EDUCATION AND TRAINING FOR THE DECISION MAKERS

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Contents

Summary

Today the main challenges in water management are not derived from hydrodynamic problems but correspond to global water management and the means to harmonize the different uses. To be efficient, a sustainable approach expressed in the concept of integrated management should be introduced and followed. The institutional context refers to the question of who is responsible for what. Process management is a game which aims at reaching a consensus between the different parties and policy development and implementation. This result is obtained by structuring the decision-making processes and by promoting a real co-operation between the institutional bodies and the users.

Due to the complexity of the problems and situations, water management is now the meeting point of many sciences and techniques which associate and combine technical and socio-economic demands. With this new approach, the public and specially the decision makers are confronted with the multiplication of the results and with the difficulty of understanding all the aspects of a project.

In a favorable institutional context, water resources management must now integrate criteria of sustainability and new ecological values. Both require more information which, in turn, highlights additional new risk and uncertainty. The decision makers must be able to obtain this information, to understand and to play an efficient role in decision processes. The deep understanding of integrated water management and the agreement with the collaborative process are the most sensitive points which also determine the possibilities of meeting the public demand, answering to their needs, and developing and extending institutional and financial structures which are necessary to promote the sustainability concept.

1. Introduction

"[In making a decision]…never give your reasons; for your judgment will probably be right, but your reasons will certainly be wrong." Lord Mansfield

Today, and specially in the European background, the main challenges in water management are not derived from hydrodynamic problems but correspond to global water management and the means to harmonize the different uses. To be efficient, a sustainable approach expressed in the concept of integrated management should be introduced and followed. The substance of this concept is to treat the different elements of water systems in relation to each other in order to prevent ineffective or sub-optimal sectoral solutions. The institutional context refers to the question of who is responsible for what. Process management is a game which aims at reaching a consensus between the different parties and policy development and implementation. This result is obtained by structuring the decision-making processes - what are the rules of the different actors?

- and by promoting a real co-operation between the institutional bodies and the users.
- Since the 1970s a series of international meetings and conventions have provided milestones on the way to sustainable water resource management, leading to the widely accepted Dublin principles for managing water:
- Freshwater is a finite and vulnerable resource, essential to sustain life, development, and the environment;
- Water development and management should be participatory, involving users, planners, and policymakers at all levels;
- Women are central to providing, managing, and safeguarding water;
- Water has an economic value in all its competing uses and should be recognized as an economic good.

These principles recognise the close interrelationships between economic, social, and environmental security. Due to the complexity of the problems and situations, water management is now the meeting point of many sciences and techniques which associate and combine technical and socio-economic demands. Hydraulics, hydrology, ecology,

biology, economy, and sociology are now essential in every new project linked to water resources management. With this new approach, the public and specially the decision makers are confronted with the multiplication of the results and with the difficulty of understanding all the aspects of a project.

Who are the decision makers in water resources management? What could be an educational program for the decision makers? Water resources management must now integrate criteria of sustainability and new ecological values. Both require more information which, in turn, highlights additional new risk and uncertainty. The decision makers must be able to obtain this information, to understand and to play an efficient role in decision processes. To achieve this situation, three major different conditions must be realized:

- a favorable institutional context for water management;
- real qualification and knowledge of the decision makers about technical aspects;
- agreement of the decision makers to play their role in the decision process.

Clearly the challenge is now to propose a comprehensive set of practical principles for implementation. A priority is to involve in the process the decision makers who could be the most efficient actors in the spreading of the integrated water resource management concepts. For all these reasons, education and training advances must be developed and proposed to the decision makers.

2. World Water Challenges and Decision Makers

Fresh water available for human consumption, for social, economic and cultural needs and for environmental requirements is rapidly becoming scarcer. In the 1950s, only a handful of countries faced water shortages. In the late 1990s, the number of countries facing a water deficit has grown to 26 with a total population of 300 million. If action is not taken to reverse this trend, it is predicted that two-thirds of the world's population will face water shortages in one form or another by the year 2050. Food production, which consumes about 70% of the world's fresh water, is at risk and is the first area to be severely affected, with a wide range of ramifications.

Despite international effort, approximately 1.2 billion people lack access to clean drinking water, 2.2 billion lack adequate sanitation and 4 billion do not have sewerage service. Those that suffer the most are the poor, particularly women and children. Some 5-10 million deaths annually are attributed to water-borne diseases. This trend is likely to grow as water scarcity increases and investment in the provision of water and sanitation services continues to decline. The world, for all its wealth and technology, today fails to meet the most basic human needs of its population.

2.1. The Key Position of the Decision Makers

The contribution of the World Water Council for the last World Water Vision presented at the 2nd World Water Forum and Ministerial Conference, March 2000, in The Hague (The Netherlands), formulated three primary objectives of integrated water resource management:

Empower women, men, and communities to decide on their level of access to safe water and hygienic living conditions and on the types of water-using economic activities they desire and organize to achieve them;

Produce more food and create more sustainable livelihoods per unit of water applied (more crops and jobs per drop), and ensure access for all to the food required for healthy and productive lives;

Manage human water use to conserve the quantity and quality of freshwater and terrestrial ecosystems that provide services to humans and all living things.

To achieve these three objectives, which are widely accepted, the World Water Council indicates five primary actions which are needed:

Involve all stakeholders in integrated management. Today water professionals manage most water, often on a sectoral basis, without co-ordinating their planning and operations, without close collaboration with the environmental community, and within administrative boundaries that usually ignore the natural surface and groundwater basin divides. Worst of all, the most interested stakeholders, who are the women and men in the community whose lives and livelihoods depend on wise water management, do not participate in decision-making. All experiences demonstrate that sustainable water resources management is obtainable only if these stakeholders are involved in making social and economic decisions affecting land and water use. Governments should establish the institutional mechanisms to make this happen with the adoption of a national legislation requiring land and water planning and management with participation of women and other stakeholders representing the economic, environmental, and social interests of the community and full sharing of information.

Move to full-cost pricing of water services for all human uses. Because of its scarcity, water must be treated as an economic good. Today the majority of international conferences on water management and expert groups recommend that consumers be charged the full cost of providing water services. That is, they should pay the full cost of obtaining the water they use and the full cost of collecting, treating, and disposing of their wastewater. This does not preclude governments from providing targeted, and/or transparent subsidies to the poor, always taking into account the other calls on public funds. It is a paradox that the poor suffer the most from water subsidies and from policies that treat water as a social good. Too often, water subsidies are captured by the wealthy, leaving insufficient resources for system operation and expansion and resulting in rationing with the poor always at the end of the line. Pricing water services is a good step towards establishing a framework that will eventually recognize the full economic value of water, including the cost of externalities. Full-cost pricing must be accompanied by targeted, transparent subsidies to low-income communities and individuals to allow them to pay to meet their minimum requirements and to encourage user participation in decision-making. This approach to valuing water will encourage infrastructure investments and private sector involvement and provide the revenue to cover the costs of operation and maintenance. It will make water suppliers accountable to users. It will reduce water withdrawals from and pollution of ecosystems. And it will encourage the use of water-saving practices and technologies, as well as further

research.

Increase public funding for research and innovation in the public interest. The consultations held for the World Water Vision demonstrate that because water and the environment have not been valued, there are enormous gaps in the quantitative knowledge about freshwater ecosystems. Similarly, there is little stimulus for innovation in water conservation technologies. Pricing water resources will encourage the private sector to do some of this. Still more publicly funded research is needed to promote the development and dissemination of innovative technological, social, and institutional approaches to international water resource management, especially in areas serving the public interest and not addressed by market-driven research and development.

Recognize the need for cooperation on integrated water resource management in international river basins. Clearly, this recommendation concerns the traditional cooperation in international water basins management. It suggests that nations voluntarily restrict their sovereignty to make it possible to apply the principles of integrated water resource management in international watercourses.

Massively increase investments in water. Addressing the world's water resource problems will require massive investments. More investments are needed in water infrastructure, from current levels of $70-80 billion a year (1999-200) to about $180 billion, with $90 billion coming mainly from the local private sector and communities, including contributions in kind. Coupled with this added investment would be government subsidies targeted to reach the poor (effectively and efficiently) so that they benefit from the new infrastructure. Pricing water to produce the cash flow for future investments and for operation and maintenance should go a long way towards making this possible. Contrary to a lot of thinking today, the World Water Council recommends that governments maintain their water budgets at current levels, mainly to provide funds indirectly to low-income individuals and communities who otherwise would not have access to water services and to keep food prices affordable for poor people.

From all these objectives and remarks, it is clear that the key position for the choice, promotion and application of the concepts of sustainable water resources management is that of the decision makers. They have an essential role to play in institutional choices, in economical strategies, in public research funding, in the promotion of cooperation in the international background and in the increase of investments. To play an effective active role, it is also obvious that this special group need information, education and training. Meeting these requirements must be a priority for each country. These tasks must be defined and coordinated from local to international level. Today, although the concepts for the sustainable management of water resources are widely accepted since the Dublin conference, the actual application and know-how are still very little used.

2.2. Awareness Raising by Education and Training

More and more actors are thus involved in water management:

- to participate in dialogue bodies or in the procedures organized by the public authorities;

- to realize investments either individually or collectively and to ensure their management;
- to make better use of water, thus combating and preventing wastage and pollution, and better maintain the aquatic media and the bed of the basin;
- to organize risk prevention and warning systems.

Thus, new parties -- engineers, technicians, civil servants -- are coming onto the scene to mingle with the water professionals. Their direct or indirect roles will become more and more important. The first level of decision-makers may be grouped into two categories: individuals and collectives. Individuals are heads of industrial enterprises, farmers, fishermen, waterways representatives and so on, and collectives correspond to local elected officials, heads of village communities, heads of trade unions or co-operatives, and associations' representatives. Associated with this first level of decision makers appears the group of information relayers. They are mainly journalists, teachers, members of associations, popularizing bodies, health care staff and so on, and play an interactive role in broadcasting both the information and the knowledge, but also in being aware of the problems and the opinions of the users and of the population.

It is extremely important to implement specific means to raise their awareness, and provide them with the information they require, in the appropriate forms and with the necessary support. They all have in common, on the one hand, that water is not their profession and that they have not been trained to play a role in it, and, on the other, that they are often geographically dispersed, even isolated sometimes, especially in rural areas.

In France for example, the International Office for Water has developed awareness-raising programs with the support of the Ministries, the Water Agencies and Associations of elected officials or professionals. These programs are particularly intended for the mayors and civic representatives of rural communities (more than 10 000 participants in the "Water information days for local elected officials") or the people in charge of professional agricultural organizations with the support of the European LIFE-River-Water sharing program coordinated by the European Commission.

In Poland, the Gdansk Water Foundation (GWF) has organized seminars for the people in charge of all Voïvodships which are the national river basin organizations. In Hungary, the awareness-raising days for elected officials have also been organized with Hungarian instructors who were specially trained in France. In Mexico, the Guadalajara seminar in July 1994 was particularly aimed at informing the users' representatives on the future basin committees.

With the fulgurating development of Internet, new intelligent, on-line services will develop and allow responses in real-time to the questions asked the most frequently by the various categories of managers. Services of this kind are being used experimentally within the framework of European programs such as "Ecomanagement", intended for managers of Small Industries or for mayors of rural communities.

To be really efficient, the decision makers must be in a position to receive information,

to understand and to play an active role in the decision-making process. To achieve this situation, three major conditions must be realized:

- a favorable institutional context for water management;
- real qualification and knowledge about technical aspects;
- agreement to play their role in the decision making process.

All the educational actions are organized around these concepts which are the basic components of integrated water management. For the majority of educational programs destined for the decision makers, it is proposed that the water management knowledge should be organized in four different categories:

- institutional and regulation;
- training, research and development program;
- administration of data;
- documentation (reference basis, full text basis and directories).

For each category, collection of information will cover once again four main topics:

Knowledge of the functioning of the hydrosystem

This requires regular diagnosis based on systematic monitoring of the quantity and quality of water and aquatic ecosystems, with the help of tools such as geographic information systems, standardized indicators for follow up, etc. These tools are necessary for controlling water use, network operation and discharges, controlling quality, river monitoring and water policing.

Knowledge of uses and of their impact

The optimization of resource management also requires a global vision of all the water uses in the basin (withdrawals for irrigation, drinking water, industry, etc...) and of the impacts of human activities on water and the hydrosystem (polluting discharges but also disturbances of the "water cycle" process by deteriorating some elements of the hydrosystem, such as the drying up of marshes, the lowering of groundwater level through over exploitation, etc.).

Knowledge for defining long-term objectives and plans

Integrated long-term management must be organized, based on the information thus gathered, on the global comparison between the state of the resource (water, hydrosystem) and uses and impacts, and by integrating long-term perspectives: status and evolution of the aquatic resource, evolution of needs (demand increase, possibility of saving water). New water supply opportunities must be identified as well as the limits of the natural resource and the risks of shortage (quantity) or of deterioration (quality) which can also lead to impossibility of or difficulty in using it. The planning objective is to enable the meeting of use requirements through a sound management which is not detrimental to the aquatic "resource" nor to the hydrosystem, thus enabling the good functioning of the process that generates this resource.

Knowledge of technologies, innovations, experts, and working teams in that field

Some techniques are well adapted to hydrological and hydrogeological contexts; the transfer of technology to save water, to choose and optimize better treatment processing, and new strategies to protect environment are required. Collaboration between exerts has to be improved by specific list services and news groups.

3. Favorable Institutional Context

The fragmentation of institutions in the water sector is a serious obstacle to the integrated management of water resources advocated as the desired approach for several decades. The people, organizations, and laws and regulations for water supply and sanitation for residential use often have very little to do with those applicable to the water used for, say, irrigation, flood protection, or hydropower. Also surface and groundwater are often managed separately. On top of the fragmented approach within the water sector come the insufficient links to planning and management of other, closely related, sectors. First and foremost is the link to land use planning. A land use decision is also a water decision. Planning and management of land and water resources should be closely linked, or better, completed integrated.

Today, many international structures such as the United Nations underline that the biggest challenge in water resource management remains institutional. Political will must change decision making to include all stakeholders, especially women, so that stakeholders have the power to manage their own resources. Public and private management of water can only be improved through greater accountability, transparency, and rule of law. The education actions and programs, which are the most useful tools to develop this new legal environment, must be focused on the group of decision makers who have responsibility for the implementation of a favorable institutional context.

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Biographical Sketch

Philippe Gourbesville received a PhD in hydrology and hydraulics at the Louis Pasteur University, Strasbourg I (France) in 1993. His PhD, realized with the support of local collectivities and a national industrial program, focused on modeling tools and multi-model procedures for complex hydrological situations.

From 1988 to 1997, he was with SOGETI, an engineering consulting company, as hydraulic engineer first and head of the hydraulic and environmental department. After 10 years of consulting activities, Philippe Gourbesville left SOGETI to join the Department of Geography of the University of Nice-Sophia Antipolis as Associate Professor and became the dean of the faculty of the geographic sciences in 2002. Since 1997, he has developed teaching activities on Water management (quantity and quality), sustainable development, hydrology, free surface flows, hydroinformatics, data processing, impact assessment, integrated coastal management, Geographical Information Systems (GIS), Decision Support Systems, and project management. He also created a national postgraduate degree: Hydroprotech (http://www.unice.fr/hydroprotech). This program dedicated to hydro-technologies receives every year students and professionals interested to learn and practice modeling systems on water management. Outside the University of Nice-Sophia Antipolis, Philippe Gourbesville developed teaching activities with the ETNET 21 network, at the Department of the Civil Engineering at Vrije Universiteit in Brussel (VUB-Belgium), at the International Institute for Infrastructural, Hydraulic and Environmental Engineering in Delft (IHE-The Netherlands), at the National School of Geographic Sciences in Marne la Vallée (ENSG-France), at the National Center for Public Engineers in Nancy (CNFPT-France) and at the Ecole Polytechnique Fédérale in Lausanne (EPFL-Switzerland).

The research activities of Philippe Gourbesville are focused on hydroinformatics, DSS, GIS integration and water resources management. At the same time, he follows international consulting activities as expert on water resources management, hydroinformatics, integrated coastal management applied to anthropogenic coastal development and ecosystem equilibrium impact assessment. He is a member of the professional organizations IAHR, IAHS, and AGU.