Themes for action

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Themes for action

Making water governance effective

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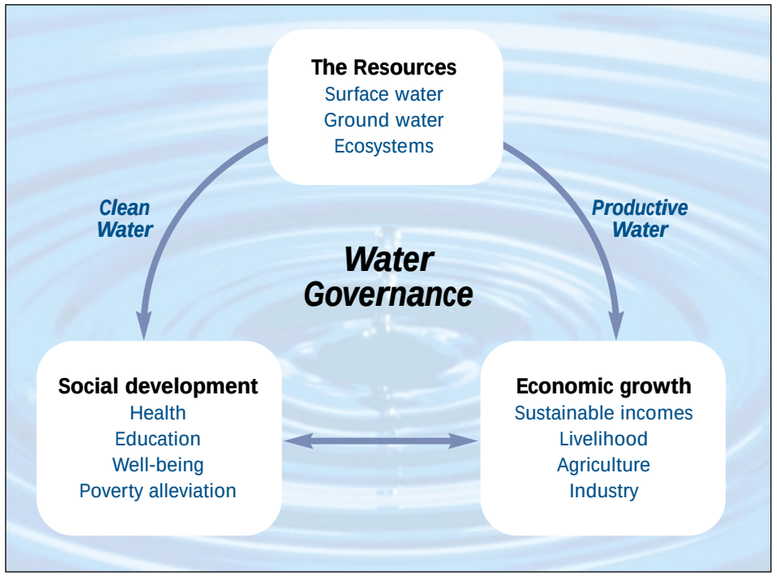
Making water governance effective

The water crisis is mainly a crisis of governance. The present threat to water security lies in the failure of societies to respond to the challenge of reconciling the various needs for and uses of water. The Vision can only be achieved if the institutions that determine the management and use of water resources are effective.

Water needs careful husbandry and management in order to serve humanity and nature renewably and sustainably. Protecting the resource and at the same time reconciling powerful, sometimes conflicting, social and economic demands upon it lie at the heart of water resource management. And *governance* lies at the centre of the tension and delicacy of balance between different water uses and their management.

> ***"Co-ordination of inter-sectoral water allocation is needed, with emphasis on demand management and enhanced stakeholder participation within the framework of comprehensive institutional reforms"***
>
> The Arab Countries Vision for Water



Good governance requires transparency and accountability, participatory mechanisms appropriate to local realities, needs and wishes, and respect for the law and contractual obligations. Good water governance exists where agencies of government allocate and manage water resources based on legitimate policies, laws and an efficient administration. Governance encompasses many interlinked social players and must be responsive to citizens' needs and to the long term sustainability of the natural resource base of the country and region.

To achieve the Vision at least 75% of all countries should put into place a process for enacting comprehensive policies and strategies for IWRM by 2005. The remaining countries need to do this by 2015. These targets should be agreed by governments as an essential means to the goal of global water security.

This chapter discusses governance under three headings:

- **Putting IWRM into practice;**
- **Promoting transparency and participation;**
- **Reform and development of institutional frameworks;**
- **Realigning economic and financial practices.**

Putting integrated water resource management into practice

The challenge is to work towards good water governance. In many regions and countries, the rules of water governance have to be changed and the performance of the players improved.

The key to effective water policy reform is the enactment of enforceable legislation that establishes the rights and obligations of all stakeholders, while retaining sufficient flexibility to adapt to changing circumstances. Such water policy reform must be matched to the capacity of societies to adapt to change. The presence of an effective legal and regulatory framework has been shown to act as an essential spur to private investment and the participation of the non-governmental sector (commercial and civil society) in water services.

The key to effective water policy reform is enforceable legislation which establishes the rights and obligations of stakeholders while retaining sufficient flexibility.

Political leaders and governments, both national and local, will need to:

- Create an enabling environment in which the goal of safe water and secure food and livelihoods for all can be achieved by sustainable means. This will require encouraging, creating and then integrating, large numbers of private initiatives (by individual water users – women and men – corporations, commercial business and civil society) and public sector initiatives (by local governments and public utilities).
- Establish the rules by which the transactions between the stakeholders take place. These should be participatory, transparent, gender-sensitive, clear and create trust.
- Take responsibility for water resources and establish institutional arrangements to manage and resolve water-related problems such as over exploitation of aquifers and many more.

In water policy reform there are no universal models and no universal timetables. Windows of opportunity are often the essential catalysts for water policy reform.

Integrated water resources management (IWRM) is an essential component of good water governance. IWRM has two dimensions. On the one hand, it consists of a common sense holistic approach to water that integrates hydrological, engineering, social and economic best practices – an approach accepted as desirable by most water professionals.

IWRM and the sector users

Windows of opportunity

In South Africa, the end of apartheid in 1994 enabled radical ideas and approaches to be embraced. Water policy reform and the introduction of new water laws were politically feasible as part of the realignment of rights and entitlements. The presence of a lawyer at the helm of the Department of Water Affairs and Forestry lent confidence to the process of legislative and regulatory reform. In Eastern Europe, accession to the European Union provides impetus to change. Many countries are drafting new water laws, often with help from the World Bank. The next action is to provide support to such countries so they can develop capacity and reform institutional structures. Only then can the laws be implemented and enforced.

The second dimension of IWRM is more contentious, and requires integrating the seemingly incompatible goals, beliefs, interests and knowledge of every water user. Social and political capacity is thus as important as physical water availability in good water management. This is the more difficult and largely unfulfilled political challenge; but it must be met if water security is to be achieved. Increasingly, there are conflicts between rural and urban communities, between agriculture and industrial/domestic use, and between environmental use and all other users. There are also an increasing number of conflicts between countries or states over shared water resources. Of all the contentious issues, the conflict over allocation of the increasingly scarce resource is becoming by far the most important and one that IWRM must resolve.

Given the political nature of integration, the first challenge to enabling IWRM is to cultivate the political critical mass in favour of it. This involves raising awareness of local and wider water crises and serious shortfalls in water services, and simultaneously raising the profile of successful initiatives.

The Hague Forum is only one of many opportunities for politicians and policy-makers to meet and learn more about integrated water resources management. Some countries with deeply ingrained traditional approaches have resisted IWRM, at least initially. However, indications are that the trend toward its adoption is growing. More action is needed, involving lobbying, advocacy and roundtable exchange, from committed professional associations, civil society and others to explain the need for, and benefits of, integrated water resources management and raise political commitment wherever possible. This is discussed further in the next chapter.

"Governments should be encouraged to set up Water Resources Task Teams with a clear mandate to address the issues comprehensively. These teams should draw upon the necessary expertise from all walks of life, including civil society and the academic community."

South Asia Vision for Water

Benefits of an integrated approach:

Through harmonisation of water management plans, spatial development plans, and environmental policy plans, several combined land and water development projects were initiated in the Netherlands in recent years: raising of storage capacity in river basins through habitat creation, landscaping and the development of outdoor recreation areas along the Rhine and the Meuse; the combination of water storage, habitat creation and natural water treatment in several newly developed housing areas; clean land use earmarking for dunes and other areas, where groundwater is abstracted for drinking water; nature and landscape development with natural water treatment in several small rivers.

Putting IWRM into practice involves developing three components of governance at the same time. These are the enabling environment, briefly discussed above, an institutional framework, and management instruments and tools. Many countries need help in developing these components and putting them to work.

The IWRM Toolbox

One place they can turn for help is the IWRM Toolbox currently under development by the Global Water Partnership. The Toolbox contains a range of options on a wide range of topics, including social and administrative change, economic, legal and regulatory instruments, capacity building, financial instruments and technologies including examples of best practices. The instruments and ideas in the Toolbox are based on a wide range of experiences and knowledge held by practitioners, policy makers and water managers from all over the world.

The intention is that the Toolbox will become a user-friendly compendium of alternatives for policy-makers implementing the Framework for Action.

The GWP recognises that there are many different ways to implement IWRM, requiring a variety of tools, policies and actions. Annex II illustrates the scope of the Toolbox and gives a sample page of the first draft. It will be developed as an early priority action of the Framework for Action and then disseminated as widely as possible through the Internet, through publications and through training networks. The intention is that the toolbox will become a user-friendly compendium of alternatives that policy-makers can use as they try to implement the Framework for Action.

Promoting transparency and participation

IWRM principles cannot be accepted in a society that does not enjoy transparent water allocation and management at all levels; and without the trust engendered by transparency, the participation of water users cannot be secured.

The critical nature of water for domestic use and agricultural production, and the substantial expenditures involved in the provision of water services, have resulted in corruption in many parts of the world. Corruption has misdirected investments and stifled partnership between water providers and users. It has created indifference and cynicism, and assigned a low priority to the search for a balance among water uses. A lack of transparency has led to opportunistic behaviour; decisions in water resource management are often the outcome of negotiations between central government bureaucracies and financial institutions with no meaningful participation of relevant stakeholders. A number of actions will contribute to greater transparency and participation in the water domain, as discussed below.

Devolving responsibility to water users

This is an on-going trend that closes, if not completely removes, the gap between those that control and those that use water. In irrigation this means that the drive towards management transfer to farmer-controlled organisations – as, for example, in Mexico, Andhra Pradesh (India) and Albania – needs to continue. Wherever practical, in new irrigation schemes, users should manage the investment directly, rather than public entities managing all the funds and then asking for cost recovery from the users.

Similarly, in water supply and sanitation, demand-driven approaches need to become the norm. Water utilities need to operate under greater autonomy in decision-making, have sustainable strategies for cost recovery, clear standards for assessing performance, and be publicly accountable through regulation. Customers' interests need to be represented and consulted. Where formal local organisations are formed, special care is required to ensure that women are properly represented. Community management is a powerful mechanism for developing IWRM.

Although community management started through rural development projects, it is now increasingly seen in urban settings, fostered by NGOs who believe that the urban poor, like the rural poor, can be mobilised to help themselves. Experience in rural communities has shown how effective people can be in installing their own water supplies. This will need to be replicated widely in urban settings, which face the largest future challenges in demand for drinking water and sanitation.

"We must build on people's energy and creativity at all levels – empowering and building the capacity of people in households and communities to take action, and applying technologies that respond to actual needs."

Vision *21: Water Supply, Sanitation and Hygiene*

Documenting urban community management

One research programme by the international NGO Solidarité Eau looks specifically at water and sanitation in small towns, informal neighbourhoods within cities, and peri-urban areas in Africa. It concludes that community-based organisations have as valid a role as the other types of organisation (such as municipal authorities, private concessionaires and ad-hoc project committees) that are moving into the managerial vacuum left by the shrinking of public-sector water distribution companies.

The small local organisations that support community management lack the resources to publish their work or evaluate it scientifically. A few international NGOs do publish examples of successful community actions and recently access to such information has greatly increased. Access to documented success is important so that lessons can be learned and applied elsewhere. Without documented proof of success many governments and others are sceptical that communities really can manage their own supplies, particularly at any scale larger than a village. The IWRM Toolbox mentioned above will provide a useful place for recording and sharing the results of case studies and pilot projects.

Actions for Community Management:

- Government and other agency staff to voluntarily reduce their own power and involve communities in the decision-making process from the beginning.
- Government and external agencies to provide technical support to community organisations.
- Local governments to pass and enforce legislation that favours community management.
- Community organisations to devote the time and energy to managing their own services.
- The advocates of community management to research and document their successes and inform others to develop sustainable application on a larger-scale.

Most examples of successful community management are so far relatively small in scale, although there are exceptions (see examples below). With government support, good initiatives can be scaled up to some extent. This requires institutional and capacity development at the local level, and appointing or electing representatives at the different and successively higher groups to give them power to make important decisions.

The active involvement of the private sector can encourage efficiency and transparency, and introduces the concept of contract between service suppliers and users.

Large scale community management

An example of successful community management is the large-scale gravity-flow water supply system serving over 60,000 people at Bwera in Uganda. It is the third-largest water supply in the whole country. Its construction, operation and maintenance have been managed by the community, with initial support from WaterAid, an international NGO. The supply serves 14 small towns and villages. Each village elects a water committee for the maintenance of its distribution system, while a central committee is responsible for the source and the supply pipeline. Each committee has a written constitution, and the relationship between the central and village committees is also defined in writing. Since the project was completed in 1996, significant numbers of people have moved into the area because of the reliable water supply. The district government has recently decided to site a new hospital there for the same reason and the water committee has negotiated the tariff for a metered supply for the hospital. For most of the past three years, Bwera has been at risk from the civil war in neighbouring Republic of Congo and yet the water supply continues to function well without any external support to the committees.

Broadening the options for operating utilities

For water supply and wastewater there is a gradual shift in many countries from central government as the operator to communities, autonomous public authorities or the private sector. This shift demands a parallel and fundamental shift in behaviour and expectation by both old and new entities. The active involvement of the private sector can encourage efficiency and transparency, introduces the concept of contract between service suppliers and users, and can significantly improve service delivery. Government's role, meanwhile, changes to one of effective regulation, in the context of laws which are both clearly articulated and effectively enforced.

In an increasing number of larger conurbations, water supply systems are operated by private companies under public service standards, often with private capital investment. In many parts of the world, informal water vendors play an important role in providing water services and their role should be formalised and contribution improved. The broadening of options with private service providers – both domestic and international – further brings competition from bodies of a different nature and thus provides an incentive for publicly owned utilities to reform. Various examples of public-private partnerships now exist around the world. These can form the basis for the reorganisation of water utilities. The term 'private sector' is used in this report for a range of entities including small local enterprises as well as large corporations. The table opposite identifies the different modes of public and private involvement.

Summary of Options for public–private partnerships

Option	Ownership	Financing	Management
Concession	Public	Private	Private
Lease (Affermage)	Public	Public	Private
Management Contract	Public	Public	Private
Service (Technical Assistance)	Public	Public	Public & Private
Joint Ownership	Private & Public	Private & Public	Private & Public
Full Privatisation	Private	Private	Private
BOOT	Private then public	Private	Private

From: EC Guidelines for Water Resources Development Co-operation

In many parts of the world, informal water vendors play an important role in providing water services and their role should be formalised.

The maintenance of public service standards needs strong regulation and can be facilitated by benchmarking. An example is the GWP programme in support of the Water Utilities Partnership (WUP) in Africa. Such initiatives need to be more widely replicated. Civil society in general and water consumers associations in particular will have an important role in monitoring these service standards. For any of this to happen, national governments must sincerely want to transfer management of water systems to users; they must encourage both user and commercial investment, and create the legal framework for stakeholders' organisations to function.

Recommended actions include:

- Both governmental and non-governmental organisations should work with finance institutions to further develop the modalities of demand-driven water development and promote domestic investments in small and large water facilities.
- International water research and training centres should provide support by piloting and documenting new approaches, and providing appropriate training.
- In many poorer countries, the international community should help governments to develop the capacity and institutional structures to implement the right legislation, set standards, negotiate contracts and establish well-managed regulatory systems and enforcement mechanisms.

Many countries are beginning to implement reforms that promote private sector investment and reap rewards in terms of efficiency.

Toolkit for public-private partnerships

The World Bank has prepared a useful toolkit for private participation in water and sanitation. It sets out the different options for private sector involvement, the pros and cons, key factors for success and practical guidance on the steps to take and the pitfalls to avoid when considering private sector involvement. It provides detailed help in setting the legal and regulatory framework and advice on drafting contractual agreements.

It should be stressed that an increased role for the private sector does not diminish the role of government; it changes it. Direct operational and financial involvement of government decreases and water resource management, regulation and governance increase. The government also needs to make sure that the rules in which the private sector operates are extended to public service providers (municipal authorities, irrigation agencies etc), providing public entities with incentives to increase their efficiency and transparency. For example, one of the roles of OFWAT, the regulatory body governing the privatised water industry in the UK, is to monitor prices and ensure compliance with environmental regulations (e.g. on the quality of wastewater discharges). Many countries, for example China and Chile, are beginning to implement wide reaching reforms that promote private sector investment and are reaping rewards in terms of efficiency.

Even with increased private involvement, municipal authorities are likely to remain the main water managers in urban areas around the world. These municipal authorities need to be helped to modernise along the lines of efficient private operators.

Where governments are reluctant to change or modernise, a concern for the poorest communities is often given as a reason for restricting private sector involvement. However, the poor already suffer from bad or non-existent services from the public sector or are exploited by local, unregulated operators. A strong regulatory body and a more transparent system would thus benefit the poor.

Recommended actions for Government include:

- Pursue and accelerate the on-going trend towards devolution of responsibilities to water users and building transparent and accountable mechanisms for resource allocation.
- Improve the allocation of water resources through better decision-making and the use of decision making tools which can express the value of water in different uses.
- Establish the right operating framework to attract private sector and civil society involvement in providing water services.
- Force both public and private sector operators to obey the rules.

Reform and development of institutional frameworks

Strengthening national and local institutions

Effective institutions are essential for the planning and implementation of water policy reform. However, water institutions tend to be numerous, unwieldy and resistant to change. In many countries water management is dispersed over several ministries and agencies without adequate mechanisms to co-ordinate and reconcile needs and uses. This fragmentation reinforces the potential for conflicts between sectors over the use of water resources. Reviewing and evaluating water institutions is a major challenge, complicated by the fact that they are enmeshed with many other agencies and political groups.

"The priorities: capacity building and training, long term planning for the Nile Basin, enhance confidence among the Nile Basin countries, high priority for national and regional water projects, each country to form its own water plan which relates to the master plan as a whole."

Vision for the Nile River Basin

Co-ordination between institutions:

Water institutions are so numerous in Egypt that it is impossible to 'map' them. Lebanon also has a highly textured set of water institutions including 22 water authorities and numerous other water agencies which are resisting recommendations to reduce their number. Thailand has eighteen organisations for managing water. The water institutions and customary water laws of Palestine are diverse and flexible reflecting the influence of Turkish, British, Jordanian and Israeli involvement making it difficult to formulate a new Palestinian Authority water law.

The action needed is to develop mechanisms to co-ordinate or take overall responsibility for water management. In several countries this process has started with the establishment of 'co-ordinating committees' or task forces on water. Co-ordinating committees have to be located at the highest administrative levels to be effective. Preferably, special 'apex' bodies should be made responsible for water, such as the proposed National Water Authority in Brazil and the Water Resources Organisation in Tamil Nadu, India. These bodies must be empowered to make independent allocation decisions and ensure that national water resource plans are implemented. High level apex bodies are equally vital for the often-neglected management of aquifers.

Similar mechanisms are needed at the local level. The decentralisation of water management functions to the lowest appropriate level (often termed subsidiarity) is now theoretically accepted as a sound management principle. However, this can only be effective if the human capacity and financial resources to handle the new responsibilities are available. A similar move towards integration and co-ordination between different water uses is required at this level, preferably focused on tangible water issues. This may involve strengthening existing local government functions or special water management boards.

The World Water Commission proposes that riparian countries should accept some form of 'restricted sovereignty' over their shared resource.

Actions leading to strengthening institutions:

- Establish water resources co-ordinating committees or independent apex bodies for the management of aquifers and surface waters and establish mechanisms for co-ordinating water uses at national level through the preparation of national water resource strategies and plans.
- Initiate laws that compel the integrated management of water resources, such as the 1997 River Law of Japan that combines flood management, water supply and environmental management.
- Review the mandates, structures, objectives and procedures of water management institutions and adapt and build capacity so that they can meet the challenge of IWRM.
- Facilitate the integration of water resource management at local level by dovetailing land use and water resource planning and provide adequate budgets and revenue generating abilities to sustain the local agency.
- Strengthen human resources capacity to fulfil the tasks devolved to the various institutions with special emphasis on training women.

Strengthening the management of shared waters

There are a two specific legal principles for shared waters, 'sovereignty' (or versions of sovereignty) and 'no harm', which accord with the interests of upstream and downstream riparians. There is also the compromise principle of 'equitable utilisation'. However, none of these principles have been made universally operational and they are impaired by the lack of third party jurisdiction for conflict resolution when there is no agreement between the concerned parties. The basis for agreeing co-operation over shared international rivers is thus limited. To overcome this problem, the World Water Commission proposes that riparian countries should accept some form of 'restricted sovereignty' over the resource. This concept is yet to be fully defined, but is intended to encompass the idea of equitable utilisation and co-operation in the use, development and conservation of shared waters for the benefit of all riparians. The basis for consensus would be strengthened by the reactivation and follow-up of the currently stalled work of the United Nations Convention on Non-Navigable Uses of International Watercourses.

Despite the potentially explosive nature of transboundary river management, the last decade has seen a number of positive developments around the world whereby co-operation mechanisms between riparian states in some major river basins have been developed and strengthened. The multi-national initiatives on the international rivers of Southern Africa, the bi-lateral agreements being discussed in the Jordan Basin, and the major shifts in perspective occurring in the Nile Basin bear witness to a move towards dialogue in international water affairs since the end of the Cold War. Similarly, substantial progress has also been made in South Asia on the Ganges, and in South East Asia on the Mekong. Most agreements are bilateral; some involve many partners. The Southern African Development Community (SADC) Protocol on Shared Watercourses is an example. Much remains to be done elsewhere but progress is slow.

The challenge is to build on these successes and initiate and firm up agreements on all transboundary waters, to prevent regional conflict and improve the management of these vital water resources. Shared aquifers need to be included in transboundary water discussions.

Actions required include:

- Promoting confidence-building measures among riparian countries, starting with the development of shared perspectives, data collection to form a factual basis for discussion and compatible information formats.
- Identifying water ambassadors with negotiating skills to start the required diplomatic initiatives.
- Establishing a means for adjudication and negotiation with the help of UN organisations or other international agencies.
- Establishing links between regional organisations, regional water partnerships and civil society that support the above measures and help in bridging the gap and breaking the ice.
- Developing a legal framework on which to negotiate agreements for shared aquifers.
- Following-up the work done on the UN Convention on Non-navigable Uses of Watercourses and establish an acceptable basis for the management of shared rivers using the principles of equitable utilisation and regional co-operation.

While there will be a unique solution for each river basin, effectiveness in river basin management depends on a number of common features.

Strengthening river basin and aquifer management

The lack of integrated water resource management is nowhere more visible than in the deplorable state of many of the world's rivers. The Vision records that 50% of the rivers in Europe and North America are seriously polluted and the situation is even worse in some developing countries where wastewater treatment facilities are lacking. Several of the large rivers of the world are no longer perennial. Of similar concern, but made worse by their invisibility, are the mining and pollution of aquifers vital to many people's livelihoods.

The challenge is to strengthen river basin and aquifer management in a manner that is acceptable and compatible to the overall administrative structure of a country and at the same time achieves a high level of effectiveness. While there will be a unique solution for each river basin, experiences have identified a number of common features promoting effectiveness in river basin management. Where these features are absent, river basin authorities lack political legitimacy and sustainability. These are:

- a high level of autonomy and enterprise of the management organisations,
- transparency, accountability and stakeholder participation in decision making,
- the availability of information and the capacity to use it to anticipate developments, and
- reliable, sustained financing.

The need for mediation among different users – often around single issues – and the resolution of upstream and downstream conflicts are driving a move toward pro-active river basin management. Many countries are creating institutional mediation structures that may take many forms. In France the *Agences de l'Eau* have joint responsibility for large hydrographic basins including financing, and set taxes according to the principles of 'polluter-pays' and 'user pays'. The planning and implementation of the necessary investments are carried out at the level of the smaller sub-basins where water development and management programmes *(Schéma d'Aménagement et Gestion des Eaux)* are set up. In the UK, basin management is the responsibility of the Environment Agency which is administratively divided according to groups of river basins.

Functioning river basin management systems must be established on all the main river basins within the next ten years.

At the same time as developing organisational structures for river basin management, it will be necessary to take stock of the quality of water in the rivers, and the historical and expected development of discharges and flood risks. This may then be followed by the development of a shared vision, with all stakeholders having unlimited access to data. The management of river basins must incorporate land use planning as activities such as deforestation and urbanisation have a direct impact on water resource availability and water quality.

Co-operative relations between users of shared waters are usually most difficult to achieve when they are most needed, such as when major dams or similar large infrastructure is involved. The interests of various groups or constituencies may be diametrically opposed and the process will often require strong political sponsorship. Awareness-raising and compensatory action may be needed, in addition to skilled diplomacy and well-informed negotiation.

Much work on river basin and aquifer management needs to be done and initial action is needed to:

- Establish partnerships between government and civil society to identify the most critical rivers in the region for priority action. Civil society can offer independent monitoring, raising awareness of river issues and lobbying for action.
- Promote confidence building measures between riparian countries, starting with the development of shared perspectives and compatible information formats.

Civil society, the private sector and river basin management

Civil society has in many instances given the impetus for improved river basin management. NGOs, such as the Save the Rivers Network, the Clean the Rhine Movement and many others have changed river management policies and practices.

Also commercial private enterprise has pressed the case for clean water supply from rivers. This happened for instance in the water supply concession in Lima, when no private operator was willing to put its reputation at risk because the bulk supply from the Rimac River was too unreliable.

Functioning river basin management systems must be established on all the main critical rivers within the next ten years. In some countries this may lead to the creation of dedicated organisations, in which case they must be staffed with competent people and have the resources and mandate to operate effectively. Intermediate steps to system effectiveness are outlined opposite. Community participation through catchment committees or water 'parliaments' as in France can help to ensure that the public authorities managing basins are accountable to all stakeholders.

Actions developed during the preparation of the Framework for Action are:

- A GWP Associated Programme has been developed by the International Basin Network Organisation (INBO), which builds linkages between existing and new or potential River Basin Organisations (RBOs).
- A proposed programme by the Dutch Government for the twinning of RBOs will allow staff from more established river basin organisations to provide advice and help to existing and emerging organisations in such fields as river basin policy and planning, operational management and analytical tools. The Dutch government has also prepared draft guidelines for river basin management.

Intermediate steps for creating and strengthening river basin organisations

- Design institutions acceptable to the formal and informal structures of the country (countries with strong municipal systems, grass-rooted local governments and established federal regimes are not amenable to models fit for other realities).
- Conduct appropriate fact-finding, awareness and negotiations campaigns, not a quick round of visits to justify the proposal of a blanket blueprint.
- After bargaining and negotiations with relevant stakeholders, develop an RBO work plan that provides incentives for integration and co-operation, and that has the potential to satisfy real and concrete interests of local people.
- Involve all relevant stakeholders, as in Water Parliaments in France, and not just the ones supporting a particular institutional design.
- Provide a 'seed' organization to initiate the development of agreed RBOs. Development will not automatically follow approval of an agreed RBO, support and planning will be required.
- Equip RBOs with best management practices and appropriate legal powers, status, and the financial resources to carry out their responsibilities.

Realigning economic and financial practices

Realigning economic and financial practices is at the heart of the World Water Vision. It is essential to the achievement of water security and is a driving force for change and modernisation. Actions are needed in two separate but complementary areas: the economic sector, relating to the valuation of water; and the financial sector, concerned with charging for water. Incorporating economic valuation of water in national policies and establishing policies leading to full cost pricing should be included as a sub-set of the IWRM targets. These are discussed below and in *Investing for a secure water future*.

Valuing water

Although water is sometimes recognised as both an economic and social good, in many instances it is not used to maximum economic or social benefit. The notion of water as an economic good reflects the fact that water has different values in different uses. To avoid confusion it is important to distinguish between valuing and charging for water. Water's *value* is important in deciding on alternative uses of the scarce resource whilst *charging* is an economic instrument to recover costs and provide incentives for efficiency and conservation. Decisions on allocations should take the different values into account rather than rely on historical patterns. Because current water allocation is rooted in prior direct use, public good uses such as stream flows and eco-system protection are often inadequately reflected.

"Service rates for use of the resource must guarantee an adequate economic remuneration; subsidy systems – when justifiable – must guarantee the principles of equality and universality for access to the resource. Financing and investment tools must be developed – including private sector participation – to meet proposed targets."

South America Vision

The recognition of water as an economic good is central to achieving equitable allocation. Water should be allocated to maximise its value to society, and reallocated from low value uses – low value agriculture in some cases – to higher value uses – basic drinking water supplies, some industries or eco-system protection.

Instruments that promote demand management, poverty and health improvements, and water conservation should be given priority.

National governments have a number of tools available to adjust their legislation and regulation to promote appropriate water reallocation. Tools include property rights instruments such as licensing, tradable rights, water rights reform and permit granting (see box). Clear legal structures and framework are also important. Decision-making tools include proper cost benefit analysis and environmental impact assessment. Demand assessment and market research help to improve decision-making in general and hence contribute to better water allocation.

Action to ensure economic efficiency include:

- Ensure that the value of water is fully recognised and that instruments that promote demand management, poverty and health improvements and water conservation are given priority.
- Apply economic instruments such as pollution charges to ensure the polluters pay towards the cost imposed on society by pollution.
- Include water and other natural resources in national accounts through the establishment of natural resource accounting or 'green accounts' (as for example in Norway). By treating water as a capital resource, policies focus on maximising the return on the investment while ensuring its long-term sustainability.

Property rights and water resource allocation

- Ensure that water rights are tradable – preferably separately from land rights to which they are often attached. This will make it possible to reallocate water to uses that give higher financial returns within the constraints of the water resource system. The reform of water rights in Australia may serve as an example.
- Allocate water that is unallocated with priority uses for the poor and the environment. This is necessary to avoid water being simply taken by the first or most assertive user, as is often the case with groundwater. The delineation of water and land regimes is important for securing livelihoods and improving efficient utilisation of resources.
- Establish and effectively implement permits for the use of all water resources – such as extraction from groundwater for any use.

Establishing sound finances

Equally important is the need to realign financial practices and introduce water *charges*. As advocated in the Vision, practices should be based on the *full economic costs* to recover capital and O & M costs, opportunity costs from alternative uses and economic externalities, such as environmental degradation and eco-system damage. As already stated, the value of water and the price for obtaining it are not the same thing although closely related. Water pricing ensures that users pay full service costs. The 'user pays' principle should be applied in all water use. In addition, the principle of charging should apply to pollution and those who pollute should pay for what they do – the 'polluter pays' principle. There are many examples of this principle in action: 20 years of pollution charges in the Netherlands have facilitated investment in wastewater treatment, and in China, pollution charges have provided revenues for environmental management. Both the 'user pays' and 'polluter pays' principles should be applied to return flows from agriculture and industry, and for groundwater and surface waters.

Revenue generation, sound and sustainable water management practices and 'water wise' behaviours should all be promoted by the application of these principles. They apply equally in the contexts of domestic, municipal, agricultural and industrial uses. The principles need to be backed up by systems for effective and honest revenue collection. Subsidies that encourage profligate use of water – whether for water services or for other inputs such as energy – should be progressively reduced. Cross-subsidisation to meet equity targets can be used, but should be carefully applied. UNDP indicates that 70% of the poorest of the poor are women; yet surveys show that women are more willing to pay for water than men as they recognise its value. Clearly more involvement by women will bring greater benefits to water service delivery. Sound financial management will also be needed to create the incentive for private investment in water services and ensure sustained quality of services. Greater transparency and financial accountability will contribute to the achievement of water security.

In Mexico City, the annual subsidy for operation and maintenance of water systems is equivalent to 0.5% of GDP.

Actions to support the effective introduction of pricing for water services include:

- Introduce pricing to facilitate full cost recovery and to encourage careful use. Organise participation of stakeholders in water allocation and pricing to gain support and acceptance of charging structures. Link pricing to benefits such as reliability of water supplies and the implied contract between supplier and user of water.
- Introduce economic instruments such as pollution charges to ensure that polluters pay towards the cost imposed on society by pollution.
- Establish mechanisms to protect the poorest and to ensure effective operation of pricing and charging systems including the elimination of corrupt practices. Establish welfare support systems such as water vouchers or stamps to support the purchase of water supplies, and the careful design of the services to ensure that that they are both effective and affordable.

Tariffs, fairness and support to the poor

There is now considerable experience with water charging and tariffs, and a growing understanding of the conditions which need to be met to make charges effective. It has been argued that water services need to be subsidised to protect the poor. In practice this means utilities cannot generate sufficient revenues to cover their operations and maintenance costs, let alone replacement and new investments. In fact, subsidies on water supply tend to benefit the rich – who have more reliable water services. Because of under-investment, the poor are not served, and they are often forced to take coping strategies through the acquisition of water from water vendors and their own wells and other informal sources. A more thoughtful approach is needed to water investment and water operations for the poor to ensure they have sustainable access to services rather than simply unsustainable subsidised provision.

The cost of subsidies is often substantial at the macro level; in Mexico City for example, the annual subsidy for operation and maintenance of water systems (excluding capital investment) is equivalent to 0.5% of GDP. Many believe that this money could be invested much more effectively to alleviate poverty rather than subsidise water flows to the rich.

Imaginative approaches can be used to support tariffs to make investment more attractive to private investors, thereby obtaining both efficiency gains and improved service delivery – the whole point of the exercise from the water perspective. In Guinea-Conakry, as quoted in the Vision report, the World Bank is supporting tariffs to finance investment by a private company over a 10-year period until the delivery base builds up, service levels improve, and tariffs reach the required levels. Importantly, the roles of the Government as regulator and the utility operator as service provider are clearly demarcated.

The active involvement of the private sector can encourage efficiency and transparency and significantly improve governance.

The pattern of water financing is already shifting from governments to the private sector. This shift demands a parallel and fundamental shift in behaviour and expectation by both investors and users. The active involvement of the private sector can encourage efficiency and transparency and significantly improve governance. Government's role, meanwhile, changes to one of effective regulation, in the context of a legal environment that is both clearly articulated and effectively enforced.

Tariffs should:

- Maximise efficient allocation of the resource
- Be perceived as fair by water users and equitable across customer classes
- Bring in sufficient revenue to support the service and operations
- Provide adequate funds for stability in the event of surges or shocks
- Comply with regulations
- Promote resource conservation
- Be easily implemented both technically and administratively
- Ensure affordability by the poorest
- Ensure that the welfare role (which is that of government) and the business role (which is that of the utility managers) are not confused
- Be forward looking to provide revenues for future investments in water resources
- Include environmental costs reflecting ecological, recreational and environmental uses of water
- Be consistent with other government policies (eg development goals, poverty alleviation)
- Reflect characteristics and quality of service (eg water quality, supply reliability, differentiating for different uses and quality levels)
- Vary according to level of consumption

Generating water wisdom

Jayashri Ghosh, Kadamtala Girl's School, Jalpaiguri, India

Generating water wisdom

Generating water wisdom means raising public awareness and building and sharing knowledge and capacity about water matters. The first step, as identified in the Vision, is to make people more aware of the importance of water, the threats it is under, and what improvements and corrective actions are within reach. Water knowledge needs to be generated, reviewed and tested, and then shared without restriction. Moving towards better water resources management and demand-driven service delivery means a major change of attitudes and development of different skills both technical and communicative. Considerable investment is needed in people – the fundamental resource.

A balanced water future in which targets can be met will not be possible without significant breakthroughs in water science and technology. There are many as yet unresolved questions in the field, such as climate change, the role of bio-technology in crop production, and eco-system water needs. Research in such high priority areas and stimulus for technological innovation are needed as the foundation for practical solutions to water problems. As far as possible, research should be results-oriented, with an emphasis on piloting innovation, demonstration and bottom-up research and development.

This chapter will discuss generating water wisdom under four headings:

- **Raising awareness of water issues;**
- **Investing in people;**
- **Promoting research, development and demonstration;**
- **Improving information generation and sharing.**

> ***"The priorities: promote the dissemination of know-how; encourage the exchange of information and technologies; promote technical development of water management personnel at different levels; promote water resources and environmental issues among all decision-makers and the wider population, starting with primary schools."***
>
> South America Vision

Raising awareness of water issues

Participants in the Vision to Action process in many regions highlighted the need to raise public consciousness on sustainable water use and management. Hygiene education was deemed an especially important topic. People need to understand the threats to fresh water resources and the consequences of irresponsible and unsafe water behaviour to water users and custodians. Messages should be targeted to specific key audiences, such as farmers, industry, opinion leaders, youth and the general public. People need to think about what they are doing, every time they use water. Messages need to deliver practical ideas on safe domestic water supply and sanitation, on maintaining ecological values of water, on checking overexploitation or contamination of scarce water resources.

Building on considerable global experience in the power of public awareness, a wide-ranging *Water Awareness Initiative* is needed covering the following groups:

Involving children and young people:

The youth of today will be the leaders and implementers of 2025. If they are sensitised to the threats to a resource on which they depend, the consciousness of those around them will also be raised, now and in future. Education on water issues is fundamental to the future sustainability of the resource.

Safe and wise water behaviour should be an element in all school curricula. Education authorities should develop materials on local water issues and actions of direct relevance to children and their families. Help will be needed to prepare accurate and meaningful teaching materials, establishing

Religious leaders in Saurashtra, India, reversed a trend of groundwater depletion and motivated construction of 200,000 infiltration wells.

professional teacher training courses and networking assistance. The International Water Education and Training (WET) Initiative is an example of a source of such help.

UN organisations, notably UNESCO and UNICEF, are urged to support such an initiative. NGOs can supplement the outreach of public sector education. International organisations and academic bodies can help by providing research outputs and other materials. Hygiene education in schools is of particular importance.

New youth initiatives can draw on many successful activities around the world. Examples include aquatic restoration drives in Japan, water expeditions and research programmes such as the *Cintah Sungai Kita* campaign in Malaysia and the Water Watch Victoria Habitat Survey in Australia, and writing and drawing competitions such as those in Fiji and Namibia. Links should be established between groups and initiatives in different countries.

Water stewardship

A well-known multi-national company has adopted fresh water stewardship as one of its ethical objectives. One example is the impressive calendar on safe water use for primary schools in Sri Lanka which was distributed to all schools in the three national languages. This could be replicated elsewhere.

Reaching decision-makers and opinion leaders:

This target group includes political, business, administrative and religious leaders. Opinion leaders should be approached by water ambassadors, professionals and committed civil society groups, by briefings and advocacy. Many such openings have been made during the Vision Process, and these activities should continue after the World Water Forum (see also *The way forward*).

Business schools and civil administration training institutes should be approached to incorporate programme case studies on water security and sustainable water management in their curricula.

Since all the major world religions consider water as precious, religious leaders should be a particular target for involvement. Religious codes of behaviour often include rules on personal hygiene, as does Islam's *harim*, and even on water management such as strictures on groundwater abstraction. An example of the potential influence of religious inspiration on water behaviour is the groundwater recharge movement in Saurashtra in Gujarat, India. Support from religious leaders has helped to reverse a well-advanced trend of groundwater depletion and motivated the construction of nearly 200,000 infiltration wells and recharge structures.

Religious initiatives

Catholic bishops in north-western USA issued a document in 1999 urging people to view the Columbia river as a sacred source of life and a symbol of people's connection to the divine. This initiative exemplifies the actions that religious groups can take to preserve water resources through consciousness-raising.

Reaching out to women:

Women are active in two heavy water-use sectors – agriculture and fisheries – as well as being exclusively responsible for managing water at the household level. Women may therefore be more responsive to concerns regarding long-term safe and sustainable water use, and are a key target group for messages on hygiene, water saving in agriculture, the need for water quality conservation, and the protection of aquatic resources. There should also be a promotion of shared responsibility and authority between men and women for water management. Messages should take advantage of women's networks, women's educational institutions and women's associations. International organisations can help with technical expertise, examples, and advice on communications strategies. Water-related literacy campaigns, incorporating hygiene and water conservation messages, have the double advantage of providing education as well as water awareness.

"A massive awareness raising and advocacy programme must be instituted. Issues such as water conservation and land-use, must be made part of school curricula at all levels to develop a well-informed and motivated citizenry."

Vision for Southeast Asia

Reaching women in India

The Indian Self-Employed Women's Association (SEWA) has a membership of over 200,000 self-employed women. SEWA members have developed a water vision, and have set up Watershed Committees whose impact on tackling local water problems in many parts of Gujarat State has been significant.

Raising awareness of farmers:

With 70% of water resources used in agriculture, farmers are the main custodians of global water resources. Although farmers are often targeted for messages about many aspects of agriculture, there has been little outreach on the topic of local water management and water protection. Extension programmes should include local water management messages, as should the outreach programmes of private agro-chemical companies. Local experts will need to create well-crafted water messages in local languages.

Approaching industry:

Greater awareness, public pressure and legislation can help to encourage more responsible behaviour on the part of industries using large quantities of water and/or inclined to pour wastewater and pollutants back into water systems. Major polluters must develop messages and training programmes for their employees and agents, and develop methods for safe effluent disposal. The tourist industry should adopt codes of practices on water use, disposal and conservation, and make these known to commercial outlets and customers. The US Green Hotel Association is an example of a group currently operating a code of water conduct, and regulating and monitoring water-wise behaviour among its members.

The Water Awareness Initiative will act to overcome 'water blindness' in the building industry and to popularise building practices that encourage water conservation. Professional builders associations and architects associations should endorse water safe practices and where practical incorporate them in building codes. Professional associations and academic bodies can help by developing good building guidelines and encourage their use among members of building associations.

Groups in the industrial sector that have pioneered and adopted new modes of operations need to be recognised. The International Standards Organisations and national equivalents could develop 'water eco-efficiency' standards, along the lines of those tested by the World Business Council for

Sustainable Development and translate this into 'blue eco-labelling'. Countries should use blue eco-labelling to reward those products deemed water-friendly. Environmental performance practices included in the International Standard ISO14000 can be used to formulate water conservation and protection standards.

Chambers of Commerce can spread information on clean technologies among their members, and lobby for tax concessions on water-saving devices.

Paper industry

In Germany, pressure from the environment movement and polluter-pays legislation has prompted the pulp and paper industry to modernise its processes. This resulted in a reduction in industrial water use from 47 litres per kg. of paper in 1974 to 1.5 l/kg in 1995, with appropriate savings in waste and costs. Following the Forum more must be done to learn from, and replicate, such examples around the world.

Factor Four, Weiszacher et al, Earthscan, 1997

Existing clean technologies are often either not known or not accessible to industries around the world. Local Agenda 21 programmes are active in promoting cleaner production in industry. Local Chambers of Commerce can spread information on clean processing technologies among their members, and lobby for tax concessions on water-saving devices. Driven by good business practices and social responsibility, multi-nationals, particularly those with a global outreach, can do significant good in raising the profile of the water movement and delivering the message of wise water use while gaining ethical credibility.

Environmental measures in the Philippines

An environmental user fee has been imposed on establishments discharging wastewater into Laguna de Bay, the country's largest lake. The fee is composed of two elements: a fixed sum to cover inspection and monitoring expenses, and a variable cost based on the organic pollution carried by the wastewater measured as the total biological oxygen demand. As a result, a pollution reduction of 5.6 million kilograms of BOD – a reduction of 46% – was achieved in 1997 by the 535 industries and businesses around the lake.

Reaching the general public:

An aware general public can exert useful pressure for political reform in water resources management. To reach the public, material on water issues can be disseminated through news programmes and documentaries, but also as themes in dramas. For instance, Rand Water in South Africa, a supplier of drinking water, has a regular Saturday morning slot on the children's television channel (KTV). The water community should use well known celebrities to spread the water message, emulating the successful recruitment by UNICEF of goodwill ambassadors. The Water Supply and Sanitation Collaborative Council (WSSCC) is pioneering this approach.

Promoting water-wise products:

Consumers (corporate or individual) can make investments in a safe water future by buying water-wise products – if they have the option. To provide this opportunity, the following type of water-wise goods will need to be developed and energetically marketed:

- water conserving devices (low water consumption toilets, water restrictors, low-flow aerators, high-quality faucets and washers, self-closing taps, leak detectors, testing kits, water-saving dish washers and washing machines);
- low water pollution products (from safe detergents to water treatment systems);
- micro-irrigation facilities (drip, sprinkler and bubble systems);
- local drainage systems and safe water supply and sanitation equipment (safe taps and sanitary seals).

Demand and consumer awareness will need to be stimulated through marketing campaigns, build up of distribution networks, product development investment, smart subsidies and 'blue eco-labelling'. Local campaigns should collate information on water-wise products, promote water-wise concepts, and disseminate information through product directories and public advertisement. An example of effective action along these lines is the Water Wiser Product Directory (USA).

"A global research network 'Science for Sustainable Water Co-operation' contributes to technological changes a great deal. International science and technology co-operation can fill the lack of environmentally-friendly technologies which we used to have in Russia."

Russian Water Vision

Water wise campaigns

Campaigns can make a real difference in water-wise behaviour. Members of the association of Dutch Water Utilities (VEWIN) succeeded in reducing average per capita domestic water consumption from 148 to 124 l/day by making the public aware of water issues, and providing information on water saving appliances.

Investing in people

Knowledge alone is not enough. National and local water resource managers and service providers need to be able to use knowledge to design and manage effective water management systems, based on up-to-date concepts and principles (demand management, stakeholder participation, and appreciation of the ecological functions of water). Enabling individuals to use water-wise knowledge well will require programmes of training, capacity-building and human resource development. Policy-makers and politicians, whose decisions affect water management, must be kept informed and encouraged to apply water wisdom.

Challenges in capacity development

- To strengthen capacity development networks and promote curriculum reform.
- To raise the profile of women water professionals and develop the capacity of water professionals to be sensitive to gender issues.
- To generate knowledge and information about best practice to support the implementation of integrated water resources management.
- To familiarise water stakeholders with the concepts and benefits of new approaches to water management.

To support training, gender sensitisation and capacity-building, IWRM capacity-building networks should be developed.These networks should play a major role in:

- gathering, sharing and synthesising knowledge from a variety of disciplines on best practices;
- developing best practice tools and guidelines;
- building up understanding and consensus on new approaches;
- supporting national and local focal points for capacity building;
- training of trainers.

The dissemination of best-practice knowledge and of guidelines for new-style approaches is essential for rapid uptake of ideas and strengthening capacities.

CAPNET

With the help of the GWP, UNDP has recently established a capacity building network (CAPNET). The overall objective of CAPNET is to improve livelihoods and protect the environment, by promoting IWRM and effective service delivery concepts. CAPNET aims to strengthen the capacity of both institutions and individuals though a combination of networking, awareness creation, training and education, and the development of tools and materials. CAPNET will serve as a global network supporting existing regional and national networks and training institutions that are the ultimate capacity builders. The IWRM Toolbox will be an important instrument for supporting capacity building.

Training and curriculum reform is needed to enhance practical understanding of IWRM and demand-based approaches. Water management training institutes can help develop a new generation of water-wise professionals. As responsibility for water management is increasingly shared with users and local organisations, knowledge of and respect for community approaches must become an integral part of training. New curricula should teach a practical understanding of participatory decision-making.

The dissemination of best-practice knowledge and of guidelines for new-style approaches is essential for common understanding, rapid uptake of ideas and strengthening capacities. To get maximum benefit from such material there is a need for in-post practical training for water managers and service providers at all levels.

EC Guidelines

The European Commission has developed a major new set of Guidelines for water resources development co-operation: *Towards Sustainable Water Resources Management – A Strategic Approach*. Intended for use by water practitioners, the Guidelines represent an important contribution by the Commission to the global effort to reduce stresses on the world's supply of freshwater. The strategic approach proposed in the Guidelines is designed to bridge the gap between a wide-ranging set of policy principles based on the international consensus of Dublin and Rio, and their systematic operational practice at all stages of the programme cycle. The Guidelines are available in three languages, on the Internet and on CD-ROM.

Involving Women:

Except in a few parts of the world, water-related activities are marked by a dichotomy: while men and women are equal water users, professionals and decision-makers are predominantly male. Women typically occupy less valued positions in terms of decision-making and remuneration than men.

This unbalanced situation has many causes including gender stereotyping in terms of education and careers, innate conservatism and resistance to equal relationships in professions traditionally dominated by men, and the lack of gender sensitisation programmes to compensate for rigid attitudes and behaviours. Even when fully-qualified, women rarely have equal access to the labour market. As a result, few organisations involved in water resource management and water-related services yet have the capacity to mainstream gender dimensions of water supply, sanitation, waste disposal, irrigation or drainage programmes.

Few organisations involved in water resources management and services yet have the capacity to mainstream gender dimensions.

The challenge is to correct the gender imbalance in the profession and train professionals to take into account the different concerns of men and women in the design and management of services. the promotion of gender-sensitivity is part of a larger move towards demand-driven services and an associated shift from 'infrastructure' thinking to 'service' thinking.

The required actions are:

- To revise standard perceptions of technical careers and train teachers to enhance the interest of girls and boys in water-related careers. This will require the development of learning packages for primary and secondary schools and special teachers training.
- To promote water professional associations among women and female role models, and adopt strategies to encourage positive discrimination in new recruitment.
- To incorporate practical customer analysis, gender sensitive design, and multi-functional water use in the curricula and refresher training of water professionals.
- Enable resource centres to help national educational boards and water agencies develop appropriate programmes and ensure that buildings are suitable for female students and professionals.

All major national training institutes should have gender analysis as part of their educational package to increase the presence of women in water-related professions. Capacity building is essential so that women are able to perform managerial functions. This includes skills in financial management, community participation, leadership, confidence building and communications.

Women managers:

The effects of female participation in management on the women and men in communities are manifold. Recognition of women's management tasks and training for new tasks and skills has increased their status and self-confidence. Women in the Visayayas in the Philippines reported that their views are increasingly respected and their needs met with regard to time of meetings, design of water supply and design of latrines. They now believe that they can really contribute something for the good of the community and be 'partners in progress' and not 'for decorative purposes only'. In a project in Indonesia women grew in knowledge, self-confidence and leadership, and autonomous management of water systems increased.

Promoting research, development and demonstration

Achieving the Vision will need new knowledge in a number of critical areas as underlined in most of the regional Vision to Action reports. Knowledge must also be translated into benefits to people. This in turn means that research must be problem-centred, and that findings are translated into practical solutions via pilot projects and demonstrations. It also requires that research reflects demand and is output-oriented. Research should be complemented by a thorough search for 'solutions in use', through grassroots experiments and new forms of action research.

The focus has been on water issues in industrialised economies. The challenge now is to undertake similar research for issues affecting poorer economies.

As highlighted by the World Water Commission, technological solutions will play a major part in bringing water equations into balance. Much past cutting-edge research and development has been by the commercial sector, for example on cost effective desalination. While this has brought about many important innovations, the focus is largely on issues in industrialised and richer economies. The challenge now is to bring together public and private research and development interests to undertake similar research for water issues affecting poorer economies. Research must focus on innovative, low-cost and clean technologies to promote efficiency gains. It is equally important to find ways of getting solutions taken up and used.

There are many water-related research issues that must be addressed at the global level, such as global warming, public health, and energy conservation. Research in these fields, whatever its original inspiration, should address the implications of these phenomena for future water resources use and management.

The Vision exercise identified challenges to promote and facilitate public and private research in water-related priority areas; in particular water productivity; freshwater eco-system functioning; environmental sanitation; and water demand management. The research must be targeted at practical solutions to pressing problems and be accessible and applicable to the poorer countries of the world. It is essential that special measures are taken to ensure field research and the uptake of new innovations through pilot demonstrations and networking.

To increase investment in innovative solutions, it is recommended that a private sector led International Research Foundation or Water Innovation Fund is established, in partnership with international organisations.

Water productivity:

The link between land and water use is still poorly understood. Crop productivity should be studied in relation to the amount of water supplied to both high- and low-input producers. Links between the management of water deliveries (timeliness, reliability, crop production) should be studied, particularly in low-yielding and stagnating production systems such as the rice-wheat system in much of Asia. Water-efficient, and salt- and water-stress-tolerant crop varieties should be developed, including by the safe use of bio-technology. New crop varieties and husbandry techniques should dovetail with existing production systems and male-female farming roles in countries where most livelihoods depend on agriculture.

Combined agronomic and water management research by the Consultative Group for International Agricultuarl Research (CGIAR) centres should be strengthened. The CGIAR institutes have been conducting public domain agricultural research in partnership with national agricultural research systems, including research institutes and water agencies. Since many countries do not have specific inter-disciplinary irrigation or water management research organisations, the CGIAR centres, such as the International Water Management Institute (IWMI) and the International Food Policy Research Institute (IFPRI), often work with more specialised institutions in these countries, or assist irrigation management agencies to strengthen their own research capabilities. Multi-disciplinary programmes should be developed on water and food production interactions, which involve both agricultural and water management researchers.

In the same way as the World Health Organisation (WHO) works with pharmaceutical companies, water research centres and academic bodies should consider joint ventures with private agricultural research entities, such as budding bio-technology firms in emerging economies. This is likely to be workable in areas with potential commercial pay-off, such as cereals and horticultural crops. The Dutch government are preparing a twinning programme for food security between developed and developing countries to link institutions involved in research and water management.

Freshwater ecosystems research:

One of the greatest knowledge gaps preventing sound water resource management concerns the functioning of eco-systems and the seasonal water regimes required to sustain them. Good management at the eco-system and basin level is vital to a holistic water resources management approach. The needs of freshwater eco-systems is therefore a priority research area.

Cross-disciplinary research is also needed. Where possible, freshwater ecosystems research should be linked to pressing problems, such as freshwater fish stock declines, ecosystem rehabilitation, and alien weed infestations. An applied research facility – supported by a network of institutes – should be developed to support basic research and respond to requests for research findings by management organisations such as municipalities, irrigation departments, and river basin organisations.

"Research and development of crops resistant to drought, pests and salt is needed to reduce water use in agriculture. Other important research areas include clean technologies, groundwater recharge and rehabilitation, salt water intrusion, watershed hydrology. There is currently a poor understanding of water and land eco-system processes."

Southeast Asia Vision

Freshwater ecosystems research

The Co-operative Research Centre for Freshwater Ecology (CRCFE), in Canberra, Australia, addresses issues of current concern to the Australian water industry, include, environmental flows; the control of toxic blue-green algae blooms; the effects of excess nutrients in waterways; the control of alien species, native fish decline; floodplain and wetland ecology; and river and wetland rehabilitation.

One specific example illustrates the value of this problem-centred research. A toxic blue-green algae bloom extended for more than 1000km in the Darling River and was adversely affecting town and rural water supplies. This prompted immediate research to understand what caused the bloom and how such blooms could be prevented in the future.

Sanitation research:

Future sanitation research should focus on the further development of cost-effective, robust and low pollution systems. Special emphasis should be given to systems for the urban poor, and to a reduction in dependence on conventional water-profligate sewerage systems – especially in water-short environments. Sanitation research needs to further develop the wider aspects of environmental sanitation and such relatively new techniques as bio-remediation and ecological sanitation, and to focus on the rehabilitation of disused sewerage treatment facilities around the world.

A networked research programme is needed with participation from water supply and sanitation centres, financial institutes and private sector R&D units. The objective should be to develop sanitation systems and waste reuse

systems for local investment by individuals, communities and local private entrepreneurs. Technological research outputs need to be supported by financing programmes for the poor, such as micro-credit schemes, user shares and commercial services (see *Investing for a secure water future*).

Emphasis should be on the use of economic instruments, such as stepped pricing and tariff structures, to promote careful water use.

Dry sanitation

In northern Vietnam it used to be common practice to fertilise fields with excreta. As this pracitce could endanger health by the spread of pathogens, the health authorities started to promote the construction of double-vault dry composting latrines in which the pathogenic material in excreta was neutralised before the fertiliser was spread on the fields. Long and persistent health education programmes were undertaken as part of the campaign. More research in needed on similar ecological approaches to sanitation before they can be widely promoted; however, a pilot programme is underway in China.

Practical water demand management research:

Water agencies need to conserve and re-use water and deliver services at maximum efficiency. Research is needed to identify ways to reduce water demand. Possibilities include the development of techniques for leakage control and rehabilitation, and exploring market-based incentives and non-market measures (such as licensing, quotas and controls). Emphasis should be on the use of economic instruments to promote careful water use, such as stepped pricing and tariff structures and water saving measures as part of irrigation modernisation.

Demand management

The International Union for the Conservation of Nature (IUCN) is carrying out a major multi-country study on water demand management in Southern Africa to evaluate current policies and strategies. The first phase of the research is based on five country case studies which demonstrate the benefits of water demand management, identify best practices, and encourage information exchange. A proposed second phase of the research will involve pilot studies to demonstrate the benefits of adopting water demand management within an overall framework for integrated resource management.

The link between energy and water use and conservation is of great importance. Inefficient water use often has a direct energy cost; bad policies and unreliability tend to promote excessive and wasteful use. In parts of India, for example, excessive abstraction of groundwater is causing serious problems, largely due to the unsustainable policy of providing free electricity to farmers. This is also ruining the electricity utilities. Better quality, more reliable energy with full costs paid by the users, would greatly improve agricultural, municipal and domestic water service delivery.

Solar power and desalination offer considerable scope for providing water services as most of the world's population is situated close to the sea. More research and pilot trials are needed to develop energy-efficient and resource-conserving water and energy supplies, and to reduce current costs. Research is also needed to develop policies and mechanisms that promote the uptake of such technologies.

Improving information generation and sharing

As already discussed, good water governance requires thorough and accurate water data made widely available. Creating water wisdom requires that information is accurate, understandable, and easily accessible. A common understanding is needed between information providers and users as to what information is required to support the decision-making process. The need to present global water data in a comprehensible form is one spur for the proposed World Water Development Report (see *The way forward*). This should also guide information initiatives at regional, national and local level.

"Better comprehensive information on the Nile Basin environment as well as free accessibility for such information is needed."

Vision for the Nile River Basin

Closing the main information gaps:

During the Vision exercise a number of key information gaps were identified, such as insufficient knowledge about groundwater systems in many groundwater dependent environments, the limited understanding of the status of aquatic eco-systems and the environmental implications of water utilisation patterns. Information gaps have the effect of making important water issues invisible. Governments must make clear choices as to which information to collect; aiming to meet strategic requirements in water resources assessment and water services monitoring rather than producing low quality bulk data, particularly where financial resources are limited.

South Africa

In South Africa, a rational and reliable information system has been established to assist water resource planning, management and monitoring functions. Based on a needs assessments for all key functions, the system is tailored toward improved service provision. It also provides a sound knowledge base and an integrated reference system that is helping to co-ordinate and align the activities of many stakeholders. Information delivery has been established as an important output from contributory projects and programmes.

The development of standards and protocols at all levels:

Standards are needed to ensure data are comparable, of reasonable quality, and that, once collected, data is not classified or otherwise withheld from dissemination. There is also a need to establish regular mechanisms for publishing and disseminating water information locally, nationally, regionally and internationally. Publications should not only serve water managers but also provide a mechanism for users to assess the quality and standards of service they receive. Water information providers and research institutes should adopt such protocols and have pro-active public information policies. Non-governmental organisations are encouraged to undertake independent reality checks – to counterbalance the high unreliability of official data in many places.

Many poorer countries access the web and the globalisation of information provides a huge potential for reducing information gaps.

Water resources data:

In response to a declining ability to provide information about the status and trends of water resources, in the 1990s the World Hydrological Cycle Observing System (WHYCOS) was initiated. WHYCOS serves to supplement and enhance the quality and consistency of existing systems rather than replace them. Implemented through regional components (for example, in Southern Africa and the Mediterranean region) the aim is to improve information services for regional integrated water resources assessment, monitoring and management, as well as to provide a vehicle for national capacity building, technology transfer and training. The programme aims not only to improve information services and availability but also to contribute to collaboration and co-operation between nations and regions.

The establishment of networks for technology transfer:

New information technologies and networking facilities make it possible to gain access to information without establishing costly libraries and databases. The mutual exchange of data and information between different domains is particularly important in integrated water resource management and should be encouraged through shared definitions and standards. The GWP have recently created an 'Infonet' service for water conservation in agriculture co-ordinated by International Programme for Technology and Research in Irrigation and Drainage (IPTRID), and other networks are creating similar web-based services. The Euro-Mediterranean Information System on Know-how in the Water Sector (EMWIS) is an example of a regional network covering 27 countries and is disseminated in 15 languages. Many poorer countries access the web and the globalisation and democratisation of information provides a huge potential for reducing information gaps between industrialised and developing countries.

STREAM

The STREAM Programme, led by the International Reference Centre, has synthesised the lessons of four years of action research on community water management in 22 communities in six countries. The programme is also seeking to strengthen information capacity in the participating countries through various methods, including email conferences.

Themes for action

Tackling urgent water priorities

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Tackling urgent water priorities

Actions outlined in earlier chapters provide the all-important enabling environment for investment and management of resources. They cover the priorities established in the Vision by the World Water Commission – reinforcing messages from Dublin and Rio de Janeiro in 1992, stressing institutional innovation, and emphasising pricing and technical innovation. This chapter will discuss the application of these messages to actions in five urgent areas where water-related problems are severe or disastrously neglected.

> ***"A coherent set of actions is urgently needed. No single set of universal actions would however be appropriate. Actions will differ depending on the context".***
>
> Water and Nature Vision

Of the following five areas, the first two are critical to water resources management, the next two to healthy and dignified living for the poor, and the last for human safety:

- **Protecting and restoring water resources and ecosystems**
- **Achieving water-food security**
- **Extending sanitation coverage and hygiene education**
- **Meeting the challenge of urbanisation**
- **Improving flood management**

None of these areas is new, but almost 25 years on from the elaboration of the Action Plan at the 1977 UN Water Conference at Mar del Plata, urgent action is still needed along with renewed enery and commitment. The five areas are closely linked. For instance, irrigated agriculture, essential to meeting food needs, withdraws 70% of total water used and an even higher proportion in water-short areas. These abstractions are often at the expense of other users and can exacerbate water quality problems. Sanitation is a particularly acute problem in many rural and almost all urban environments; in some towns and cities, rivers are almost anaerobic as a result of the human wastes that routinely enter them leading to a dramatic deterioration in water quality downstream. The intense demand for water for agriculture and for growing mega-cities is leading to the mining of aquifers. Meanwhile, surface water quality is so poor that it cannot be used for human consumption and fish cannot survive. Some obstacles to progress are common to all five areas, stemming from deficiencies in the political or financial environment. But each area also has unique, complex and controversial issues that require special attention.

Highlighting these five urgent action areas should not lead to neglect of other important activities. The Vision meetings identified many other areas of concern, including rural water supply, drought management, and broader rural development. These are important in specific regions are are covered in the regional and sectoral Vision reports.

In the case of water supplies there has been great progress during the 1990s. Coverage levels in rural areas have steadily risen to a point not far behind urban levels, so that 65–75% of people in developing countries are now estimated to have access to safe drinking water. Maintaining the present rate of progress – 90 million more people served per year – would reduce the unserved by half to about 400 million by 2015. Full coverage by 2025 appears achievable and realistic. The water security target proposed for drinking water has therefore been set at the reduction by half of the proportion of people without safe and affordable drinking water by 2015. Increasing coverage of safe drinking water supplies continues to be seen as an important issue, therefore, but not one that is ignored, neglected, or needs a dramatic extra push.

Protecting and restoring water resources and ecosystems

The Vision estimates that mined groundwater is used to cultivate ten per cent of the world's food supply.

The world is slowly becoming aware of current abuses of nature and misuse of resources in which humanity is engaged – a pattern of socio-economic behaviour which is unsustainable and even unethical. Restoring water quality lies at the heart of strategies for eco-system and resource protection. Around the world many wetlands and river systems are over-used or severely polluted. Since quality and quantity are directly linked, the present over-abstraction of water and excessive discharge of waste back into the system multiplies the problem. Freshwater is only reusable downstream if quality is maintained. However, polluters often have no incentive to avoid pollution or to carry out clean-up operations, causing a vicious cycle of ever-worsening conditions.

As a result, eco-systems are under threat, creating negative impacts on human livelihoods and recreation. The costs of providing drinking water from these heavily polluted sources are spiralling. Good water quality is not a luxury, it is essential for humanity and for protecting eco-systems and environmental resources.

Everybody lives downstream and everybody must act responsibly to improve water quality. As already noted, it is essential to raise awareness of the importance of protecting the resource. People and organisations at all levels of society must work together to protect water and maintain its quality and cleanliness. The environment movement has had a powerful influence in establishing methods and the political will for improving water quality, and communities should build on this and – with suuport from the authorities – undertake clean-up programmes for the most polluted and populated areas.

Establishing standards for ecosystem protection

A necessary pre-condition for improving water quality is to establish realistic, financially viable and realisable surface water standards related to eco-system protection. (Standards already exist for drinking water.) These standards need to be developed to ensure healthy ecosystems for fish, human beings and other species. This requires the development of indicators, and once these are set, programmes must be introduced to ensure compliance. The European Union has introduced standards and laws that have led to significantly healthier rivers. Institutional restructuring may be needed in some countries to integrate existing water quantity and quality monitoring centres so that they can carry out regular quality-quantity inventories, and develop league tables of water 'health'.

To promote the establishment of standards it is recommended that a water security target is adopted, requiring all countries to put in place by 2005 standards for ensuring healthy ecosystems, and programmes for their implementation by 2015.

Protecting vulnerable ground water resources

Groundwater is especially vulnerable as its loss and deterioration are almost invisible. In the past 50 years groundwater has been mined indiscriminately. The Vision estimates that mined groundwater is used to cultivate ten per cent of all food. In many parts of the world, including in some with very large agricultural economies (Northern China, South Asia, North America) and in some major cities, the water table is plunging and groundwater quality has drastically deteriorated. Several cities are experiencing land subsidence and, in coastal areas, saline intrusion. Pollution and contamination are widespread; continued reckless use of groundwater will have serious implications for future water availability.

A major Groundwater Initiative at the global level is needed to raise consciousness of the crisis. A bottom-up approach with support from the international community is essential. A set of tools and services must be provided for practitioners to address local regulation and legislation issues and hydrogeological and institutional aspects of groundwater management. Groundwater must not be allowed to suffer continued neglect. In areas of severe over-abstraction the international community, donors and experts, should help resolve critical problems and develop measures to improve recharge and reduce abstraction. Society in general, and policy-makers in particular, need to learn more about the implications of this 'groundwater rush'. The groups who need to be informed include farming and domestic water user groups, political leaders at local and national levels, those who negotiate with riparian neighbours, and the public at large. A groundwater initiative will be developed as part of the follow up to the FFA.

"The poor quality of surface water and groundwater in the Central and Eastern European region has been documented extensively. Indeed in the early 1990s the ability of water resources to meet human and eco-system needs was seriously threatened by continuing degradation of resource quality. Health risks from low water quality have been much greater than those accepted in OECD countries."

Central and Eastern Europe Vision

Actions needed include:

- Professional hydrogeology associations should campaign to raise awareness on the risks to groundwater.
- Programmes of aquifer rehabilitation, remediation, monitoring and stocktaking for quality and quantity should be urgently introduced.
- Property rights should be established; as has proved key in many arid countries, including Mexico and arid US states.
- Effective groundwater licensing systems, as operate currently in UK, France, Spain and Western Argentina, should be established.
- Community-based programmes for the protection, rehabilitation and recharge of groundwater should be introduced.

Groundwater recharge and poverty alleviation:

In the mid-1980s, Tarun Bharat Sangh, an NGO working in the Alwar district of Rajasthan, encouraged the drought-prone village of Gopalpura to revive its traditional water harvesting tradition of capturing surface runoff. By 1998, this success had encouraged 650 other villages in the drought-prone district to undertake similar efforts, leading to higher groundwater levels, higher and more stable agricultural incomes, and reduced migration. With 70 villages building 238 water harvesting structures in one watershed, the 45 km long Arvari river which would earlier flow for a few months during the monsoon season now flows round the year making life easier for innumerable families living along it. Village communities around the Arvari river have even formed a voluntary River Parliament to regulate the use of the river and the groundwater resources of the watershed.

Prevent pollution rather than treat it

In many regions improving water quality is a priority issue. In Central and Eastern Europe, decades of neglect have left surface waters from the Baltic to the Balkans heavily polluted. Many of the measures already presented for realigning financial and economic practices directly benefit water quality – for example, pricing incentives to reduce water use and control pollution. Charging polluters has had a significant impact in many countries; examples include palm oil producers in Malaysia, and industries in China and the Ruhr region of Germany, which have responded to pollution penalties. Treating polluted waters should be the solution of last resort. If action is not

taken now to prevent pollution, the level of investment needed to cover the costs of wastewater treatment for cities and industries will become astonomical, possibly leading to macro-economic distortions.

The links between land use, food security, eco-system protection and water resources management are not well articulated and frequently misunderstood.

Actions to prevent pollution include:

- Increase watershed management programmes to protect upper catchment forests and wetlands.
- Encourage waste minimisation, clean technologies, and reduction of pollution at source through training, environmental impact assessment and pilot programmes.
- Establish and enforce environmental legislation, incentives and policy instruments.
- Introduce industrial waste exchange programmes, such as those currently being piloted in Southeast Asia.
- Promote research and development of environmentally friendly agricultural industrial and household products.
- Accelerate adoption of the environmental standard (ISO Standard No. 14000) by large companies; promote certification for sound environmental management systems.
- Improve agricultural practice through new incentives, pilot schemes and training in the application of inorganic fertilisers and pesticides. (In Indonesia the reduction of subsidies on pesticides lead to lowered pollution and more efficient grain production).

Achieving water-food security

Agriculture will continue to use more water than any other area of human activity. The World Food Summit in 1996 and the Vision have recognised that feeding the ever-growing world population and solving the looming water crisis are inextricably linked. Unfortunately, the links between land use, crop production, food security, eco-system protection and water resources management are not well articulated and frequently not understood or ignored by policy-makers. They are also handled by different government departments with weak inter-departmental co-ordination.

On the one hand, the fundamental fear of food shortages encourages ever greater use of water resources for agriculture. On the other, there is a need to divert water from irrigated food production for other users and to protect the resource and the eco-system. Many believe this conflict is one of the most critical problems to be tackled in the early 21st century. Addressing it must become a priority for policy-makers if the world is to avoid twin food and water security crises. It is therefore recommended that, by 2015, all countries should have managed to improve water productivity and increase food production by 30% from water withdrawals. This will not be easy but with real commitment, mobilisation of adequate resources and their proper utilisation, it is achievable. Given the inevitable time lag between initiating action and securing resources, appropriate investment decisions are needed urgently.

Because of its political sensitivity, the vital link between food and water security has only very recently been the subject of public debate. The topic cannot be raised without addressing such concepts as household subsistence, investment choices, vulnerability to drought and famine, and trade in agricultural products versus self-sufficiency. So far, access to cheap food imports has often enabled governments to avoid the tough decisions needed to improve water use efficiency in agriculture. But there is a strong likelihood that they will no longer be able to rely on food imports since political pressures in temperate zone countries are likely to reduce agricultural subsidies and seek controls on environmentally damaging farming practices.

Food and water security for all the world's inhabitants can only come from concerted action to achieve more crop productivity from every drop of water available for agriculture and from every unit of investment, thus maximising efficiency and cost effectiveness. This requires actions that address both rainfed and irrigated agriculture at local, national and international levels, so that water is no longer regarded as a cost-free and infinite resource, but as an input whose relative value against other inputs must be factored into costs and prices. Agriculture comprises many important elements other than food crop production, such as livestock, non-food crops and fisheries; however, the priority from the water resource perspective is water for food.

It is inevitable that in regions facing water stress, water will be diverted from low value agriculture. In countries like Israel, Cyprus and Malta, governments have successfully moved their populations into other activities, including industry, commerce, and tourism. Agriculture is mainly restricted to high value export crops, and most food is imported rather than produced at home. The value of 'virtual water' (the water imported in food grown elsewhere where water is more plentiful) in food security must be recognised. Where countries have made the political decision to forgo domestic food security, and have prospered economically from that decision, they have achieved food security through trade. Other countries may learn from their experience.

"Irrigation management institutions need to be reformed, making them user-controlled and self-financing. New missions for public irrigation agencies should be agreed and systems of charging for water and rural electricity established to recover at least the costs of operating and maintaining supply and delivery systems."

Vision for Water for Food

Getting more from rainfed production:

Yields need to be raised in both irrigated and rainfed agriculture and the issues are complementary. Highly productive rainfed agriculture has traditionally been practised in the temperate areas of Europe and North America, but environmental concerns (such as the heavy use of agro-chemicals and other inputs) and changes in policy are likely to slow future growth in production from such areas. There are other climatically favourable areas, such as in parts of China, where strenuous efforts are needed to close the gap in yield from rainfed agriculture between traditional and modern farming systems.

In the less favourable agro-climatic zones, where rainfall is low or very erratic, as in much of sub-Saharan Africa, farmers are unlikely to invest in adequate fertilisers, crop protection measures and good quality seed. Here research, including bio-technology, is needed to develop and then introduce drought-resistant crops and simple water harvesting techniques for supplementary irrigation.

In some regions, rainwater harvesting, a traditional technique with considerable potential, can help to meet the water and irrigation needs of the poor and to recharge depleted groundwater aquifers. With increased community participation in water management, this tradition – which has been in decline – can be revived and promoted. However, appropriate agriculture and soil conservation techniques are needed to ensure sustainability.

Locked within all imported crops is the water used to grow them. Importing food can thus transfer 'virtual water' from abundant to scarce regions.

Recommended actions:

- Promotion of community-based water and soil conservation techniques such as rainwater harvesting, terracing and a mix of small-scale water storage approaches. Informal supplementary irrigation methods can also be used to enhance production on smallholdings in Africa.
- Measures and incentives should be taken to increase the use of fertilisers in parts of Africa and other regions where soil nutrients are naturally extremely low.
- Promotion of better education for women and enlightened policies to give women greater access to inputs such as credit and land/water rights, especially in sub-Saharan Africa where women are often the main household food producers.

Multiple benefits: the Chikava Garden scheme, Masvingo, Zimbabwe

As part of their small dams rehabilitation programme in Masvingo, CARE Zimbabwe, aims to boost the nutritional status of families in the newly irrigated area by encouraging vegetable production. The 92 participants, all women, produce a surplus to family requirements for sale to local householders, local businesses and the local school. The women have used some of the money from the garden to organise a playgroup for the children, which enables them to devote more time to their gardens while confident that their children are well looked after.

Trade food as well as grow it:

In many parts of the world limitations on the water supply and diversions of water for other purposes will limit the scope for production increases and food security will increasingly depend on trade. Locked within all imported crops is the water that has been used to grow them, known as 'virtual water' and importing food can thus transfer water from abundant to scarce regions. However, political and economic factors combine in many parts of the world (such as parts of the Middle East) to create national insecurity which in turn leads to reluctance to be dependent on food imports. More open trade regimes linked to regional security-building could overcome this reluctance.

As was evident in the Seattle World Trade Organisation (WTO) meetings in late 1999, the whole topic of international trade is highly charged and fraught with sensitivities. The World Water Commission emphasised that protectionism within the industrialised countries, and the detrimental effect this has had on trade, has implications for water security. Apart from discouraging agricultural reform, the effect is to close export markets to poorer countries and weaken calls for more open markets. Attempts by External Support Agencies to realign financial practices in developing countries are also weakened. On the other hand, many of the poorest and most vulnerable importing countries rely on cheap food to feed the urban poor. Drastic increases in world prices could lead to serious instability or civil strife.

In many countries food production is adequate but many people lack the income to purchase it; this needs to be addressed as part of a wider development agenda. Unrestricted access to food markets for the most vulnerable countries would benefit poor consumers, and could be built into trade agreements. However, this is unlikely to meet universal acceptance in the short term. This highly political and complex international issue needs to be given urgent attention by international organisations.

The following actions can help:

- Establishment of a Consultative Group under international auspices to take food trade higher up the political agenda. The Group should assess the implications of market liberalisation on access to food by the poor and on the use of water by agriculture.
- Establishment of national policies for food security that recognise trade as a key element.
- Establishment of programmes in water-poor countries to create jobs in low water-use activities, as a precursor to any reallocation of water away from agriculture.

Closing the yield gap for both rainfed and irrigated land is the most important action for meeting the food challenge.

Enhancing crop productivity per irrigated drop:

Resolving water-food security and improving crop productivity per drop and crop productivity per unit of investment are particularly important for irrigated agriculture in the 21st century. Traditional supply-side ways must now adapt to the demand-based approach to allow for other urgent uses of the scarce resource, especially in Asia which has about 50% of the world's irrigated land. According to the World Food Summit, 1996, much of the extra food production must come from irrigated agriculture. Considerable improvement can be achieved on existing irrigated land, according to the Vision's Water for Food and Rural Development Sustainable Scenario for 2025, new irrigated areas must be developed at a rate of 0.3% per year (10% over the next 25 years) to meet expanding food requirements. This would increase the overall area from the present 268 million ha. (FAOSTAT) to almost 300 million ha. in 2025. More reliable water supplies should improve irrigation performance and entice farmers to invest in fertilisers, pesticides and high quality seeds.

The Vision identified closing the yield gap for both rainfed and irrigated land as the most important action in meeting the food challenge. Yield levels in all irrigated areas should be raised to levels currently attained under irrigation in Australia and the USA, without substantially increasing present water withdrawals. Performance of irrigation systems must be improved, and further land degradation in irrigated areas due to salinity prevented. New investment should also focus on reclaiming the considerable area of degraded land lost each year to waterlogging and salinity. Reuse and better treatment techniques for recycling poor quality water for agriculture should be a priority.

Policies and financial instruments must be developed to give farmers an incentive to use their water more efficiently. Technically, there is little difference between the service delivery function of water supply to industry and households, and to canal-based irrigated agriculture. Private sector operators would act as a catalyst to bring in modern water saving technologies as well as introduce more customer focus. The private sector may also galvanise the government into introducing regulation, pricing and performance measures, all of which would help to transform public sector agencies. Increased cost recovery, channelled back to systems, will contribute to improved maintenance and lower water losses.

There are many models, mainly in developed countries, of public-private partnerships (see *Investing for a secure water future*) and an appropriate model must be found to suit local conditions; the most important feature is to ensure less dependence on central government budgets and administration. If private and public operators in poor rural areas need financial support from governments, subsidies should be transparent, be used to improve water use efficiency, and support better service delivery. Pilot systems should be initiated with donor support.

Technically proficient NGOs are needed to support these water user groups to help them to develop productive livelihoods.

Recommended actions include:

- Countries should introduce demand management practices and other incentives in irrigated agriculture. Income from fees should be used directly on system O & M.
- Investments should be focused on improving performance of existing systems and on new developments for re-use of water, prevention of land degradation and reclamation of degraded land. New land developments should be critically assessed and if necessary regulated to ensure water availability.
- Governments should reform or dismantle inefficient central irrigation bureaucracies and rebuild vibrant autonomous locally based authorities answerable to the farmers.
- Private sector modes of operation should be introduced in the management of irrigation distribution systems, learning lessons from and forming partnerships with the water supply industry.
- Irrigation infrastructure should be included in the Public-Private Infrastructure Advisory Facility (PPIAF), a multi-donor technical assistance facility aimed at helping poor countries improve the quality of their infrastructure through private sector involvement.

Autonomous irrigation supply company:

The Goulburn-Murray Water Company in Australia, wholly equity-owned by Victoria State government, operates independently to provide irrigators (using almost 70% of the water) as well as other users with a reliable supply, based on a well established mechanism for seasonal allocations with licenses and water rights. The company guarantees this allocation at 97% reliability. If water resource assessments show additional water is available, it is sold to users. The company covers an area of 640,000 km^2. Customers are involved in decision-making through Water Services Committees. Since users became responsible for paying all costs, both of operation and future investments, operating costs have been cut by 40% and rehabilitation and future investments have been modernised with an asset management programme and a sharp reduction in the costs of replacement.

Involving the farmers:

A major feature of irrigated agriculture over the last ten years has been the turnover of irrigation schemes to farmer management – usually through some form of Water User Group. The phenomenon is still not very well established and considerably more grassroots support is needed to make it effective. Moreover, more support systems are needed to ensure that O & M is carried out under farmer management. Technically proficient NGOs are needed to support these water user groups to help them to develop productive livelihoods as well as provide social or humanitarian services. Experiences gained in community-level water supply projects could be useful. Community action should also target rural employment creation opportunities outside agriculture.

Recommended actions include:

- Providing long-term technical support to make farmer turnover sustainable.
- Involving NGOs and farmer groups in community activities to raise agricultural efficiency and establish other rural development activities as alternatives to crop production.
- Promoting small-scale smallholder schemes for supplementary irrigation, especially in Africa, using cheap modern methods, for example the low cost low-lift pumps developed by Approtech in East Africa.
- Improve extension services to cover irrigated agriculture and provide greater access to extension services for women farmers.

Divergent perceptions of irrigation – a service essential for food production, or a wasteful and polluting water user – must be reconciled.

Farmer Managed Irrigation:

The International Water Management Institute, a CGIAR centre, has been documenting and studying Farmer Managed Irrigation Systems (FMIS) for many years and FMIS is gradually being adopted by many governments with donor support. Mexico is perhaps the best known example, where a water law of 1992 paved the way for turnover. About 90% of the irrigated area has now been transferred to farmer associations who have management autonomy with government providing technical assistance. In India, the state government of Andhra Pradesh has recently started a massive turnover programme. There is considerable need for NGOs and community groups to become involved in this process to provide assistance to resource poor farmer groups to ensure successful transfer.

Water for Food Vision, 2000

Mechanisms to achieve water and food security:

Most of the ideas for action put forward so far require development and further debate. Divergent perceptions of irrigation – on the one hand a service essential for food production, on the other a wasteful and polluting water user – must be reconciled, and the groups holding different views encouraged to communicate and understand each other's perspective. Building on the momentum generated by the Vision exercise, all stakeholders must take steps to work together to develop clear programmes of action for achieving both water and food security. This will mean reconciling the need for expansion of more efficient irrigated agriculture in those regions where this is possible without affecting other users and minimising any negative impacts on eco-systems. It also requires the development and promotion of modern technologies and reuse of marginal quality water.

The recommended action is:

- Establishment of a Task Force to develop a programme of action on water-food security. This could be a programme of the GWP under the auspices of the on-going development of the Framework for Action, and completed by August 2001.

Extending sanitation coverage and hygiene education

Sanitation coverage is very poor in almost all developing countries. In rural areas, sanitation coverage actually declined during the early 1990s and overall in urban areas it remains below 60%. Present progress is not keeping pace with population growth although there are indications of recent improvements. Unless urgent action is taken now, there will be over 4 billion people unserved by 2025. An immense effort is thus needed to accelerate coverage. A target should therefore be established to reduce the proportion without access to hygienic sanitation services by at least one half by the year 2015. Given the present low level of activity it will take some time to develop momentum and a huge effort will be needed to reach this ambitious target. The most urgent priority is a hygiene education campaign in all schools.

Waterborne sewerage requires large volumes of water for transporting waste. Often this water has then to be expensively purified for re-use.

The choice of technology will have a major effect on water demand. Waterborne sewerage requires large volumes of water (in the order of 100 litres per capita per day) for transporting waste. Often this water has then to be expensively purified for re-use. Waterborne sewerage should thus be the technology of last resort. There are many hygienic alternatives and Japan, the country with the highest life expectancy in the world, has only 39% coverage with conventional sewerage. Technological innovation therefore has a key role to play.

Low standards of public health and endemic diarrhoeal disease are closely associated with lack of sanitation and poor hygiene. The critical need from a health perspective is in crowded and insanitary slums and shanty-towns; but many rural areas, at least in South Asia if not in Africa, are similarly becoming very congested. The convenience, safety, and privacy (an important value for women) of outdoor defecation is rapidly dwindling. It must be recognised that people wish to improve sanitation facilities for these reasons as well as for health and human dignity. Greater investment in hygiene and health education programmes will significantly increase the demand for sanitation facilities.

Actions:

- Raise awareness through international networks and initiatives on sanitation, such as the Water and Sanitation Programme's (WSP) Urban Environmental Sanitation Network and the Global Environmental Sanitation Initiative of the WSSCC.

The importance of laws and policies

Making water governance effective has already emphasised the importance of appropriate policies and institutional frameworks; they are certainly of vital importance in the field of sanitation. The principle of subsidiarity holds in this area; sanitation services should be developed and provided at the lowest possible local level. Nevertheless central government can play an important catalytic role by establishing the right incentives.

In the late 1980s politicians in Europe decided that the provision of urban sewage collection and treatment facilities was fundamental to the well-being of all 350 million people in the European Union's Member States. They adopted the EU Urban Waste Water Treatment Directive in 1991 requiring all Member States to provide these facilities in a phased programme ending in 2005. They provided funds for certain countries that needed particular support over this period. Progress is regularly monitored at European level. This Directive is an example of politicians having the will to ensure that all their citizens have access to particular services. It has provided a model that other countries are also adopting.

The following is recommended for action:

- Governments should establish laws and policies that promote sanitation and facilitate subsidiarity, and accompany these with programmes of support to local communities and local governments.

An example of good sanitation policy development:

The Government of Zambia adopted a new National Water Policy in 1994. Among other policies, this gave operational authority to local authorities, keeping co-ordination and regulation at the national level. It was clear to the government and external donors that sanitation would need special emphasis so a Working Group on Sanitation (WGS) was established and supported by UNICEF and other donors. The objective was to develop a national sanitation strategy.

The WGS is a small group of people from the Government, donors and NGOs. Within 18 months it had developed a strategy by a consultative process and submitted it for Cabinet approval, and prepared plans to implement the strategy. In reviewing the good progress on national-level collaboration on sanitation, UNICEF identified three key factors: active participation by many people in the discussion workshops, establishment of WGS at a working level, closely linked to actual field work and finally interest in the WGS on the part of the Government.

"Sanitation must take its rightful place as a major intervention for improving the human condition. Inclusion of sanitation and hygiene education with water supplies affirms that these are three independent, though interlinked, interventions, each of which can have a positive impact on people's lives and on a healthy environment. Future planning needs to reflect this synergy."

Vision 21 for Water Supply, Sanitation and Hygiene

Promoting hygiene education:

The Water for People Vision 21 report stresses the importance of hygiene education as the base on which sanitation services depend. Hygiene promotion programmes using social marketing techniques can have great impact in raising people's priority for sanitation. Experience from Pakistan and Nepal and other South Asian settings suggests that, once stimulated, people will carry out their own sanitation improvements with little or no external subsidy. This avoids inappropriate external support that often fails because the beneficiaries are not yet convinced of the need.

Recommended for action is:

- Instigation of major sanitation awareness campaigns, using social mobilisation techniques (such as Clean Community Days) and gaining endorsement from political and religious leaders.
- Accelerate hygiene education programmes, especially in schools, to promote demand for environmental sanitation; all sanitation investment programmes should include an education component.

Where human waste disposal is promoted as part of a cleaner living environment, communities will adopt installations they can afford.

An example of integrating hygiene education in sanitation projects:
The Nepal Water for Health (NEWAH) is an NGO that has recognised the need for hygiene promotion and education as an integral part of water and sanitation projects since its inception in 1992. NEWAH treats hygiene promotion holistically, helping with the supply of water, the building of latrines and the raising of awareness of what hygiene is and what good hygienic behaviour can do for the community. Hygiene promotion starts before water supply construction, in discussions with the community about the existing situation and their perceived needs. Health motivators (mostly women) are recruited from within the community for each project, trained and supervised by NEWAH's professional field staff.

Recognising the importance of community collaboration:

Toilets are usually household facilities, but without their widespread installation the whole community suffers from an unpleasant environment. Almost every community desires waste removal and a clean environment, even where certain individuals do not perceive these needs. Where human waste disposal is promoted as part of a cleaner and healthier living environment, communities will be encouraged to adopt and maintain technologies and installations they can afford.

The recommended action is:

- Establishment of campaigns to promote sanitation on the basis of a 'healthy environment', a broader and socially more attractive concept than excreta disposal. Such an approach gives sanitation an importance in its own right rather than as a weaker and less attractive add-on to drinking water supply.
- Having raised people's priority through hygiene education, external agencies must respond to requests for appropriate materials and components and mechanisms established for micro-finance to respond to the demand.

Educating communities to want sanitation:
A 'latrine revolution' in China's Henan Province has provided an outstanding example of political commitment and strong local leadership. It started in 1987 in a few villages in Yucheng county because of the efforts of Mister Latrine, the physician Dr Song Lexin. It became a provincial programme in 1989 with full support of the Provincial Governor. By 1995, nine of the ten counties most advanced in latrine coverage in China were in Henan Province. Dr. Song had gone from village to village on his bicycle, discussing the benefits of his latrine with the villagers. After the villagers he visited experimented with a demonstration latrine, they gradually saw that the manure from this latrine made their apples grow larger and sweeter. Conviction that the latrines had made their villages richer was evident even eight years after the 'revolution' began. Most of the latrines were still found to be kept very clean, thanks to the efforts of village women. In most cases, the communities themselves pay 90% of the total costs of their improved latrines. Efforts are underway to develop a revolving fund and other credit options to help spread latrine improvement to poorer villages in the province.

Involving women:

Both men and women receive health benefits from improved sanitation. Women also derive additional benefits as their needs for personal hygiene are greater. So sanitation significantly benefits women, and indeed women consistently state sanitation as a higher priority than do men. Women also have a greater understanding and interest in its benefits for health, privacy and convenience. It is therefore particularly important that women's views are respected and acted upon by the people and organisations who make decisions about sanitation.

Women also have a greater understanding and interest in the benefits of sanitation for health, privacy and convenience.

The opportunity for influence in the field of sanitation in turn gives women more confidence to lead development activities in general. Sanitation is thus an active force in promoting women's influence and involvement. Many women's organisations have been involved in hygiene education and sanitation programmes and this needs to be supported. Efforts should be made to facilitate knowledge-sharing between organisations, and also with government bodies, international institutions and development organisations. Resources should be directed at assisting women's organisations in the capacity-building exercises that they say they need.

The recommended actions are:

- Establish capacity building programmes specifically targeted at women and sanitation
- Explore, encourage and develop the rich mine of original solutions for promoting sanitary facilities that exist within women's organisations.

Involving women in Indonesia:
In west Lombok, the Indonesian Women's organisation (PKK) drew up lists of beneficiaries for latrines and set up a village production centre where local boys learnt how to make sanitary wares with UNICEF funding the materials. Previous efforts to promote latrines were discouraging but the PKK built 20,000 within months and by the end of 1994, sanitation coverage in West Lombok was nearly universal. This success is credited to the pressure women exert on the menfolk and the emphasis on hygiene as part of religious duty. This success prompted the creation of a movement called Clean Friday an idea taken up throughout Indonesia and launched in 1994 by the President.

Children First by Maggie Black, OUP 1996

Providing the right sanitary systems:

Many alternatives to the water-profligate waterborne sewerage systems have been developed. In South America, small diameter shallow sewage systems separate solid and liquid waste. These systems use much less water and are cheaper than conventional systems. Other alternatives include ecological pit latrines (with or without water operation). New methods need to be developed to tackle the special challenges of providing less water-wasteful systems, and affordable services to the urban poor.

In India, small scale urban and rural sanitary ware enterprises have been encouraged, and are producing affordable local products. Rural Sanitary Marts form part of this programme; the Marts educate people about hygiene and sanitation, creating demand for improved sanitation; the volume of demand ensures that necessary sanitary items (such as latrine components) are available locally at a reasonable price. This model is now bing replicated in Nigeria, with UNICEF assistance.

The necessary actions are:

- Promotion of small-scale urban and rural sanitary ware enterprises as in India. NGOs should be supported in their work on hygiene education, and in the search for innovative sanitation solutions.
- Invest in technological innovation to meet sanitation needs in a wide variety of contexts.

By far the fastest rate of urban growth is taking place in slums and squatter settlements, many situated on waste ground.

An innovative sanitation NGO:

Since 1990 an Indian NGO, Sulabh International, has pioneered many innovations in urban sanitation. It has developed and built over 1 million cheap hygienic twin-pit pour-flush household latrines. Its designs have been adopted by many Indian and international organisations. Sulabh also designs, constructs and operates hundreds of public sanitation blocks in poor urban neighbourhoods: men pay to use these blocks, generating enough money to maintain the facilities well and to allow free use by women and children.

Meeting the challenge of urbanisation

Urban populations are growing as never before. This is most conspicuous in the mega-cities of over ten million people, but can also be seen in less populous cities and towns. While today 45% of the world's population live in urban areas this proportion is likely to increase to 61% by 2025. Most of this increase will be in developing countries, where, by 2025 the urban population will double to some 3.7 billion people while the rural population will stay more or less constant at around 2.8 billion.

The level of urbanisation is presenting profound challenges to urban water management which are made more difficult by the relative lack of resources and capacity in those countries where the speed of urbanisation is most dramatic. By far the fastest rate of growth is taking place in slums and squatter settlements situated on waste ground, floodplains or unstable hillsides. A wide range of challenges have to be met that require the integration of all water-related services into overall urban planning. These services involve not only drinking water supplies, sanitation, and wastewater treatment, but the management of urban stormwater and run-off, flood management, and solid waste removal, all of which may be further complicated by possible climate change and sea level rise. Urban water management also links closely to public health through the control of water-related diseases, such as dengue fever, cholera, malaria, and typhoid fever.

Examples of actions that have improved the water status of urban areas include:

- The introduction of cost-effective and efficient sanitation and sewerage systems in crowded central and peri-urban areas.
- Management that is transparent, operationally efficient and financially sound.
- Public-private partnerships that introduce cost-efficiency and effectiveness without neglecting poorer neighbourhoods – as in Port-au-Prince, Dhaka and Ouagadougou.
- Programmes of water leakage control as in Quito.
- Support for small-scale private sector water service providers in urban areas, as in Senegal.

- Demand-led designs for water supply with targeted lifeline rates, as in innovative privatisation project in Guinea-Conakry.
- Incentives for the development and testing of innovative technical solutions to urban water and waste management problems.

Innovative technical options for water in cities:

- Small and medium scale modular treatment works can bring down costs of waste water treatment
- Desalination of water in coastal cities to become more economically viable, offering the options of providing drinking water in a separate system from supply for other purposes
- Bio-remediation for waste water treatment and solid waste disposal.
- Cheaper energy through solar power to increase the options available and reduce costs.

"In addition to the increasing water abstraction needed to meet urban growth, increasing waste loads in the form of garbage, liquid wastes and excreta discharged into water bodies are causing freshwater quality to deteriorate. National boundary and transboundary surface waters are both affected."

West African Water Vision

Integrating water into urban spatial and economic planning

Although there are examples of impressive achievements in some of the world's urban areas, much more must be done to ensure that water and waste management issues are seen as vital elements of urban planning. Concerted efforts linked to public-private partnerships, cost-efficiency and demand management practices, and the integration of urban water resource planning in spatial and economic planning are required. Possible actions include the reduction of leakages, repair of decayed infrastructures, enhancement of managerial competence, consultation of users on affordable and adequate levels of service, and transparency and decentralisation of responsibilities. Urban waste is a threat to coastal environments and municipal wastewater treatment is likely to become one of the most costly water services. UNEP and others started work in 1999 on a strategic action plan to address sewage as a major land based pollutant and will report at a major conference in 2001.

The provision of urban water services needs to move towards a more differentiated model where different parties, including private non-formal operators and communities, as well as the traditional public sector, provide and fund water services, and service provision is differentiated according to capacity and willingness to pay. Continual reduction in energy costs, efficiency and advances in technology may also provide alternative solutions to scarce supplies -- for example, through desalination in coastal cities.

Recommended actions include:

- Integration of water services with other urban services – energy, transport, health services – into urban planning and the city's overall economic structure.
- Incentives for communal industrial effluent treatment (particularly for small scale industries), as in the Cairo programme to relocate tanneries to a serviced site.
- Sub-division of large cities into smaller manageable zones for service development and provision, as in Bangkok.
- Suport for technological development and pilot trials for low cost, clean and efficient technologies for supply and waste treatment.

Urban waste is a threat to coastal environments and municipal wastewater treatment is likely to become one of the most costly water services.

Water service provision in urban slum in Pakistan:

The people of Hassanpura, a slum community in Faisalabad, identified water as a top priority and asked Anjuman Samaji Behbood (ASB), an NGO to help them with it. Hassanpura was not officially scheduled for supply until 2008, funds permitting. So ASB and the people decided to go ahead on a self-help basis, with the community providing 100% of the capital costs because they could see the future benefit of ending their dependence on expensive water vendors. The Faisalabad Water and Sanitation Authority (WASA) gave a Certificate of No Objection, and connected the community-built distribution pipeline to the mains supply. The municipal authority has gained a new, legal customer at minimal capital cost, while the people of Hassanpura have gained a cheap and reliable water supply. All this was only possible due to the collaboration between the community, ASB and WASA.

Strengthening existing initiatives:

The efforts of initiatives such as the Sustainable Cities Programme of Habitat/WHO, the Urban Water Programme of the Academie de l'Eau and the African Water Utilities Partnership of GWP should be widely replicated elsewhere. The recently created Cities Alliance provides a mechanism to tackle the urban challenges. This is a global coalition of cities and multi-donor partners (UNEP/UNCHS/World Bank and others) and private sector and civil society partners. The Alliance aims to improve the efficiency and impact of urban development by analysing economic prospects, establishing a city development strategy, identifying priorities for action based on stakeholder visions and improving living conditions of the urban poor through urban regeneration. External resources will add value to the efforts of local partners. The Cities Alliance initiative and the proposed City Alliance Trust fund should embrace urban water management as a priority activity.

Urban programmes should fully integrate water issues and provide support such as:

- Financial advice and brokering.
- Help with formulating urban water improvement packages.
- Experience sharing on efficient techniques for such activities as low water use sanitation, dengue fever eradication, water treatment rehabilitation and leakage/non-revenue water control.
- Advice on urban water resource planning and its integration in city planning.
- Management training of urban water planners and operators.

Improving the management of floods

"We have to learn that we can not avoid every disaster and that we have to live with floods and droughts".

Sector Consultation: Water in Rivers

Floods are the most common natural disaster, causing the greatest number of deaths and damage. The hazards to human life are increasing; floods killed almost a quarter of a million people in the period 1987-96, over 90% in Asia. Increased flooding is the result of growing pressure on floodplains, substantial damage to watersheds, and perhaps also climate change. In industrialised countries, improved flood management has led to a dramatic reduction in deaths and human suffering even though economic losses have increased. Loss of life and human suffering can be prevented and the international community should work towards halving the number of deaths from floods and climatic disasters by the year 2015.

Climate change has important implications for flood management especially in coastal towns and cities, with possible sea level rise and storm frequencies and flooding along coasts and in estuarial areas. Additional studies and research are needed to understand these threats and to monitor and understand rivers and river basins vulnerable to flooding.

Floods are not always a hazard. They may also sustain aquatic life and riverine biodiversity, recharge aquifers, enrich soils and in some of the world's poorest areas they are the main source of irrigation. The challenge is to manage floods and mitigate the dangers they pose rather than contain them at any price. This calls for the holistic, river basin based approach to water management, already discussed in *Generating water wisdom*. Watershed management, incoporating forestry management, has become increasingly recognised as important in managing floods. Changes in land use and vegetation cover affect water regimes and may be used advantageously as part of a set of complementary measures (see sections on groundwater and rainfed agriculture). Balanced against other impacts, watershed management can serve as a key component through both direct and indirect impacts such as run-off control and the reduction of erosion/sedimentation rates.

Actions to reduce the impact of floods and maximise upstream benefits:

- Flood management must include integration with other land use plans and programmes, particularly to ensure proper watershed management; there is growing evidence linking upstream deforestation with downstream flooding events.
- Watershed management should be promoted as part of multi-beneficial community based rural development programmes for agriculture, forestry and rainwater harvesting.

Appropriate flood management will vary depending on the specific nature of the river basin and local social reality. In areas of particular hazard, it will include flood warning systems, structural flood mitigation measures (such as creating natural storage and flood protection) as well as non-structural measures (such as land use planning and regulation, flood forecasting and disaster preparedness, flood plain zoning), disaster impact mitigation and post-disaster support programmes. Flood management measures should be complemented by awareness programmes that inform builders, residents and industries about flood risks and provide practical messages of how to live with and not against the rivers. Where floods sustain livelihoods, flood management should try to maximise the positive impacts of floods on fishery, farming and aquatic eco-systems. Any river diversion work should be designed on the basis of environmental channels that retain many of the natural features.

Floods may also sustain aquatic life, recharge aquifers, enrich soils and in some of the world's poorest areas they are the main source of irrigation.

The following actions can help to reduce the impact of floods:

- In each country priority basins must be identified and flood management plans based on structural and non-structural measures for flood mitigation and/or flood use should be developed. Ideally, these flood plans would be administered as part of wider basin management. One model to follow would be the Rhine flood action programme developed in reaction to the floods of 1993 and 1995.
- Improve national capacity to plan strategically and establish flood warning and forecasting mechanisms. Nations must develop the capacity to provide disaster relief and rehabilitation.
- Flood awareness campaigns need to be launched to prepare the public for appropriate action in the event of flood. Where relevant, flood risk should be recognised in building design practices and spatial planning.

Flood warnings:

In 1996 the Environment Agency became the lead body for the dissemination of flood warnings in the UK. The Environmental Agency adopted a system of flood warnings, aimed at building a direct partnership between the public and the agency. Local flood warning dissemination plans identified which areas would be warned, and how. A national programme to increase awareness of flood warning arrangements was targeted at those living in high flood risk areas. An annual campaign is now run using a variety of media from local radio to national television. Many methods are used, including floodcall, and automatic voice messaging systems have also been introduced so that direct pre-recorded alert messages can be sent to a selected group of telephone numbers rapidly.

The Flood Action Programme in Bangladesh also worked towards improved flood warnings. It developed a modernised and expanded telemetric network, a real-time flood forecasting system, a public awareness programme and an improved dissemination system for flood messages.

In the monsoon regions in Asia, inter-seasonal water transfer through new multi-purpose storage still provides opportunities for economic development through hydropower and irrigation and protection of livelihoods from flood disasters. Recent experience, however, has also shown the extreme caution required to avoid and curtail negative social and environmental consequences of large dam construction. Another special concern is the siltation of reservoirs and rehabilitation or decommissioning of ageing dams. Concerns over the development of large dams has led to a significant reduction in the development even of smaller dams, although considerable scope and demand still exists, particularly in Asia. This impasse has led to the establishment of a World Commission on Dams. The Commission will report in mid 2000 and hopefully provide recommendations that can be adopted as a basis for assessing large dam development. In the meantime countries should prepare plans for the long-term development of water storage capacity and assess the recommendations of the Dams Commission once released.

Investing for a secure water future

Priyanka Chowdhury, Sishu Niketan Junior Basic School, Jalpaiguri, India

Investing for a secure water future

To meet the challenges of the Framework for Action and realise the Vision, investment in water resources must increase substantially. The two key challenges for the future are to increase significantly the level of investment in water infrastructure and services, and to improve the equity, efficiency, and effectiveness of investments in water.

The largest obstacle to achieving the Vision will be obtaining the required investment. Indeed many of the actions called for earlier in this report directly relate to securing investment. Meeting the investment challenges requires good governance and better decision-making as well as innovative technological solutions. It also requires heightened political awareness of the importance of water so that resources are allocated where they are needed. Investment is the key factor in tackling the urgent priorities just outlined.

This section examines the scale of the problem, and the amount of resources needed. Actions and investments are needed in all countries and regions. The poorer countries of the world have a greater need for financial support and this section focuses on the challenge of meeting the investment needs in the developing world. It will also discuss where the additional resources may be found, and propose a set of actions that together can meet the twin challenges. The discussion is organised in three parts:

- **Assessing investment needs**
- **Meeting the resource challenges: bridging the gap**
- **Measures to support financial flows**

> ***"The challenge is how to launch the upward spiral in which water resources development and economic development become mutually supportive."***
>
> Africa Water Vision

Assessing investment needs

Investments will be needed to serve existing and new members of the population. The Vision Staff Report estimates the total to be 7.5 billion people by 2025. under the sustainable scenario. Of this the main increase will be in developing countries with an expected increase from 4.6 billion to 6.5 billion people. The main investment issues thus relate to meeting the needs of the backlog of people in developing countries who at present do not have adequate services or a clean and sustainable water environment.

Increased investment will be needed in many areas to:

- Ensure the spread of drinking water supplies and sanitation facilities.
- Improve the efficiency and productivity of irrigation services.
- Protect the environment and the basic water resource through the clean-up of contaminated waters.
- Protect surface waters through the treatment of municipal and industrial discharges to watercourses or aquifers.

The scale of the resource needs for achieving water security is hard to estimate. Agenda 21 estimated the additional cost of achieving water security at US$56 billion per year. The World Bank has suggested that US$60-80 billion per year is needed to provide basic water supplies and sanitation for all. At present, the total annual investment in water in developing countries is estimated at around US$70-80 billion per year. As the following table indicates, achieving water security goals imply a doubling – at least – in the level of investment in developing countries to some US$180 billion per year.

For drinking water, additional investment needs are relatively modest at US$13 billion per year, since substantial progress has already been made in providing access to potable water. The investment costs for dealing with sanitation at US$17 billion per year are not much higher than those needed for drinking water, but may be harder to mobilise for a number of reasons.

The investment needed for sanitation – US$17 billion per year – is not much higher than that needed for drinking water, but may be harder to mobilise.

Indicative annual cost of water services for developing countries
(US$ billion per year)

	Today	*Between 2000 to 2025 Estimated cost per year*
Access to drinking water Annual cost	13	13
Sanitation and hygiene Annual cost	1	17
Municipal waste water treatment Annual cost	14	70
Industrial effluent Annual cost	7	30
Agriculture Annual cost	32.5	40
Environmental protection *Annual cost*	7.5	10
Total cost $billion per annum	75	180

Notes: These figures are very approximate and assumptions used for the estimates are set out in Annex III. Costs for today represent broad estimates of the current levels of investment in water services. The estimates include about 15% of total cost for O&M although it is recognised that the actual O&M costs will vary widely.

Sources: Various, including Vision report for agriculture in 2025, Lane (1999) and ERM (1999) for water supply and sanitation.

Firstly, demand and a willingness to pay must be generated; secondly, raising funds from the private sector will take time; thus initial investment will depend on the traditional public sector and communities themselves.

Investment needs for improvements to irrigation, drainage and the necessary increase in irrigated area, are estimated at US$40 billion per year, but much more work needs to be done to obtain realistic figures. This level of investment would improve efficiency and productivity and thus earn a good return. Municipal wastewater treatment to protect surface and groundwater quality could well cost over US$70 billion per year. This value is based on future treatment of about 20% of municipal waste prior to discharge, which may not seem ambitious but given the level of investment needed for treatment plant, it will be challenging. Treatment of industrial effluent could also be costly and while technologies can produce cleaner production and reduce waste, some investment in end of pipe treatment will be inevitable if environmental standards and goals are to be met.

To put the cost of protecting the water resource into context it is useful to note the costs of achieving high water quality standards in industrialised countries. In the European Union, it is estimated that US$150–215 billion is needed to achieve wastewater treatment and environmental goals. In France, annual expenditure on wastewater collection and treatment is around US$8–9 billion per year (capital and current expenditure); in the UK investment in water services is around US$5 billion per year. In the USA, the costs of implementing the Clean Water Act have been about US$32.5 billion per year between 1990–95. These costs may be too high for many countries, but over time as incomes rise, demand for clean surface water increases, as is likely to happen in the newly industrialised countries of Asia, and in the countries of the former Soviet Union and Central and Eastern Europe. The latter are prepared to invest heavily to meet water quality standards demanded by the European Union.

These high costs emphasise the importance of establishing optimal decision-making patterns. Resources need to go where they are most needed: where rivers are most contaminated, where the greatest number of people are at risk of disease or low quality of life, or where eco-systems are most fragile and vulnerable to damage from heavily polluted waters. Investments in clean surface water must be subject to careful cost-benefit analyses, which reflect as fully as possible the eco-system value of water protection and the value of clean water in people's quality of life.

Meeting the resource challenges: bridging the gap

The first challenge is to close the current resource gap for provision of all water services (treatment, supply, environmental protection). In practice this means there is a need to:

- mobilise new sources of investment from the international private sector;
- stimulate effective and efficient domestic private investment;
- integrate service development with the local consumer economy to generate enterprise and employment surrounding water services and wares.

At present the largest investor in water services in developing countries is government – the traditional public sector – which contributes around US$50 billion a year. The domestic private sector, ranging from small-scale water vendors to private municipal and metropolitan utilities, contributes around US$15 billion. International donors contribute a further US$9 billion covering both water and sanitation services and irrigation and drainage. An investment newcomer is the international private sector, which now contributes around US$4 billion a year.

Changing patterns in financing water

The balance between these sources has been changing dramatically. While international private sector funding is still less than 10% of the total, it has increased from virtually nothing over a decade. Between 1984-90 the international corporate sector invested US$297 million in developing countries; between 1990 and 1997 the total was US$25 billion.

Bilateral aid to water (comprising water supply and sanitation and water for agriculture) also increased during the 1990s, from US$2 billion in 1990 to US$4 billion in 1997, although the contribution of multilateral agencies, in particular the World Bank, fell from US$1.6 billion to US$1.2 billion over the period. So the period is characterised by a shift in emphasis from international donor to international corporate sector.

This pattern – using private sector resources to meet the challenge — will be important in the future. To meet the challenge, investment by all groups will have to increase, as the following table shows.

The pattern of movement from public to private sector will need to be sustained, with both domestic and international funds contributing. These increases are plausible, but need strong institutional support and capacity building, with special support from donors. Domestic governments have a role to support the poorest and meet social goals, investing in public goods where the private sector is unwilling or unable to participate. There is complementarity between the four sets of investors.

"Service rates for use of the resource must guarantee an adequate economic return. Subsidies – when justifiable – must be used to guarantee equity and universality of access to the resource. To achieve integrated and sustainable water resources management requires sizeable financial resources. Financing and investment tools must be developed – including private sector participation.

South America Vision

The pattern of movement from public to private sector will need to be sustained, with both domestic and international funds contributing.

Sources of funds for investment in water security in developing countries

	US$ billion per annum		% of total	
	Today	Vision	Today	Vision
In country Governments, public sector	48	50	64	28
In country private sector (including small scale)	14	70	19	39
International Private sector	4	48	5	27
Multilateral and bilateral donor funds	9	12	12	7
Total	75	180	100	100

Notes: Estimates developed by Vision team and GWP Framework for Action Unit

International private sector

To date private sector investment has concentrated on relatively few countries in the Far East and Latin America, and is limited to water supply and sewerage projects. The reasons for this are to a large extent historical. There has been private investment in other utilities in these regions and once successful contracts have been implemented, more projects can follow. Where there is experience of setting up, negotiating and operating contracts, the perceptions of risk and uncertainty from both private sector and government are reduced. The other reason for the geographic focus is differences in government policy; countries in Africa have not yet moved so far towards the involvement of private sector in running utilities, although this pattern is beginning to change.

The water utilities sector is well able to make substantial investments to improve service delivery. A recent London stockbroker report puts the global market for water services at US$370–380 billion by 2010, and private corporations seek to participate in these markets. However, attracting this investment will require that recipient countries have good water governance – strong regulatory frameworks, sound policies, and up-to-date laws. Utilising investment funds effectively and minimising the risks of exploitation by foreign companies will, additionally, require openness and transparency, stakeholder involvement, and efficient local management regimes. Both private sector and government need to ensure that the relationship is mutually fruitful.

A range of actions relating to legal procedures, contractual measures, charging structures – indeed governance – is needed. Governance and tariffs – at the heart of the matter – have already been discussed in *Making water governance effective*.

Measures needed to secure additional and more effective private investment include:

- Strengthen national institutions, with donor support for developing countries, to attract and benefit from private funds; water pricing and a stable investment framework are precursors to attracting private finance.
- Develop guidelines for good practice and support capacity building, training and pilot programmes for new efficient management.
- Introduce economic instruments (charges and tariffs), and use micro-credit and other innovative financing mechanisms to encourage investment at community level.
- Establish, in partnership with international organisations, a private sector led International Research Foundation or Water Innovation Fund to carry out research and training.

"Sustaining the required level of investment would require urgent steps to alter significantly the 'business as usual' approach prevailing in South Asia. Effective use of investment funds will also require openness and transparency, stakeholder involvement and efficient management regimes."

South Asia Framework for Action

Domestic investment in water services

The role of domestic private sector funds is also emerging as significant, particularly in the small-scale and informal sectors.

For water supply and sanitation, there is an important distinction between formal private sector involvement, and smaller scale community-based or small-scale private initiatives for water supply. These latter include investments by water vendors in supplying water to households without connections; community-level development of water resources, and the private digging of wells by households or communities, which may or may not be registered or approved. These investors have been important in overcoming the shortcomings of public supply. Even though water vendors often charge prices well in excess of the costs of water supply, they provide a vital service where public provision has failed.

In Pakistan, farmers' own investments in irrigation covers 70% of the irrigated land; in India and the Philippines, 40%.

Small scale private sector provision of water in West Africa

There are many different small-scale, semi-formal service providers. These concessionaires (Mauritania has granted some100 small concessions to private operators for water supply), pump operators who maintain the local ground water pump (as in Senegal); carters, who collect water from a supply point a few kilometres away; standpipe managers; water carriers; and water truck driver providers. The efficiency of their operations depends on transparency and lack of monopoly as well as consumer demand. The average cost of potable water supplied by these operators is around US $4–9 per person per month). Private water supply operators account for over half the sales of potable water in the countries studied. Self-evidently the level of private sector investment varies by type of service. Local water carriers might invest US$500 in animal drawn carts, or US$130 in pushcarts.

Examples of the significance of the informal private sector and communities:

- *Aguaterias* in Paraguay. These are private sector informal service providers working particularly in peri-urban and semi rural areas; they range in size and coverage from neighbourhood systems with perhaps 25 connected households to larger systems with 800 or so households. Typical investment for an *aguateria* would comprise: a deep well, a submersible pump, ground level motors and pipes, generally about 40 m. per household.
- The Grameen Bank in Bangladesh has made loans to households (mainly women) for the installation of tubewells for water and for latrines. An average loan is US$100 at 20% annual interest. Grameen has lent totals of US$3.6 and US$3 million for tubewells and latrines respectively, with good levels of repayment.
- A community-based scheme in Yemen has financed two 150 m. tubewells with pumps and storage by contributions from households of US$200-600 and average monthly payments of US$6–8 per household (water is priced at US$0.23 per m^3).
- Privately dug wells around Damascus serve some 1.3 million people on illegal settlements covering an area of 4500 hectares. These private investments are meeting gaps in service provision although they need to be legalised and regulated.

To attract investment the private sector needs:

- Potential profitability and return on capital.
- Manageable risks; risks are likely to include risks concerning contract enforceability, regulatory changes and risks – e.g. concerning rights of foreign investors; construction and operating risks; and risks from scarce water resources and hidden defects. Awareness of risk can make private investors advocates of better water resource management (e.g. reducing upstream pollution).
- Political security – both in terms of political regimes and in terms of policy approaches such as political attitudes to tariffs;
- Confidence that tariffs to finance investment, operations and profit are achievable.

Equally, the government needs:

- Confidence that private companies will not exploit them. While foreign direct investment in developing countries has often had highly beneficial outcomes, there is good understanding of the risks of being a small component in a multinational company's portfolio of activities. This anxiety affects investment in utilities too.
- Mechanisms to ensure that social objectives including protection of the poorest from unaffordable tariffs are met.

As most households are able to pay for water, this revenue should be harnessed to ensure that water services are supplied as efficiently as possible.

The role of private investment in irrigation is also important but often not recognised. Private investment by farmers in sinking tubewells is widely established; in Pakistan farmers' own investments in irrigation covers 70% of the irrigated land; in India and the Philippines this proportion is 40%. These countries between them account for over half the world's total irrigated area so the importance of investment by farmers is evident. The international corporate sector has been slower to move into this sector; privately owned estates and plantations make their own investments in water, but there has been – as yet – no investment in irrigation as a service for sale to the public. Here too there are signs of change. There are reports of private sector interest in irrigation to complement investments in seeds and plant-based bio-technology. Turnover of irrigation systems to management by farmer groups is helping to modernise irrigated agriculture (as discussed in *Tackling urgent water priorities*).

Thus it is clear that the private sector is playing a substantial role in water investments, both formally and informally – and legally and illegally. In many cases, people are responding to the failure of urban water and sanitation services through high-cost coping strategies. In some cases these survival strategies may turn out to be both effective and efficient as is the case in some West African cities. The resources in both money and time represented by these strategies should be recognised in considering financial flows in water infrastructure. As most households are able to pay for water, this revenue should be harnessed to ensure that water services are supplied as efficiently as possible. The domestic private sector is important, and needs structures to regulate and manage informal water supply, so that its development complements public sector activities. Regulation is essential to ensure standards of service and to prevent monopolistic and illegal practices by local water service providers.

Although the contribution of international donors will remain a small proportion of the total, the leverage and influence of donors is important.

Measures that can be undertaken by business communities include:

- Direct investment in various water services, producing more efficient water products and supporting water-wise behaviour and awareness campaigns.
- Training of local staff, especially women, to build a larger pool of expertise.
- Ensuring donors focus on institutional strengthening to enable developing countries to attract and benefit from private sector funds.
- Gain recognition for water investments among the ethical investment community: with 'Blue Funds' to complement 'Green Funds'.

Domestic governments

Within countries, while remaining constant in absolute terms, government resources are likely to contribute a smaller share in direct capital investment and maintenance costs. Their key role lies in providing a regulatory and policy framework for investments to ensure that they are based on social equity and other guiding principles laid down by the national water policy, as well as financial sustainability. For poor countries, access to resources may be enhanced by debt relief mechanisms; the inclusion of water security investments in poverty alleviation donor portfolios would be an important step forward. The role of domestic governments is discussed further in *The way forward*.

Measures to increase and improve the utilisation of government funds include:

- Agreement by creditor nations to use funds released by debt relief for basic water services.
- Strengthening institutions, regulation, financial management and tariff setting and collection.
- Establishing programmes to protect the poorest (such as welfare and water vouchers).
- Decentralise and support community initiatives and ensure community participation in planning and designing investment programmes and tariff structures.
- Develop environmental funds to support environmental services and ecosystem protection.
- Use of revenues raised through pollution charges in water to support investments in water resources so that benefits can be clearly linked to the charges paid by individuals and respect 'public good' expenditures.

International Donors

If private investment flows can provide the major source of service investment, this will free up other public and 'softer' loan and grant resources for other water-related purposes. Access to loans can be difficult for water services. Donor contributions are needed for strategic assistance in developing policies, regulatory frameworks, institutional capacity, human resources, and the various technical and scientific competencies required for managing the resource base and water services in a fully integrated fashion.

They also play an important role in helping countries to meet the basic needs of the poorest citizens, and in promoting environmental protection. Donors need to allocate at least double the present funds for water to support integrated management and for social and non-commercial uses of water. In donor agencies, mechanisms are needed to overcome the sectoral basis for investment in water-related activity, particularly in regard to water for food production. Donors should establish strong working partnerships with countries that are committed to addressing their water problems.

Although the contribution of international donors will remain a small proportion of the total, the leverage and influence of donors is important in developing the enabling environmental for substantial investment flows, and in ensuring their equity, efficiency and effectiveness. International donor actions include capacity building through training and twinning; the development of guidelines for good practice; and support for pilot programmes to avoid conflicting sectoral approaches. All donor interventions should promote IWRM and help to ensure that the value of water in all its uses is maximised and that every drop counts. Specific actions must respond to local circumstances and cultural practices.

"The image of private corporations both at home and in foreign markets depends more and more on the attitudes to the environment: it is becoming economically unprofitable to be a polluter."

Russian Water Vision

Donor actions to support domestic investment include:

- Identify mechanisms to facilitate poor countries' access to water funds and develop micro-credit mechanisms for use at community level, to support women and disadvantaged groups (e.g. the Grameen Bank in Bangladesh).
- Support investments at all levels for water services (such as water treatment, micro-finance programmes) through innovative financing mechanisms such as supporting revenue flows until full cost recovery is reached (see *Making water governance effective*).
- Promote IWRM as part of all water-related investments, support capacity building programmes and assist governments in negotiating contracts with private utility companies; focus support on those public utilities that operate on a commercial basis.

Measures to support financial flows

The challenge is to ensure that investments go where they will have the greatest value to society and yield the greatest benefits. This is the purpose of describing water as an economic good. To meet this intention and assure recognition of water's economic value, it is necessary to move towards full cost recovery. Issues surrounding valuing and charging for water are discussed in *Making water governance effective* and are essential to securing adequate investment.

Involving local groups, women and communities in establishing charging schemes and investment programming will be important in ensuring fair and effective financial practices. A combination of capacity building, training, stakeholder participation and respect for the community voice will further help to ensure that resources go where they are most needed and valued. Donors and NGOs have a fundamental role here, in building capacity in both government and private sectors, underpinning basic human needs and social requirements and helping to build the necessary good governance.

All investors can and must contribute to meeting the goal of doubling global investment in water. The balance between investors will vary from region to region and country to country; to date most international private flows have focused on Asia and South America. Donor funds must be directed to supporting the poorest countries, particularly in Africa and South Asia, where they remain crucial. The key is to identify the role in which each can best operate – synergy rather than competition – to produce the best result.

Little is known about how water investments fit into total budgetary expenditure and investment patterns, or about affordability.

Investor Roles

International Private investors: Direct investment, participate in public-private partnerships, and develop consumer water-wares market.

Donors: Build government capacity, underpin basic human needs and social requirements, support ecosystem integrity, and public health.

Government, and public sector: Invest in policy-making, institutional, legislative and regulatory framework, training; facilitate good water governance and, support equitable access for the poorest.

Domestic private sector and communities: Direct investments in water services, micro–industries and manufacturing; provide service repairs and water wares.

It is clear that knowledge about financial flows is weak; little is known about how water investments fit into total expenditure and investment patterns, affordability, or mechanisms for support to financial flows. Techniques for appraising investments and new policy measures are still being developed. Continuing research and analysis to support financial flows is proposed as an action for the immediate future. This work can build on what has already been achieved through the regional activities of the GWP in developing estimates of financial flows, constraints and opportunities, analysing pricing structures and sustainable water use, and developing actions and best financial practices to ensure future water resource development.