship between a new vision of your own agriculture and the water utility.

Firstly, it is necessary to recognize the direction your form of agriculture will take. For that purpose, prepare an agricultural plan utilizing fundamental data,

such as what crops should be grown and how and who will grow them, farmers' motivations, market needs, accessibility to the market, and so on.

### 2.1.2

Collect the required data on water resources management including information on other sectors in the basin.

Grasp basic characteristics such as the boundary of the basin, precipitation, discharge, flow rate, water quality, ecological aspects etc, and collect data on current conditions of water intake/use, existing water regimes and proposed or potential water-use plans in the area for coordination. In parallel with this, collect information on the historical back-

ground of the region/basin with a focus on existing water rights.

Then, conceptualize the target area, the water-use method, the water resources development plan and point of intake etc. and identify problems for coordination.

### 2.1.3

Always keep eyes, ears and mind focused on the real situation in the field.

- Focusing only on text and numerical information prevents you from identifying potential issues and real needs. Building field knowledge through frequent site visits improves one's ability to validate data or analyse results.
- Direct information obtained on-site can provide a great many insights into ways to solve problems. For example, the condition of ageing or deteriorating facilities is easier to see rather than determine from numerical data or photographs.
- In order to ensure the validity of information obtained on-site, more than one person at a time should conduct site investigations, as individual persons may interpret the same information differently.

### 2.1.4

Conducting interviews with relevant people/sectors can prove effective.

- Conducting interviews as part of an assessment is quite effective for identifying problems and possible solutions in the river basin. It is important to think and act noting that it is an initial contact with the stakeholder, and coordination has already started at this point.
- When conducting interviews, it is important to obtain advance information about the person to be interviewed, including their position, what sector group he/she represents, their interests, etc.
- It is important to select an appropriate person to meet, who can provide you with the information you need. For example, if you need information regarding operational issues of water resources management in the river basin, meet with an officer working at field level rather than a high-level official in the organization. It should be noted, however, that contacting personnel at the field level directly may cause distrust of the partner organization.

## 2.1.5

Investigate the existence of farmers' groups such as water user's associations, whether or not it functions properly, and how well the relationship between the farmers' group and other sectors/stakeholders has been working.

There are a number of farmers' associations and coordination mechanisms among farmers. Such existing organizations or frameworks can be utilized in solving problems depending on the scale and type of the problems. When developing a new agricultural activity, it is necessary to consider the establishment of a farmers' organization. It is advisable to investigate in advance the relationship between farmers' orga-

nizations and other stakeholders/sectors, for example, farmers in the downstream area of the river, the domestic water-use sector, and municipalities.

On the other hand, the establishment of a farmers' organization within the area where new collective irrigation farming has been developed should be considered.

## 2.1.6

Make effective use of conventional technologies and methods applied in the basin or the region.

There are many cases in the agricultural sector where conventional technologies and methods have been applied in the targeted region. These present certain advantages; their applicability and stability has been assured over a long time, rules regarding water distribution and sequence of drainage are operational, and practical and effective use can be made of materials easily obtained in the region. It is necessary to consider applying such technologies and methods to new irrigation plans

to make operation and maintenance both effective and practical.

A fair and appropriate level of technology for the region or for the socio-economic condition must be applied both in terms of software and hardware in order to effectively implement IWRM. To this end, it is important to be aware of the technologies used in the basin and region, and to share this information among relevant sectors.

## 2.1.7

Adopt new technologies applicable to the river basin or region.

- IWRM activities in the basin can be enhanced through the adaptation of new technologies. New technologies can include technologies for collecting or analysing more accurate data, or for more precise facility operation. Adapting new technologies, knowledge and creative ideas helps secure and improve the management of water resources.
- It is important to make efforts to collect information on new technologies and knowledge. At the same time, it is necessary to examine the applicability of existing technologies in the basin for IWRM-related survey, design, construction and management.
- When introducing new technologies to replace a conventional method currently used, it is necessary to examine the benefit and cost of applying such technologies including their future feasibility.
- When examining the application of new technologies, it is necessary to take into account maintenance requirements. If facilities or devices introduced are made overseas, repairing or obtaining spare parts may be costly or difficult. In such cases the introduced facilities or devices may not be able to fully function as originally expected.



### 3.2.2 Conceptualization

The 'conceptualization' step is particularly important in the IWRM process.

#### 2.2.1

Try to search at an early stage for cooperative work with other agricultural projects or other sector's projects that have similar concepts to the IWRM your own agricultural sector intends to improve.

It is advisable to research the possibility of coordinating with other stakeholders in the agricultural sector and other sectors. Proactive exchange of information

and cooperation between stakeholders/sectors is necessary in order to construct a joint IWRM plan.

#### 2.2.2

Try to set up an organization composed of other sectors sharing similar concepts to IWRM, to promote a specific project or plan.

It is advisable to set up a promotion committee comprised of related sectors and stakeholders to promote specific projects or plans. This can be effective

in sharing information among organization members and unifying intentions.

#### 2.2.3

Clearly define the agricultural sector's standpoint when you start the coordination process.

1. You should observe carefully whether or not the coordination mechanism is favourable to the agricultural sector's interests, and satisfying to the sector when coordination is left to other persons/organizations.
2. You should make your position clear beforehand as to the following items when starting the coordination process:
  - 1) The kind of agriculture you want.
  - 2) The amount of and quality of water you need/want.
  - 3) Where is the water and how to secure the use of it?
  - 4) The kind of agriculture that is possible considering the available amount of water.
  - 5) The value of the water.

#### 2.2.4

Consider whether or not members in your own group, partners or the coordinator agree on the direction of coordination.

The coordination process and plan should be examined to ensure that they are well balanced and that consensus can be reached from three viewpoints: the

agricultural sector, partner sectors, and other sectors. Consensus will not be reached among these actors if the plan is biased towards a specific purpose.

### 3.2.3 Draft planning

#### 2.3.1

Confirm the future course of your own agriculture, taking into account restrictions of time, degree of satisfaction, and consideration of the natural environment.

Because the agricultural water system is open to its surroundings, it has a relationship to its surrounding natural environment to a certain extent. A basic plan along the following points should be clarified and strengthened, taking into account the condition of regional resources. The plan should also broadly and carefully examine the impact on the natural environment as an ecosystem, alongside its performance from the point of view of multi-functionality.

1. Examine and outline a future course of agriculture and its goals and potentially available resources.
2. Prepare a draft plan for a project area, water resources/water utility, location and method of water intake, and so on.
3. The above items should be decided upon after consideration of costs and benefits, time limitations (aiming too high risks loss of control of coordination), and these should then be balanced alongside related matters.
4. Consider a staged development plan if present social and economic conditions are not sufficiently mature.

### 2.3.2

Draw up possible implementation plans beforehand.

At this step, it is advisable to examine and clarify the basic framework of the implementation procedure for enforcement of the plan, taking into account the term of project implementation, the implementation body for construction and O&M, applied laws and legislations, provision of funds, and so on.

However, the concrete procedure should not be fixed firmly at this juncture, as flexible counter actions

might be necessary in the following coordination process with the stakeholders concerned.

For example, with regards to the implementation term, a case can be made for getting more benefit by re-setting the implementation term in the light of progress of the coordinator's or joint stakeholders' planning and coordination process.

## 3.3 COORDINATING AND DETAIL PLANNING

The aim of this phase is to finalize concepts formulated in Phase 2 into a detailed plan and, coordinate with stakeholders towards reaching an agreement.

- Is transparency secured (satisfying to the reason)?
- Are stakeholders convinced (satisfying to the heart)?
- Is it socially fair (satisfying to the law)?

### 3.3.1 Building a coordination mechanism

#### 3.1.1

Pay attention to the coordination mechanism whether or not it properly reflects claims by the agricultural sector, particularly when your own agricultural sector is in a coordinated position.

If the agricultural sector leaves coordination to a third party, you should examine whether or not the third party is a reliable organization/person; members of participating coordination mechanisms are appropriate.

You should also confirm whether or not the representative from the agricultural sector, government/local government department in charge of agriculture are eligible and entitled to be members of the coordination mechanism.

### 3.3.2 Coordination

#### 3.2.1

Ensure that the new plan is coordinated in a well-balanced manner for all stakeholders concerned, such as your own agricultural sector, other stakeholders in the agricultural sector, and other sectors.

Understand and share the sector plans and financial conditions with other stakeholders in the agricultural sector and other sectors, and establish relationships between your own plan and other sectors' plans.

Discuss the progress and priority of the plans, and the possibility of making a joint project plan with the par-

ties concerned after understanding and sharing the information mentioned above.

Then, decide on a draft plan after all parties concerned agree upon each sector's priority and conditions.

#### 3.2.2

Examine a new plan objectively as to whether it is supported unfairly only for the sake of the agricultural sector, or also ensures social equity.

Securing transparency is indispensable for the smooth implementation of the plan, ensuring doubts are not raised regarding the planning process, and maintaining

compliance. Consensus will not be reached if the plan is biased towards specific stakeholder group(s).

#### 3.2.3

Examine the new plan to see whether or not a contribution to IWRM by your own agriculture is properly evaluated, and appropriate incentives to join the coordination process that are suitable for regional conditions have been introduced.

In a river basin where water use is almost stretched to the limit, limitations on water use are necessary to secure additional uses of water. However, reaching an agreement without incentives for the limitations, such as facilities improvement, or direct compensation for transferring water, is difficult.

Incentives must be appropriate to local conditions, taking into consideration social and economic situa-

tions, local history and culture, etc. They must also be applied in a fair and transparent manner to everyone in the basin.

It is necessary to appeal for a proper appreciation of the agricultural sector's contribution when tackling the task of re-organizing farmers' water use as this may possibly lead to future difficulties and burdens within the agricultural sector.

#### 3.2.4

It is advisable for water users to prepare an arrangement for water use during drought periods beforehand.

Under circumstances when difficulties with stable water supply due to droughts etc. can be easily predicted, it is necessary in advance to consider coordination on how to use water effectively among water users before the available amount of water declines.

Therefore, it is desirable to prepare a system for cooperation and a plan for securing water in exceptional circumstances. In the event that such a system is difficult to set up, an agreed rule among water users

regarding the point at which negotiation of a drought measure plan based on water allocation and corresponding load/responsibility will start can be helpful.

It is advisable to introduce a necessary system or framework to ensure that the agricultural sector has adequate incentives for its difficulties and burdens so that flexible use of water among sectors during drought periods can be achieved.

### 3.2.5

Consider extreme events such as disasters from the viewpoint of risk management.

Prepare a framework in advance for coordinating the amount of water use among water users for cases when available water resources become limited due to disasters and water quality accidents. It is advisable to take into account a system for flexible use of water and a method for securing water in exceptional cases.

There are two categories of such events. One is related to human activities, such as a water pollution

accident, which will influence a specific area/users. The other is a natural phenomenon, such as a large-scale earthquake, which may cause severe damage across the whole basin. Countermeasures should be considered according to each category.

It is also necessary to confirm that the new plan aligns with the flood management plan prepared by the flood management sector.

## 3.3.3 Preliminary agreement

### 3.3.1

Explain the preliminary agreement to stakeholders within the agricultural sector in advance to ensure their agreement and support.

It is necessary to hold discussions among the various stakeholders in the agricultural sector as to whether the agricultural plan is satisfactory, whether it is agree-

able to the other sectors, and to reach a consensus on the agreement before finalizing the agreement with other sectors.

### 3.3.2

Examine the content of the agreement to see if it might present additional problems in the future, even if it seems agreeable at present.

Consider if the prerequisite conditions of the plan under process of agreement would alter as a result of economic changes in the near future, rising population or an ageing generation, and variation in the water

resources situation in the basin related to climate change, etc. Then consider if the agricultural sector would be influenced when the prerequisite conditions shift.

### 3.3.3

Secure social equity and transparency.

- Lack in social equity and transparency in a plan or in a planning process will bring about dissatisfaction among stakeholders even after the agreement, and will not be able to fulfill public accountability.
- Securing social equity requires not only consensus among stakeholders but also that the result of the coordination during the planning or implementation phase is acceptable to the public and society as a whole.
- Ensuring transparency and accountability is indispensable for avoiding any skepticism of the plans or the decision-making process and for smooth implementation of the agreed plan.

### 3.3.4 Finalizing the plan

#### 3.4.1

Confirm matters and issues necessary to implementing IWRM among relevant stakeholders by preparing documents accurately and fairly.

When finalizing the agreement, you should confirm necessary matters and issues in the form of a written document among the relevant stakeholders.

#### 3.4.2

Determine that cost allocation is acceptable not only to the agricultural sector but to all stakeholders by ensuring that it is justifiable and that the nature of the plan is appropriately accounted for.

What is the main target of the plan? The characteristics or the main options of the plan must be considered. This might include a plan targeting additional domestic water supply for rapid increase in urban area, or a plan targeting environmental conservation, etc. Cost allocation may not be formulated uniformly but must be justifiable in each plan.

It is also necessary that the method of allocation be acceptable to the public.

The basic rule of cost allocation (for example, priority of use method, separable cost-remaining benefit method), and fine-tuning to finalize the share balance should be coordinated and agreed between the stakeholders concerned.

Sometimes stakeholders do not bear the cost (for example, the individual farmer). In such cases, those who shoulder the cost should be considered as stakeholders in the coordination of cost allocation. For example, a local government representative should be involved to represent the share of government subsidy.

In cases where the government pays all costs for project implementation beforehand and requests each user to amortize a part of the cost after completion of the project, it is necessary that the government explains the cost sharing plan and the estimation of the total amount of the amortization, and reach agreement in a documented form.

### 3.4.3

Consider the environment and preservation of the ecosystem in planning and designing the project.

At times when the environmental sector is not represented and the agricultural sector needs to act as the coordinator among sectors, the agricultural sector should accept the responsibility of environmental

preservation as part of agricultural sector's responsibilities. During coordination with other stakeholders, the agricultural sector should act as the advocate of environmental preservation.

### 3.4.4

Develop infrastructure with an eye to long-term sustainability.

- If the developed infrastructure is not maintained properly, it will not be able to sustain the intended functions, and the investment made will have been wasted. It is necessary to integrate the concept of 'time' into infrastructure development, i.e. account for operation, maintenance and replacement for long-term sustainability of the infrastructure.
- Ensure discussions among stakeholders take place regarding the planning and designing phases of the infrastructure to ensure the sustainable and appropriate maintenance of the infrastructure. Take into account the necessary frameworks and human resources for everyday operation and inspection, fail-safe measures, and the required stock of replacement parts.
  - o It is necessary to promote infrastructure development/maintenance by taking into account the life-cycle cost. Introduce appropriate asset management through such measures as rehabilitation of ageing infrastructure.

## 3.4 IMPLEMENTING, MONITORING AND EVALUATING

The aim of this phase is to implement, develop, manage and operate the agreed scheme or framework (including infrastructure development or establishment of legislation or institutional framework). Things to note in this phase are:

- Is the implementation programme executed promptly?
- Is the system adapted and functioning?
- Are there any new problems with the new approach/scheme?

### 3.4.1 Implementation

#### 4.1.1

Strive to realize the benefits of the project early.

- In cases of infrastructure investment, efficient financing and early completion of the project is essential in order to realize early benefits of the project and to ensure investment efficiency. Fiscal policy and financing should aim for early completion of the project.

- Prioritize budget allocation based on the urgency and cost effectiveness of the projects.
  - For example, a dam construction requires significant funds in the few years before the completion of the project. It is important to develop a budgetary plan that allows for intensive financial allocation in those years.
  - If multiple facilities, such as dams, weirs, channels or treatment plants, are to be constructed to deliver new water services, ensure that the construction and financing schedules allows facilities to be completed and commissioned in a consistent manner.
- It may be difficult to make users pay for the construction of facilities prior to completion of the project or before users recognize the benefit of the project. It is advisable to prepare a system whereby the project executing body makes an advance payment for construction of the facility and then receives payment from users following project completion through collection of fees.

#### 4.1.2

Establish a structure for operation, maintenance and management, and prepare a fund raising system for it.

From the project planning stage, consider and set up the maintenance and management plan for securing the institution and human resources for daily operation, maintenance and inspection, and repair/renew accordingly. Then, establish a structure and prepare a fund arrangement system for management at the beginning of the operation.

Participatory Irrigation Management (PIM) is a system that has been introduced in many countries worldwide to reduce the cost of irrigation management and secure new investment for infrastructure renewal/replacement. Under the PIM system, instead of government organizations, farmers themselves – as the actual users of the irrigation system – actively contribute their efforts to maintain and manage the irrigation system.

When maintenance-based organizations differ from construction-based organizations, it is difficult to reflect the problems and challenges during facilities management to the construction design.

Furthermore, it can be difficult to create an atmosphere of ownership in an operation, maintenance and management organization.

It is desirable that the organization responsible for operation, maintenance and management carry out construction of the facilities. The better the preparation of the construction design, the smoother the implementation of facility management.

#### 4.1.3

It is advisable to prepare an institutional framework to aggregate experience and knowledge obtained through construction/improvement or operation/maintenance of infrastructure in and out of the basin.

- Experience and knowledge gained through construction/improvement or operation/maintenance (O&M) of an infrastructure are extremely valuable for construction/improvement or O&M of other facilities. If such experience and knowledge is not aggregated or shared it will eventually be lost, which will be an enormous social and economic loss.

- Needless to say, infrastructure construction/improvement or operation/maintenance conducted in the basin must be appropriate for the basin's situation. At the same time, the information used can also be useful for infrastructure development in other basins. Alternatively, obtaining information regarding infrastructure development or O&M of infrastructure in other basins can usefully enhance

infrastructure development or O&M in your own basin and improve the quality of the services delivered. Thus, it is advisable to prepare an institutional framework to aggregate experience and knowledge obtained through construction/improvement or operation/maintenance of infrastructure in various basins.

### 3.4.2 Monitoring and evaluation

#### 4.2.1

Monitor and evaluate the new IWRM system introduced based on the plan, whether or not it achieves the agricultural objectives intended.

Verify that the new IWRM system can meet the agricultural objectives. Undertake continuous monitoring and evaluation from the viewpoints of economical and social effect, environmental conservation and sustainability, fairness.

The results of the evaluation should be used to improve aspects of the system that are less effective, and for materials to change the activities.

Because the method and system of evaluation must be objective and fair, it is desirable that a standard,

socially recognized evaluation system be prepared in advance.

- In the early stages of operation in an irrigation project, it is necessary to evaluate the adaptability of the new scheme and examine whether the initially expected benefits and functions have been fully realized. Based on the results, make adjustments or revise as necessary. It should be noted that some activities or projects do not provide apparent benefits in the short-term.

#### 4.2.2

It is advisable to share the data (for example, the volume of water utilization) among stakeholders, and disseminate it to the public.

Without continuous data collection, it is impossible to evaluate present status and forecast future conditions.

It is advisable to share data among stakeholders to maintain a good relationship with them.

Sharing data also enables smooth coordination of water use during drought. It is vital that individual stakeholders make decisions and act based on shared information, in order to ensure the integrity of the various activities.



## 3.5 POLICIES/NATIONAL STRATEGIES, LEGISLATIVE FRAMEWORKS AND FINANCING

The rest of this section includes keys for success, which are useful for readers concerned with policies/national strategies, legislative frameworks and financing, but are also important throughout the entire IWRM process. Things to note in this phase are:

- Can you move ahead with just the consensus built among stakeholders or do you need a formal framework?
- Are you working bottom-up to influence the national or higher level organizations?
- Do you have financial sources in mind?

### 3.5.1 Policies and national strategies

#### 5.1.1

Act to encourage the importance of water resources management at basin level. Coordination among all sectors in the basin should be addressed in agricultural policies and strategies.

The percentage of water utilized by agriculture is relatively large in terms of basin water resources. If the agricultural sector maintains a stance corresponding to its political objectives and strategies, then conflicts in water resources utilization will take place and sustainable development of the nation will be threatened.

Water has diverse stakeholders. In general, sectors are managed under the jurisdiction of sectoral administrative institutions. In order to manage water well in the field and implement water projects, cross-sector cooperation is vital. Sometimes the agricultural sector is expected to take the leading role among sectors.

Actions requested of irrigation practitioners include the following:

- Practitioners who implement IWRM in the agricultural sector should act to reflect individual farmer's

voices in policies through grass roots activities. At the same time, he/she is required to emphasize the importance of IWRM.

- Practitioners are also requested to carry out national level plans and international strategies as part of their tasks, disseminate the elements they think are necessary through political channels to policy makers, and recognize that part of their role includes promoting and reinforcing the connection between the field and policies.

Actions requested of nations and decision makers include the following:

- Take the opinions and suggestions of practitioners and stakeholders seriously, and makes sure they are reflected them in the creation of appropriate policies and legislation.

### 3.5.2 Legislative framework

#### 5.2.1

It is advisable to consider IWRM at basin level as a vital concept that reflects laws and regulations in the agricultural sector.

Since the share of agricultural water utilization in a basin is relatively large, the agricultural sector is sometimes requested to take on a leading role in IWRM

promotion. Although not necessarily stipulated in law, it is desirable to recognize that IWRM implementation is a basic form of legislation.

### 3.5.3 Financing

#### 5.3.1

Secure financial resources for IWRM coordination to promote irrigation plans in the basin.

- The financial resources required for coordination are not high when compared to infrastructure development. However, lack of understanding of the importance of IWRM can result in insufficient funds, which then prevent the introduction of IWRM or delay coordination and implementation. This can lead to enormous losses for the basin, society and, the environment.
- 
- Coordination efforts for consensus building, such as assessment of water resources in the basin, various studies and simulations, coordination for implementation, monitoring and evaluation, all require financial resources.
    - Coordination activities alone do not produce profit, and the effectiveness of the investment may not be obvious at the time of coordination. This has led to inadequate recognition of the importance of investing in IWRM implementation in many national and regional policies.
    - Implementation of IWRM delivers significant advantages to the basin and society. For example, constructing a multi-purpose dam rather than a single-purpose dam can result in massive cost reductions for the sectors involved.

This cost advantage is much greater than is the amount required for coordination.

- Irrigation practitioners need to inform policy makers of such benefits of IWRM in order to promote their understanding and awareness.
- Transparency is a key for coordination in the IWRM process. Funding from relevant sectors for coordination should be welcomed, but care must be taken in preparing the funding scheme to ensure that it does not lead to any bias in coordination or suspicion of bias among stakeholders.
- In any case, it is crucial to establish a scheme whereby financial sources are secured not in a temporary but in a sustainable manner.

# 4 IWRM Process

In this document, each stage of the IWRM process is described by four phases. The elements of the process related to all phases such as policies, legal framework,

and financing are indicated exterior of the process flow. Each phase is further explained through steps inherent in the process.

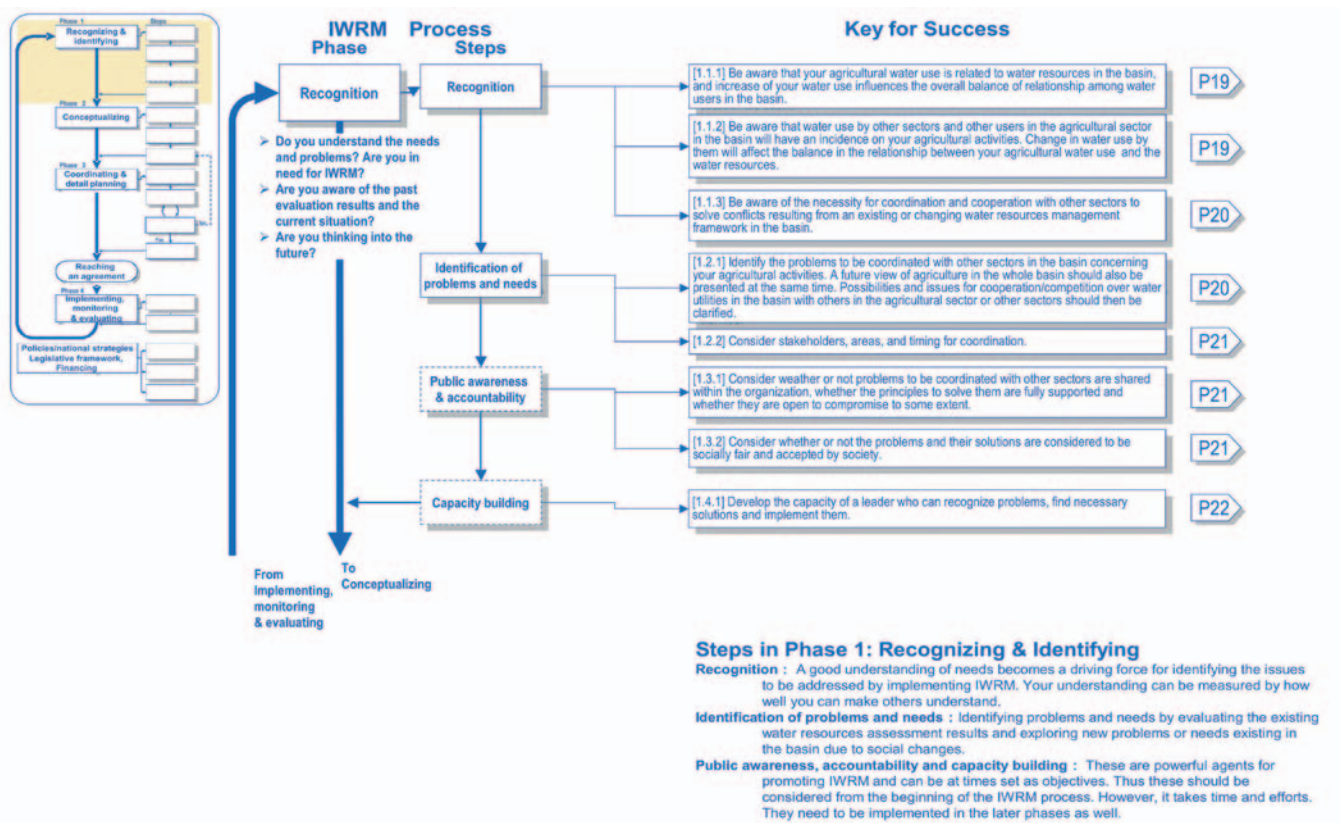


Fig. 4.1 IWRM Process (Phase I)

## 4.1 PHASE I: RECOGNIZING AND IDENTIFYING

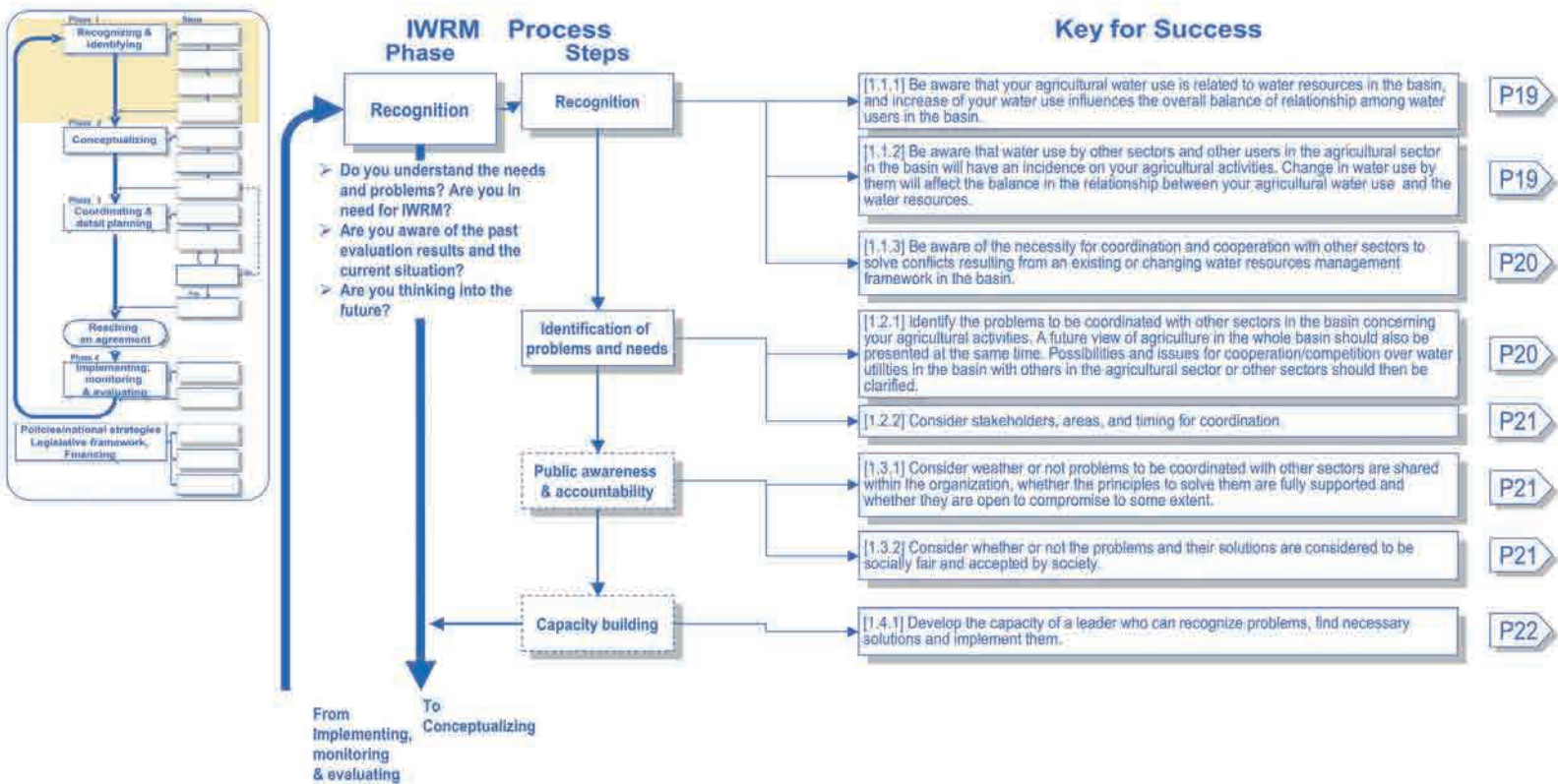


Fig. 4.2 Phase I: Recognizing and identifying

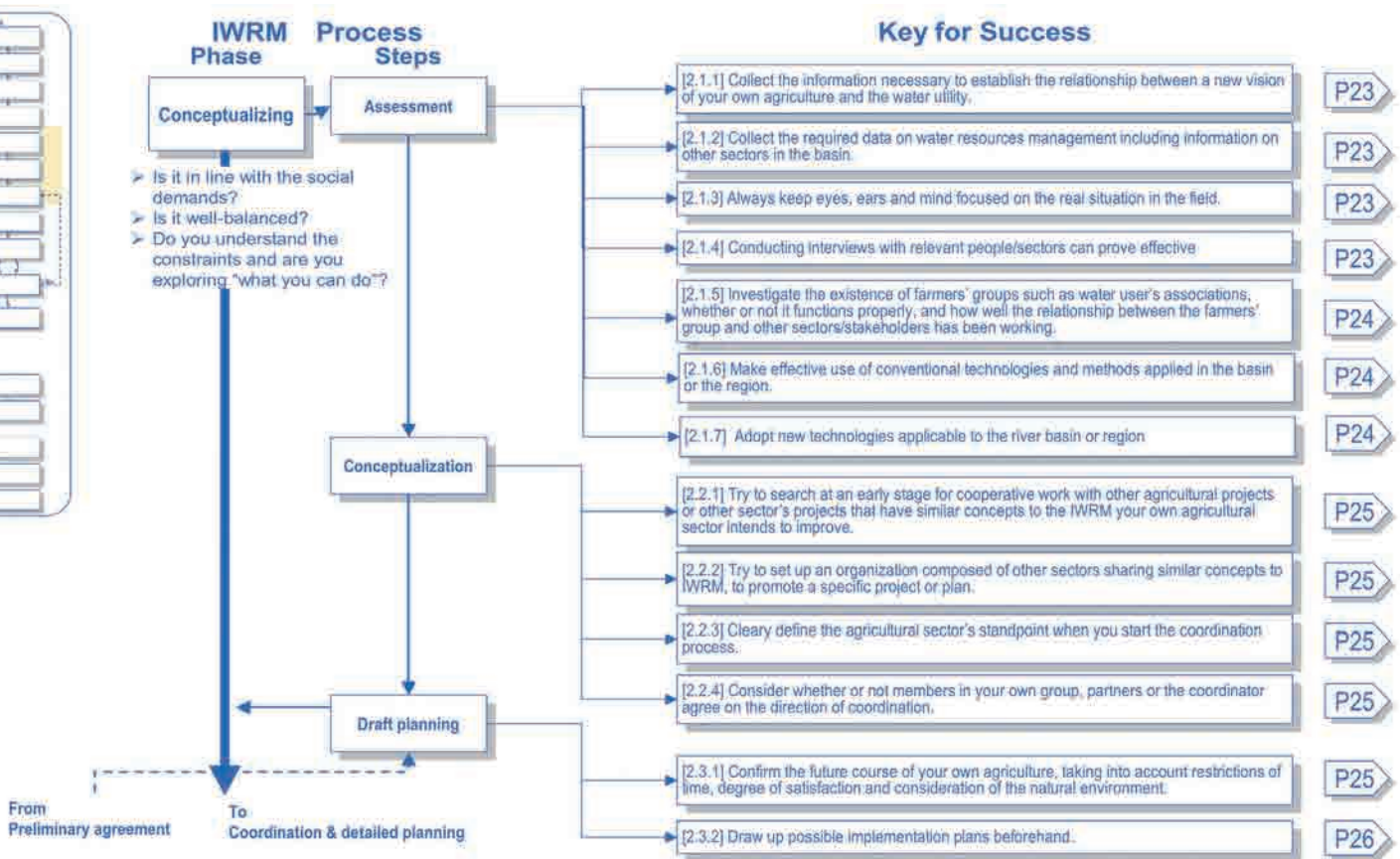
### Steps in Phase 1: Recognizing & Identifying

**Recognition** : A good understanding of needs becomes a driving force for identifying the issues to be addressed by implementing IWRM. Your understanding can be measured by how well you can make others understand.

**Identification of problems and needs** : Identifying problems and needs by evaluating the existing water resources assessment results and exploring new problems or needs existing in the basin due to social changes.

**Public awareness, accountability and capacity building** : These are powerful agents for promoting IWRM and can be at times set as objectives. Thus these should be considered from the beginning of the IWRM process. However, it takes time and efforts. They need to be implemented in the later phases as well.

## 4.2 PHASE 2: CONCEPTUALIZATION



### Steps in Phase 2: Conceptualizing

**Assessment** : Grasp the overall structure of the problem such as: 1) problems and needs, 2) natural conditions, and 3) human factors. Interactions with stakeholders have already begun at this stage.

**Conceptualization** : Consider the course of action and the relevant stakeholders and their relationships for tackling the problem based on the assessment conducted above. Conceptualize possible solutions.

**Draft planning** : Prepare draft plans based on the concepts outlined above. It is most important that multiple alternative solutions are prepared. In cases where coordination in phase 3 does not reach an agreement you may have to come back to this phase again. Carefully drafting proposed plans will avoid such impediment.

Fig. 4.3 Phase 2: Conceptualization

### 4.3 PHASE 3: COORDINATING AND DETAIL PLANNING

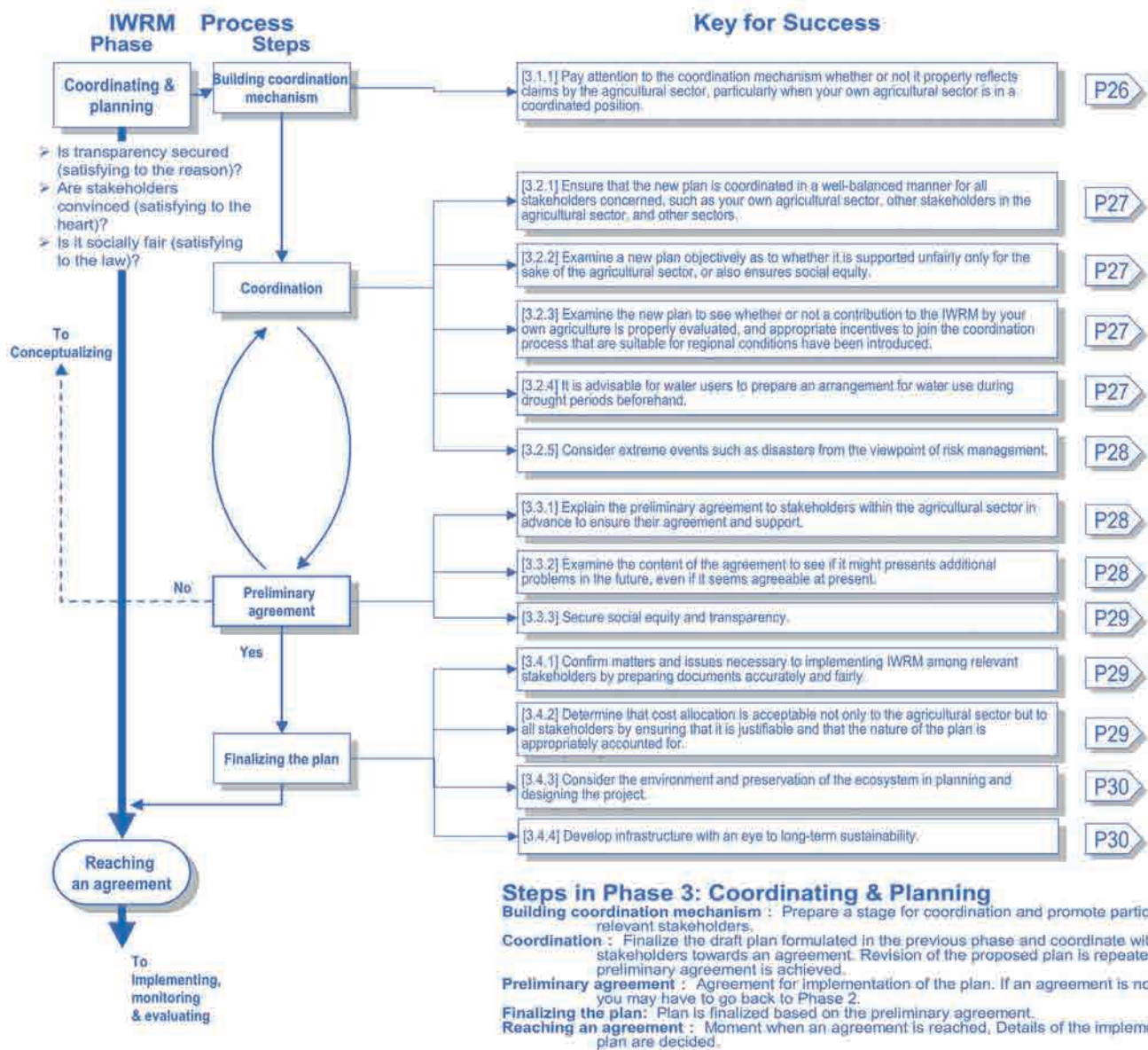
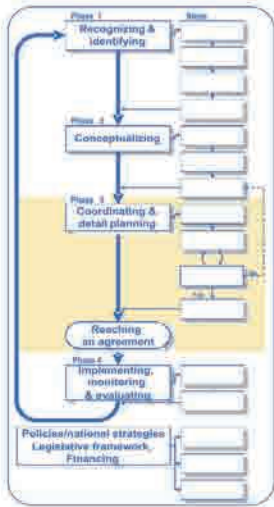
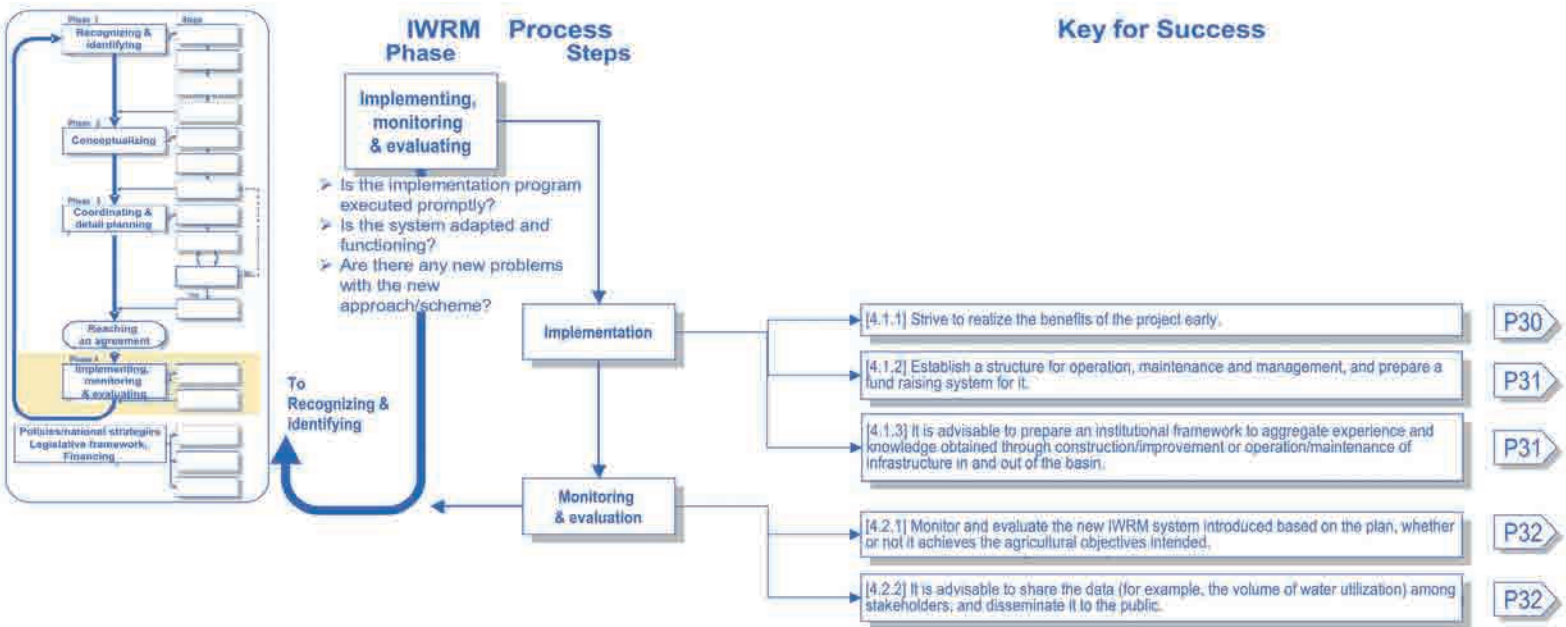


Fig. 4.4 Phase 3: Coordinating and detail planning



## 4.4 PHASE 4: IMPLEMENTING, MONITORING AND EVALUATING



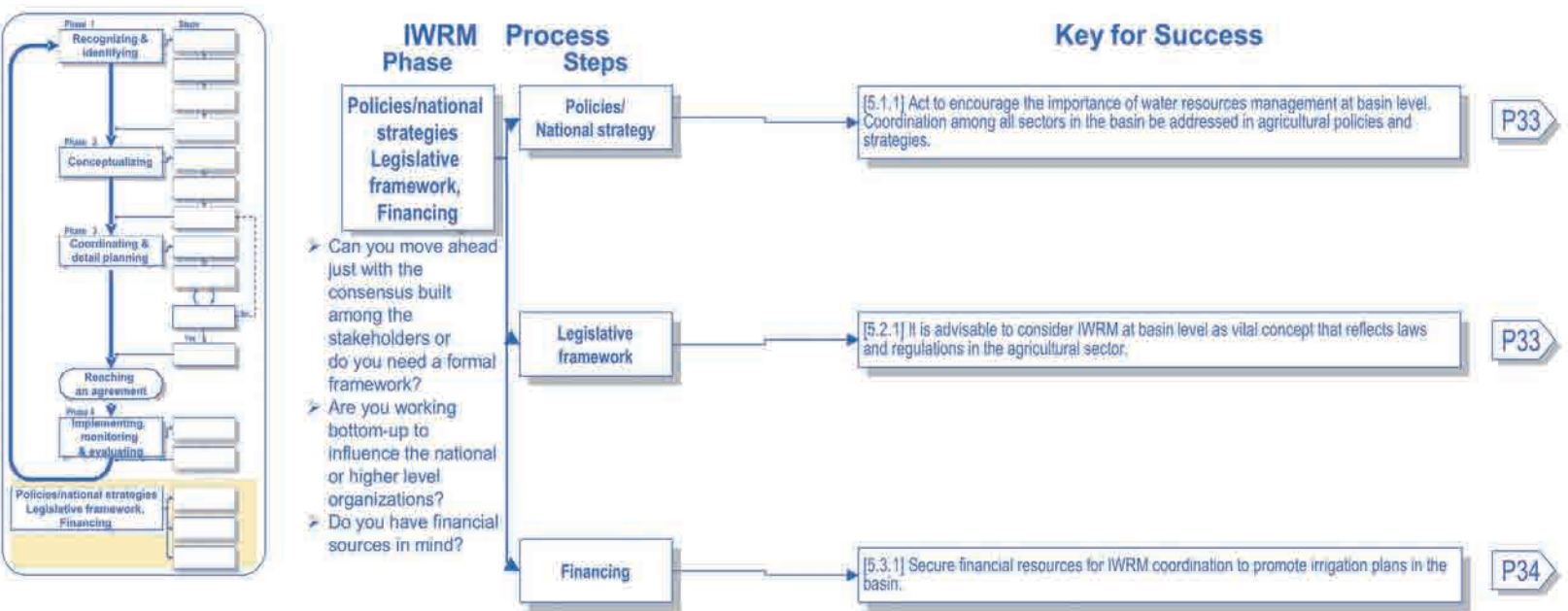
### Steps in Phase 4: Implementing, Monitoring & Evaluating

**Implementation:** Execute the implementation program and develop a new IWRM approach/scheme. For details of implementation procedures for infrastructure development projects refer to existing manuals for study, design and construction, etc. For establishment of institutional frameworks and organizations refer to existing IWRM manuals.

**Monitoring & evaluation:** Monitor and evaluate if the newly developed approach or scheme is functioning and watch out for any new problems.

Fig. 4.5 Phase 4: Implementing, monitoring and evaluating

## 4.5 PHASE 5: POLICIES/NATIONAL STRATEGIES, LEGISLATIVE FRAMEWORK, FINANCING



**Fig. 4.6** Phase 5: Policies/national strategies, legislative framework, financing