

Drafted: 25 October 1999

# **Long-Term Vision for Water, Life and the Environment (World Water Vision)**

**WORKING PAPER**

**To initiate the consultation  
towards a vision**

**WATER-EDUCATION-TRAINING  
(W-E-T)**

**-A SECTOR VISION OF EDUCATORS  
AND THOSE TO BE EDUCATED -**

**Co-ordinated by:  
International Hydrological Programme (IHP)  
of UNESCO**

**Paris, October 1999**

*(Comments, recommendations, proposed additions and deletions should be communicated either through the interactive website <http://watervision.org>, Discussion Forum WATER-EDUCATION-TRAINING category or via e-mail to [j.bogardi@unesco.org](mailto:j.bogardi@unesco.org) )*

## TABLE OF CONTENTS

**Executive summary**

**Preamble**

<b>1.</b>	<b>Introduction</b>
<b>2.</b>	<b>Scope and Target Groups of the W-E-T Vision</b>
2.1	A Vision for Whom?
2.2	Possible Futures: Scenarios to be Considered
2.3	Analysis of Scenarios
2.3.1	Demographic Drivers
2.3.2	Technological Drivers
2.3.3	Economic Drivers
2.3.4	Social Drivers
2.3.5	Environmental Drivers
2.3.6	Governance Drivers
<b>3.</b>	<b>Needs and Problems: an Analytical Review of the Present State of the Water-Education-Training (W-E-T) World</b>
3.1	General Comments
3.2	Educational and Training Needs
3.2.1	Need Categories
3.2.2	Needs at National Level
3.2.3	Needs at Regional Level
3.2.4	Needs at Global Level
3.3	Review of Problems
3.3.1	The Image Problem
3.3.2	The Disciplinarity Problem
3.3.3	Problem of Recognition
3.3.4	Problem of Budget
3.3.5	Problem of Educational Methods
3.3.6	Problem of Sustainability
<b>4.</b>	<b>Principles of the W-E-T Vision</b>
4.1	Principle of Integrated Water Resources Management
4.2	Principle of Environmental Awareness
4.3	Principle of Solidarity
4.4	Principle of Subsidiarity
<b>5.</b>	<b>Structure of the Water-Education-Training (W-E-T) World</b>
5.1	Introduction
5.2	R+E: Research and Education
5.3	CC: "Collaborative Clusters"
5.4	QF: Quality First
5.5	PA: Public Awareness
5.6	Stakeholders
<b>6.</b>	<b>From Vision to Action</b>
6.1	Overarching Priorities
6.2	Priorities within the Clusters

6.2.1	General Comments
6.2.2	Research and Educational Cluster
6.2.3	Collaborative Cluster
6.2.4	Quality First Cluster
6.2.5	Public Awareness Cluster
6.3	Examples
6.4	Outlook
<b>Annex 1</b>	<b>References</b>
<b>Annex 2</b>	<b>Acronyms and Abbreviations</b>
<b>Annex 3</b>	<b>Glossary</b>

## **Executive Summary**

The recent emergence of global initiatives, first of all the Long Term Vision for Water, Life and the Environment, underlines the growing importance of the freshwater resources for ecosystems and in particular for humankind as a part of it.

The reviews of the state-of-the-art of our observation, monitoring, analytical and management tools reveal a staggering catalogue of shortcomings: lack of data, techniques and funding are accompanied with the slow process to apply up-to-date knowledge and technologies in the "real world" praxis. Uneven geographical distribution of well trained staff at all levels, internal and external brain-drain are weakening the respective water resources management services. These are the more alarming as the forecasted most dramatic regional water demand increases coincide with those areas where the most serious problems are encountered as far as human resources are concerned.

Conservation and management of the water resources, distribution, use and recycling cannot be mastered alone by the professional community. They penetrate the entire society: touching the different administrative entities, stakeholder groups, social classes, urban and rural populations, generations and genders. Water is everybody's business! Water resources issues, like other major challenges of humankind are subject to the ongoing globalization process.

Education has been identified as the key element in forging a worldwide strategy to prepare humankind for the challenges of the XXIst century. The concept of the "learning society" means a reorientation of approaches. It implies interactions by making learning as one of the basis of human coexistence.

The recent International Symposium on the Learning Society and the Water Environment (2-4 June 1999, Paris) concluded that the ongoing Long Term Vision for Water, Life and the Environment is an excellent initiative that could further be enhanced by an additional dimension of a sectoral consultation on Water, Education and Trainning (W-E-T). The need to formulate a coherent educational vision with regard to water is further emphasized by the short-sighted, but general decrease of funds for development assistance, and for research and education.

A sectoral vision is to be conceived by those who are most deeply involved: educators, trainers, extension workers, students, participants of continuing education and training and employers.

The present working paper is aimed to initiate the consultation process to trigger responses to be considered in formulating the Vision for W-E-T.

The W-E-T Vision is expected to reflect the current issues and priorities. However, as education is a preparation for the future, the W-E-T Vision should also account for this perspective beyond the actual (priority) objectives. The professional community is thus challenged to "visionalize" in the broadest sense of this term.

The W-E-T Vision should reflect the whole scope of education, including pre-school, primary, secondary and tertiary educational levels, lifelong continuing education and training, as well as the informal and innovative ways of knowledge and information transfer.

The present working paper concentrates on the professional/academic/postgraduate/continuing education, training and professional development segment of the W-E-T World. It is considered that if we fail at this level, if we accept deterioration, then all other segments of the W-E-T World fail subsequently.

The W-E-T Vision is addressed to the following target groups:

- Intergovernmental agencies.
- Scientific and technical NGO's.
- The private sector.
- Educational and research programmes.
- Bilateral and multilateral donor agencies.
- Public awareness raising-oriented NGO's.
- Ministries and other administrative entities in international, national, provincial and local levels, river-basin agencies.
- Education "providers".
- CET institutions and their respective donors.

The World Water Vision project developed three global, reference scenarios for common use:

- Conventional Water World (CWW).
- Water Crisis (WAC).
- Sustainable Water World (SWW).

The present W-E-T Vision adopts these three scenarios irrespective the fact that the achievement of education, training, public awareness raising etc. objectives can not and should not be measured in the same way as other water-related aspirations.

The document analyses the implications of demographic, technological, economic, social, environmental and governance drivers and their interactions with the reference scenarios upon the "W-E-T World".

A sectoral vision on Water-Education-Training should also be based on an analysis of the present state of the Water-Education-Training (W-E-T) World by reviewing needs and problems.

Needs stand for objectives to be responded to and to be satisfied by the different forms and at different levels of education and training (E&T). Problems constitute a set of constraints limiting the feasible range and type of solutions. Thus, a feasible W-E-T Vision and its implementation must consider the problems and observe the inherent limitations.

Both needs and problems might be classified as global, regional and national ones.

The W-E-T Vision is also an attempt to reflect on prevailing professional, ethical and political principles and their implication to W-E-T. The draft document identifies four principles, namely the:

- Principle of Integrated Water Resources Management.
- Principle of Environmental Awareness.
- Principle of Solidarity.
- Principle of Subsidiarity.

The W-E-T vision is based on the synthesis of different aspects. Education-related problems have to be solved in order to be able to respond to actual educational needs. However, both problems and needs must be viewed at within the prevailing societal context, which in turn, reflects present day's political, economic and ethical constellation. The analysis of today's overall cultural situation cannot be the sole purpose of the W-E-T Vision but one must be aware that a vision can only be understood as an expression of the prevailing intellectual perception and aspirations. By considering the time span of the W-E-T Vision covering a period of 25 years it will be obvious that this statement cannot outline in detail what in one generation's time might be appropriate. But the W-E-T Vision should devise concepts, steps, elements that are flexible enough to accommodate changes and aspirations beyond our present perception.

It is acknowledged that water education and training do not and should not take place in an academic ivory tower. Yet it is also futile to deny that there is an educational world, existing within society, interacting with it, but still following its own "rules" developed through tradition and through the very nature of education.

To analyze the inherent processes of the Water-Education-Training World and its interactions with its surroundings, the model of the W-E-T-World is conceived, based on a triangular structure of relationships between clusters representing Research+Education (R+E), Collaborative Clusters (CC) and the Quality First principle (QF). The W-E-T World has a virtual interactive surface representing Public Awareness (PA) with its surrounding.

*How could a vision be turned into reality?*

The analysis of drivers and scenarios reveals the following overarching priority areas where urgent actions are needed:

- Public awareness raising, especially in rural context.
- Technological education, training and technology transfer.
- Negotiation and conflict resolution and mitigation techniques.
- Integrated water resources management.
- Explore the potential of the new media, learn to use them.

Based on the analysis of needs and problems the W-E-T Vision revealed the following priority areas:

- Regional education, networking.
- Sustainable funding of education and training.
- Educational methods and organisation.

While the principles

- Integrated Water Resources Management (IWRM) and
- Environmental Awareness,

can be seen as central features of the present and future educational activities.

Different analytical approaches have identified IWRM as a crucial priority area within the W-E-T Vision.

IWRM should not remain at conceptual level as far as W-E-T is concerned. Rather it is a call for a new paradigm to be consequently pursued at different levels of water management practice and thus also that of education and training.

Public awareness, technological aspects and negotiation skills are the three major thrusts within an IWRM oriented education to be pursued.

Needless to say that sustainable funding is the “a” and “o” of the “W-E-T World”. This appeal of the “W-E-T World” to the political decision-makers controlling national and international budgets and donor priorities is more than a priority. It is the prerequisite to shape a desirable Sustainable Water World (SWW) through education, training and other forms of capacity building.

However a W-E-T Vision of educators and those to be educated should not remain limited to express needs, appeals and requests. It must show the contribution of the “W-E-T World” itself. The solution of common problems, but also solidarity, dictates that the “W-E-T World” joins forces, combines knowledge and finds the most efficient and cost-effective ways to address the issues in W-E-T. In this respect, networking as the best possible contribution of the “W-E-T World” itself.

These general priorities can be further detailed for the different clusters of the W-E-T World.

- Research and Educational Cluster

- Teacher's or trainer's training.
- Development of new teaching technologies
- Policy relevant research.
- Interaction with the media, to provide it with appropriate input.

- Collaborative Cluster

- Networking of different, also non-academic partner institutions
- Collaborative arrangements to improve efficiency and effectiveness of teaching efforts.
- Interdisciplinarity exposure, also during the training period of a student.
- Guidance how to implement inter and multidisciplinary programmes.

- Quality First Cluster

- Developing criteria for the assessment of study programmes, study management and examination procedures.
- More transparency in international training.

- Public Awareness Cluster

- PA raising programmes, events and courses should concentrate to government officials, economical, financial and political decision makers.
- Other target groups of PA are youth, women, general public to be addressed, in partnerships with NGO's, youth clubs.

The working paper presents a few examples of potential and ongoing activities.

The W-E-T Vision is conceived to counteract the present trend of diminishing funding and political support for E&T while water issues in general are given due consideration at the political level.

The W-E-T Vision should be the expression of the conscience of the “W-E-T World”, a rallying point to have its reference function well beyond the “active”, elaboration phase of the World Water Vision.

The W-E-T Vision opts for the SWW Scenario as the future worth to work for.

The present W-E-T Vision's focus is on higher education. However the same triangular structure of the “W-E-T World” as shown for R+E could be repeated for Practice and Education (P+E) or skills and training (S+T) as well.

The “W-E-T World” is thus synonymous with SWW. We are all challenged, educators and those to be educated, to make this happen.

*We have to tell what the W-E-T World can do,  
We have to tell what the W-E-T World needs and  
We have to tell what the “outside” world must do to achieve our common goals  
for a sustainable common future Water World.*

## **Preamble**

*...."the key to sustainable, self-reliant development is education - education that reaches out to all members of society through new modalities and new technologies in order to provide genuine lifelong learning opportunities for all ...We must be ready, in all countries, to reshape education so as to promote attitudes and behaviour conducive to a culture of sustainability."*<sup>1</sup>

*Federico Mayor*

## **1. Introduction**

The recent emergence of global initiatives, first of all the Long Term Vision for Water, Life and the Environment, underlines the growing importance of the freshwater resources for ecosystems and in particular for humankind as a part of it. The approaching end of the 20th century and the new millennium are welcome occasions to make overall assessments of the availability, distribution and management of water regarding its quantity and quality attributes, its utilization, consumptive use and ecosystem functions. These global assessments, as well as the reviews of the state-of-the-art of our observation, monitoring, analytical and management tools reveal a staggering catalogue of shortcomings: lack of data, techniques and funding are accompanied with the slow, biased process to apply up-to-date knowledge and technologies in the "real world" praxis. Furthermore, uneven geographical distribution of well trained staff at all levels, internal and external brain-drain are weakening the respective water resources management services. These diagnoses are the more alarming as the forecasted most dramatic regional water demand increases coincide with those areas where the most serious problems are encountered as far as human resources are concerned. While the lack of educated personnel can be seen as the root of the problem, it has to be acknowledged that an enabling economic, social, institutional environment is just as pre-requisite for sustainable management of water, land and related resources. Thus education and training can not be considered without it links to society.

Management of the water resources, distribution, use and protection cannot be mastered alone by the professional community. They penetrate the entire society: touching the different administrative entities, stakeholder groups, social classes, urban and rural populations, generations and genders. Water resources issues, like other major challenges of humankind are subject to the ongoing globalization process.

UNESCO has recently identified education as the key element in forging a worldwide strategy to prepare humankind for the challenges of the XXIst century. The concept of the "learning society" (Report of the Delors Commission, 1996) means a major change in our attitudes. Fundamentally, a complete reorientation of approaches, interactions is called for, by making learning as one of the basis of human coexistence.

Similarly the White Paper of the European Commission on Teaching and Learning-Towards the Learning Society (1996), the recent International Symposium on the Learning Society and the Water Environment (2-4 June 1999, Paris, organized by UNESCO/IHP, ETNET ENVIRONMENT WATER, TECHWARE, IAHR, IAHS, OIE and co-sponsored by

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<sup>1</sup> Preface to "Educating for a Sustainable Future: a Transdisciplinary Vision for Concerted Action", UNESCO Document: EPD-97/CONF.401/CLD.1, November 1997.

WMO and UNEP) has realized the need to respond in an integrated way to these emerging challenges, namely the growing concern over the resource "water" and the ever increasing need for education, training, knowledge transfer and public awareness raising at all levels. The conference concluded that the ongoing Long Term Vision for Water, Life and the Environment is an excellent initiative that could further be enhanced by an additional dimension of a sectoral consultation on Water, Education and Training (W-E-T). The need to formulate a coherent educational vision with regard to water is further emphasized by the short-sighted, but general decrease of funds for development assistance, budgets for research and education, donor fatigue and the apparent lack of interests or ability on the part of the financing institutions to translate the oversubscribed principle of sustainability into sustainable actions in the area of education and training.

Diminishing financial resources and the simultaneously increasing need for education creates thus the external exigencies to formulate a Water, Education and Training (W-E-T) Vision as an urgent matter. The International Hydrological Programme (IHP) of UNESCO accepted the call of the Symposium to prepare an initial statement to launch the consultation process towards a sectoral W-E-T Vision. A sectoral vision is to be conceived by those who are most deeply involved: educators, trainers, extension workers, students, participants of continuing education and training and employers. Likewise education officials are also challenged to express their views to contribute to the formulation of a realistic dream: a sustainable Water-Education-Training World serving a sustainable world in the XXIst century and beyond.

The present document contains initial statements. It is the intention of this draft document to trigger responses, first of all from the targeted professional community: educators and those to be educated, but also from those felt challenged to express their views. It is hoped that end-users, the employers of educated and trained persons will also accept this invitation for consultation.

Debate, irrespective whether it is supporting the initial statements or argue with them is the only process which helps to formulate the W-E-T Vision to become a truly sectoral statement, the vision of the professional community on sustainable education and training for improved, sustainable water resources management.

It is believed that international meetings, conferences and congresses are excellent fora to facilitate the deliberation process towards a common vision. Therefore the sectoral W-E-T Vision consultation was be launched during the XXVIIIth Congress of IAHR, August 1999 in Graz, Austria.

The WMO Symposium on Continuing Education and Training (CET), from 6 to 10 November 1999 in Teheran, Iran, will provide the opportunity to have open oral debate over the emerging W-E-T Vision. Then the first version of the W-E-T Vision will be presented on the interactive website of the Vision Management Unit, with cross-reference to it in related homepages.

Debate and consultation will be open till the end of 1999. The W-E-T Vision document will then be revised and presented during the 2<sup>nd</sup> World Water Forum in March 2000 in The Hague, The Netherlands. UNDP, the World Bank Institute and UNESCO jointly convene a special event on Water and Education on March 2000. Needless to say that a Water, Education

and Training Vision will be measured by its impacts: how far its recommendations and guidance influence educators, students and donors. W-E-T Vision is not conceived as an outsider's view. It should be developed, owned and used by the very people who dedicated themselves to the noble task of education, training and knowledge dissemination in the area of water.

## **2. Scope and Target Groups of the W-E-T Vision**

### 2.1. A Vision for Whom?

Water-related education concerns first of all the knowledge of the hydrological cycle. This concerns the entire scientific profile of terrestrial freshwater resources assessment, monitoring, and management. Thus in this context, hydrology could be interpreted in its broadest sense, as defined by IAHS:

*"Science that deals with the waters of the earth, their occurrence, circulation and distribution, their chemical and physical properties, and their reaction with their environment, including their relation to living beings."*, and

*"Science that deals with the processes governing the depletion and replenishment of the water resources of the land areas of the earth, and treats the various phases of the hydrological cycle."*

Beyond this scientific knowledge of the natural process the W-E-T Vision should also address the economic, ecological, political, institutional and even spiritual aspects of water and its interrelations with the human society.

The W-E-T Vision is expected to reflect the current issues and priorities. However, as education is a preparation for the future, the W-E-T Vision should also account for this perspective beyond the actual (priority) objectives. The professional community is thus challenged to "visionalize" in the broadest sense of this term.

The W-E-T Vision should reflect the whole scope of education, including pre-school, primary, secondary and tertiary educational levels, lifelong continuing education and training, as well as the informal and innovative ways of knowledge and information transfer. Education via distant learning, self study, internet knowledge transfer etc. are examples of this process. An additional dimension reflects the different target groups: policy makers, managers within and outside the water sector, professionals, technicians, service personnel etc. In addition, the public awareness-raising component should be explicitly addressed focusing on stakeholders, women, youth. Water is everybody's business! Within this broad setup, the professional characteristics of a sectoral vision will be reflected by emphasizing university - postgraduate degree - and continuing professional education. This focus does not mitigate the importance to include water and related subjects into elementary and secondary school curricula. The emphasis on higher education includes the preparation of teachers, trainers and educators to their tasks with the young generation. The present draft of the W-E-T Vision concentrates on the professional/academic/postgraduate/continuing education, training and professional development segment of the W-E-T World. It is considered that if we fail at this level, if we accept deterioration, then all other segments of the W-E-T World fail subsequently. It is expected however that during the consultation process the other educational components will also be addressed in depth. As far as public awareness is concerned, the priority target groups of the present draft are the youth and the (political) decision-makers. In order to reach groups, mass media can be considered as an intermediate target group as well.

Correspondingly, the following target groups can be identified:

- Intergovernmental agencies (UNESCO, FAO, WMO, WHO, UNEP, other agencies and programmes of the UN System, European Commission, ASEAN, etc.) with their respective water, environment and education-oriented sub-units.
- Scientific and technical non-governmental organizations, with special emphasis on their respective educational committees and working groups, irrespective whether they operate in international, regional or national context.
- The private sector, utility companies, enterprises of consulting, technology development in the area of water and environment.
- Educational and research programmes, interuniversity and university/enterprise partnerships in international, regional and national context.
- Bilateral and multilateral donor agencies active in the area of water, natural resources and environmental education (UNDP, WB, ADB, etc.)
- Public awareness raising-oriented NGO's, programmes, initiatives and youth groups and clubs.
- Officers responsible for CET within the national hydrographic and hydrometeorological services, water affairs, environmental, agricultural, etc. ministries and other administrative entities in international, national, provincial and local levels, river-basin agencies and similar organizations of water-and environmental-oriented self-governance.
- Education "providers": responsible academic leaders, curricula planners and educators of primary, secondary and tertiary educational institutions, with special emphasis on technical high schools, technical colleges, polytechnics, universities and graduate schools.
- Budget responsables and donors of educational programmes in government, private sector and foundations.
- CET institutions and their respective donors.

## 2.2 Possible Futures: Scenarios to be considered

While the starting point, the immediate needs, issues and drivers to initiate a sectoral W-E-T Vision consultation can be fairly well defined, the perspective over the time span of a generation –25 years- needs additional scrutiny. Even immediate measures to rectify the educational and training problems of today would be really effective after a considerable lapse of time. How effective these measures and programmes may become depends on many factors of which we have only fuzzy knowledge. We are, therefore compelled to imagine possible futures, within which the urgency and efficiency of proposed measures and actions can be –at least qualitatively- measured. Possible futures may not necessarily be probable, but proposed measures and actions which seem to perform well under a broad range of possible future circumstances can be expected to remain reliable solutions also for the unknown real future to come. Therefore proposed actions and measures should be analysed to assess their robustness under the assumptions of different scenarios.

The World Water Vision project developed three global, reference scenarios for common use. Table 1 summarizes indicators and drivers which have been identified to characterise the:

- Conventional Water World (CWW);
- Water Crisis (WAC);
- Sustainable Water World (SWW).

**TABLE 1: Overview of drivers and their value in the three World Water Vision global scenarios.**

<b>DRIVERS:</b>	<b>Conventional Water World (CWW)</b>	<b>Water Crisis (as compared to CWW) (WAC)</b>	<b>Sustainable Water World (as compared to CWW) (SWW)</b>
<b>Demographic</b>			
<i>Total population size 2025</i>	Total 8 billion; 6.6 in the South (S)	About the same	Total 7.5 billion (6.2 in the S)
<i>Population growth rate</i>	1.2 percent/year (1.4 in the S)	About the same or slightly lower (because of higher mortality)	1.05 percent/year (1.1 in the S)
<i>Urbanization</i>	61 percent Urbanized (56 percent in the S)	About the same or slightly lower	About the same as CWW
<i>Migration patterns</i>	High pressures for migration S to North (N)	Higher pressures (and stronger barriers)	Low pressures for migration S to N
<b>Technological</b>			
<i>Information technologies</i>	Widely available and used for increasing water management efficiency	Widely available, but application to enhance water efficiency not effective due to other constraints.	Widely available and used for increasing management efficiency and effectiveness (including water management) and social participation.
<i>Biotechnology</i>	Widely available and used for new varieties	Privately appropriated and not widely available	Widely available and used for new sustainable crop systems and water purification
<i>Water use efficiency</i>	Increases overall, and particularly in arid areas	Increases but much less	Increases overall, faster than in CWW
<i>Water pollution</i>	Pollution per unit gradually decreases	Decreases but only marginally, due to lack of access to technology	Pollution per unit decrease much faster than in CWW
<i>New drought-, pest- and salt-resistant crops</i>	Massive development and dissemination of new varieties leading to expansion of potentially arable land and yield increases in marginal lands	Development of resistant varieties ; dissemination curtailed in countries unable to pay the royalties	Same as CWW, but combined with ecotechnologies and integrated in new agricultural systems
<i>Water sanitation</i>	Investment in S grows as fast as the economy	Investment in S falls down due to economic crisis	Investment in S grows faster than overall economy; ecotechnologies used
<i>Desalinization processes</i>	Widely available	Expensive; only adopted in rich, arid, zones	Widely available
<b>Economic</b>			
<i>Total volume of production</i>	To 83.1 trillion (40.8 in S)	50 percent lower?	To 90 trillion (60 in S)
<i>Structure of production</i>	Gradual dematerialization; agriculture growths in absolute terms	Little dematerialization in the S; agriculture growths in absolute and relative terms in the S	Fast increase of the non-material economy
<i>Water- infrastructure (availability and condition)</i>	Grows at same rate as the economy	Deteriorated gradually in S, or behaves erratically	Grows faster than overall economy

<i>Trade</i>	Universal	Some countries or regions become excluded from the global markets	Universal and strategically regulated
<b>Social</b>			
<i>Lifestyles and cultural preferences</i>	Converge to current level in the N	Preferences are the same, but real lifestyles in S and N gradually diverge	Convergence in S and N to lifestyles less material-intensive than current in the N
<i>Poverty</i>	Absolute poverty remains constant; relative poverty decreases	Relative and absolute poverty increases	Absolute poverty eradicated
<b>Environmental</b>			
<i>Committed Climate change</i>	Increased variability, agro-ecologic shifting	Very dramatic shifting, variability and global warming	Less dramatic than in CWW because of strong emission policies
<i>Water-related diseases</i>	Gradually diminishing	Gradually increasing due to low investment and climate change	Remaining only in small pockets
<i>Salinization</i>	Gradually reduced	Increasing	Stopped
<i>Exhaustion and/or pollution of surface and ground water</i>	Gradual increase	Faster increase	Stopped; water withdrawals reduced to sustainable levels
<i>Integrity and health of aquatic ecosystems</i>	Gradual decrease	Generalized decrease including dramatic ecological collapses	Recovering
<b>Governance</b>			
<i>Institutions</i>	Appropriate; new arrangements made	Institutional breakdown; arrangements increasingly dysfunctional	Strong and adequate institutions created; new shared goals; wide participation
<i>Market dominance</i>	Universal	Free market only in some rich regions	Universal, but internationally regulated
<i>Power structure (international, national)</i>	Asymmetrical but becoming more pluralistic	Asymmetrical and authoritarian; militarization of water and other scarce natural resources	Much more pluralistic than in CWW
<i>Conflicts</i>	Localized and manageable	Ubiquitous and increasing, particularly over natural resources.	Practically absent
<i>Globalization</i>	Accelerating	Spasmodic but widening	Accelerating

**TABLE 2: Drivers, reference scenarios and their E&T implications.**

<b>SCENARIOS DRIVERS</b>	<b>Conventional Water World (CWW)</b>	<b>Water Crisis (as compared to CWW) (WAC)</b>	<b>Sustainable Water World (as compared to CWW) (SWW)</b>
<b>Demographic</b>			
<i>Total population size 2025</i>	Increasing number of young people to be educated: pressure on educational system	Same as CWW	More chance for successfully meeting education needs of young generation increased need for CET, PA
<i>Population growth rate</i>	Increasing number of young people to be educated: pressure on educational system	Same as CWW	Same as CWW
<i>Urbanization</i>	Further concentration of learning facilities in the cities	Same as CWW	Same as CWW
<i>Migration patterns</i>	Language problem in education, multilingual countries/societies emerge	More than CWW impact	Less than CWW impact
<b>Technological</b>			
<i>Information technologies</i>	Chances for public, informal education, CAL use increase, innovative education methods	CWW statement regionally true, elsewhere not much change.	More than CWW impact
<i>Biotechnology</i>	New bio-awareness to be created through education	Less than CWW impact	More than CWW impact
<i>Water use efficiency</i>	Large scale PA + public info and CPD needed	Missed opportunities to launch PA and info offensives	More than CWW impact
<i>Water pollution</i>	PA, environmental, chemical, biological, hygienic education	Less than CWW impact	More than CWW impact
<i>Resistant crops</i>	Education of rural communities	Same as CWW but only regionally	Environmental awareness + education of rural communities more than CWW
<i>Water sanitation</i>	PA + technology teaching + training	Increase PA to avoid collapse of systems	More than CWW impact
<i>Desalination processes</i>	Technology transfer + PA	Much less than CWW impact	Broader than CWW impact
<b>Economic</b>			
<i>Total volume of production</i>	Strong investment need for E&T	CWW impact can not be matched	Stronger investment need than CWW
<i>Structure of production</i>	Technological education need increases	Rural educational need prevails	More than CWW impact
<i>Water- infrastructure</i>	Increased need for CET, CPD and technical education	No job opportunities, negative feedback for E&T needs	More than CWW impact

<i>Trade</i>	Not relevant	Not relevant	Not relevant
<b>Social</b>			
<i>Lifestyles and cultural preferences</i>	E&T + PA needs increase	Less chance for education and training	More than CWW impact
<i>Poverty</i>	Educational needs as means of empowerment & poverty eradication	Depresses E&T needs and opportunities	More than CWW impact
<b>Environmental</b>			
<i>Committed Climate change</i>	Environmental awareness, rethinking rural education	More need than CWW, less means to achieve	Less than CWW impact
<i>Water-related diseases</i>	PA, hygienic education	Much more need than CWW, less means to achieve	Less than CWW impact
<i>Salinization</i>	PA, rural education	More need than CWW, less chance to achieve	Less need than CWW
<i>Exhaustion and/or pollution of surface and ground water</i>	Technical education need	Needs as CWW, less chance to achieve	Same as CWW impact
<i>Integrity and health of aquatic ecosystems</i>	IWRM + ecology training needs	Educational & training needs increased, less opportunity to match them	More than CWW impact
<b>Governance</b>			
<i>Institutions</i>	Need for IWRM education	General decrease of educational opportunities	IWRM educational need, management of education needs
<i>Market dominance</i>	Not relevant	Not relevant	Not relevant
<i>Power structure (international, national)</i>	Not relevant	Not relevant	Not relevant
<i>Conflicts</i>	Negotiations skills training needed	More need than CWW, less chance to achieve	Less than CWW, but wishes
<i>Globalization</i>	More international education	Less than CWW impact	More than CWW impact

**CET:** Continuing Education and Training

**PA:** Public Awareness

**E&T:** Education and Training

**CPD:** Continuous Professional Development

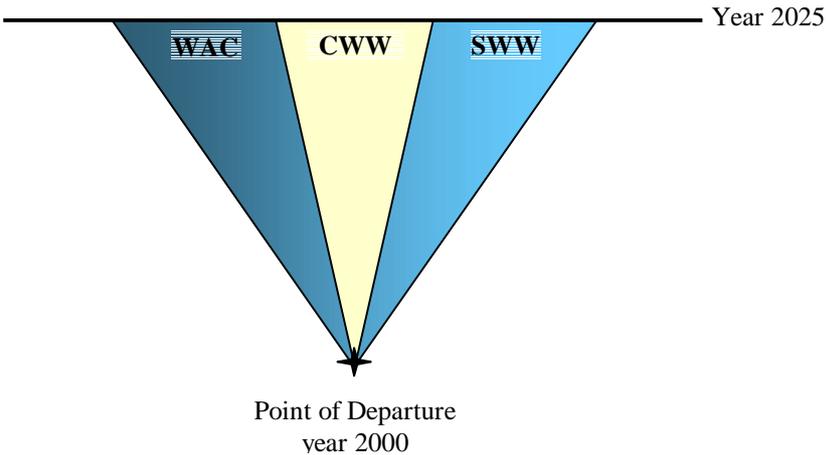
**CAL:** Computer Aided Learning

**IWRM:** Integrated Water Resources Management

The Messages to initiate consultations for the World Water Vision, 1999, contain a detailed presentation of these scenarios. The use of these three reference scenarios does not imply that either of them would occur uniquely on global scale. We may face regionally different scenarios to be realized simultaneously. Thus, on global scale in-between can also be perceived.

The present W-E-T Vision adopts these three scenarios irrespective the fact that the achievement of education, training, public awareness raising etc. objectives can not and should not be measured in the same way as other water-related aspirations (like % of people connected to safe water supply, sanitation, daily water rations in litter/capita, etc.).

The three reference scenarios of Table 1 are further developed for the purpose of W-E-T Vision. Table 2 is an attempt to comment on the relevant drivers identified in Table 1 from the point of view of their expected impact on Water, Education and Training (W-E-T). Given the draft characteristics of the present W-E-T Vision Statement readers are particularly invited to contribute to the refined characterization of the W-E-T reference scenarios). The three reference scenarios should not be seen as crisp, well defined trajectories for the coming 25 years, rather they can be interpreted as three broadening search beams illuminating the darkness of our perception of the future.



**Fig. 1: The three reference scenarios interpreted as three broadening search beams.**

Correspondingly the transitions between the scenarios are kept to be fuzzy on purpose.

2.3. Analysis of Scenarios

The analysis of the expected implications of the vision drivers on the “Water-Education-Training (W-E-T) World” under the assumption of the occurrence of the three reference scenarios CWW, WAC and SWW reveals the following:

2.3.1 Demographic Drivers

- Irrespective of the occurrence of any of the reference scenarios it is expected that the number of (young) people to be educated will increase. This increase may come as the consequence of further insufficiently controlled increase of the population, or, as in the case of SWW through the higher educational demand of a more affluent population.

- Through the ongoing process of urbanization the educational need will also be concentrated in urban centres and periurban areas. This may facilitate the task of educators, however leaves the remaining rural population relatively worse off.
- Already the outgoing twentieth century experiences large-scale human exodus, migration, refugee movements and economy-triggered displacements. All these processes have serious stress on educational systems. First of all language problems but also multicultural features have to be considered by educators and their curricula.

### 2.3.2 Technological Drivers

- The already ongoing and certainly accelerating development of the information society, more or less on global scale, will provide educators with the new media both to use in formal and informal, professional, scholar and vocational education and training and specially for public information and awareness raising.
- The potential benefits of the new media can only be fully capitalized, if teaching techniques, methods, etc. are also developed to match the available and improving technique.
- Biotechnology and its potential benefits and impacts should be communicated to a large public. In this respect both research and education is challenged. The former one to provide credible assessments of potential consequences of biotechnology (especially genetically modified crops, etc.); the second to help avoiding both needless concern and overacting public expectations. Biotechnological developments are likely to redefine water and wastewater technology thus triggering considerable need of respective technological education at all levels.
- Water use efficiency is realized as one of the immediate requirements to make (among others) “more crops for the drop”. This process is both a formidable public awareness challenge but much more, it necessitates technological education from professional down to irrigator (farmer) level. While water use efficiency is required in all water use sectors, the biggest problem and the biggest potential savings are in irrigated agriculture. It is expected that biotechnological exploits will also enable water savings thus underlining the need for techniques and their use to be developed and disseminated. Should the WAC Scenario to become a reality the missed educational steps would otherwise further aggravate the situation.
- Water pollution can be considerably reduced by public awareness raising, raising of hygienic standards through education and public information.
- Resistant crops, either traditionally bred or genetically modified, would need proper introduction to the agricultural communities.
- Water sanitation needs trigger considerable technology transfer and education along the whole profile from professional education to public information.
- Desalinization is expected to become cheaper due to the anticipated decrease of energy prices and improved technology. These research results must be translated through technology transfer, education and training into common practice in parts of the world where desalinization is a viable option to cover water demands.

### 2.3.3 Economic Drivers

- Economic development, even outside of the immediate water sector would imply strong improvement of education and training, especially focusing on the provision of the respective technological and service capabilities needed by the growing economy.
- The structure of the economic production has interestingly a certain impact on the E&T needs. Industrial or agricultural development tendencies have different educational and training needs.

- The water infrastructure, its creation and maintenance, needs technical education at all levels, including CET and CPD. In case of WAC this need may decrease considerably.

#### 2.3.4 Social Drivers

- Improved social security, affluence and the desire to keep this status can be seen as strong stimuli for the increase of E&T and PA activities.
- Poverty on its own constitutes a very “negative” driver unless there is the political will and economic power to eradicate it. In this case E&T become one of the most essential means of empowerment to break the vicious cycle of poverty.

#### 2.3.5 Environmental Drivers

- The observed tendencies of the anticipated climate change imply the need for increased PA raising as well as reorientation of the agrarian population (new crops, irrigation techniques, water availability and distribution, extreme events, etc.).
- Water related diseases are credited to cause millions of deaths annually. PA, especially for public hygiene, is a must.
- Salinization is considered as the consequence of inappropriate agricultural practices. Therefore its avoidance and management, once occurred, is closely related with PA and massive rural educational programmes.
- The lack of freshwater of proper quantitative and qualitative characteristics would have to trigger, beyond public awareness raising, research and well conceived technological education addressing both low and high technologies.
- The environmental concern, the realization that healthy aquatic ecosystems are needed for sustainable future, together with the logically emerging new management paradigm of Integrated Water Resources Management (IWRM), imply the need for ecological education for both the future generation and in form for CET and CPD also for the present generation of professionals. IWRM on its own should also be moved from conceptual stage into fully-fledged “operationalization” meaning more research and education (R+E).

#### 2.3.6 Governance Drivers

- IWRM, while could be identified as a “brainchild” of holistic views and subsequent concepts imply also redefinition of role and form of governance. In this respect massive educational efforts are needed both technical, ecological and in legal-administrative sense.
- IWRM –once operationalized- would not only enhance the long-range efficiency of caring for and sharing of water. It would expose potential conflicts more pronounced. Conflict mitigation and resolution will be very much part of the daily tasks of water managers of the early 21<sup>st</sup> century. Therefore the educational need for the conflict resolution, negotiation skills, and public participation processes will enormously increase at all levels of governance and public involvement.
- Globalization would not make halt and exclude the “water world”. International (joint) education of the future professional generation is the appropriate answer.

### **3. Needs and Problems: an Analytical Review of the Present State of the Water-Education-Training (W-E-T) World**

#### **3.1 General Comments**

It is beyond debate that education and training are needed. Yet "needs" represent several categories. Not only that individual, institutional or social needs can be different, they also imply different perception and necessary responses. Other need categories could be identified as national, regional, global ones. As far as a W-E-T Vision is concerned needs may not remain limited to aspirations to achieve certain educational objectives emanating, for example, from the expected consequences of a scenario. Needs can be identified as the driving force to derive educational visions, strategies and actions.

Needs stand for objectives to be responded to and to be satisfied by the different forms and at different levels of education and training. Needs can be identified as global ones, reflecting the common issues, existing and emerging ones, while a regional view would focus on specific needs, bringing the analysis closer to the scale of implementation usually at national levels. Without "needs", education would lose its sense.

The distinction between problems and needs is crucial. Problems constitute a set of constraints delimiting the feasible range and type of solutions. Thus, a feasible W-E-T Vision and its implementation must consider the problems and observe the inherent limitations.

Problems related to W-E-T might be classified as global ones, affecting the educational and training sectors as such. Problems, however, also have regional, national or even profession-related characteristics, and some could be seen in the context of climatic characteristics or of human activities in a specific part of a country.

Thus, the careful analysis of the 'objectives' and the 'constraints' is essential at both strategic (policy-making) and operational levels. The very feasibility of a W-E-T Vision depends on whether the identified needs and problems reflect the existing and/or anticipated reality. In the following some problems and needs will be elaborated. None of these lists is claimed to be exhaustive. The sequence of statements does not imply priority list. Rather these initial statements and analyses are meant to capture the imagination of the readers, to feel challenged to agree or to disagree and to contribute towards consolidated analyses.

#### **3.2 Educational and Training Needs**

##### **3.2.1 Need Categories**

Roughly, needs can be classified as conceptual ones and geography-based ones. Conceptual needs lead to decisions on the layout of educational policies. Up to now, educational concepts clearly distinguished between the academic and non-academic levels. However, in a number of countries at least the education of senior technicians and those of bachelor programmes leading to a final degree (not as an interim step for further studies) lose their sharp contours. They may even be amalgamated. The structure of higher education is a political problem and hence the legislative is challenged to set clear guidelines, which the institutions of higher learning then can transfer into practice. There is a need for clarity. Politicians and governments are called upon to define clear structures for studies. These

structures have immediate effects on the labour market as the job descriptions must be adapted. If, in a country for a specific job within the administration, an academic degree is required a candidate with the same knowledge but a non-academic degree has no chance. Therefore, the need exists that the governments clearly prescribe the training requirements in connection with the degrees to be held. Hand in hand with this decision goes the structural question of study duration as this has repercussions on curricula and syllabi. Related is the question of disciplinarity. The classical engineer, geographer, chemist, etc. study programmes are being challenged more and more by the call for multi-, inter- or transdisciplinarity. The emergence of ecological thinking has much encouraged the idea of interdisciplinarity and there is an urgent need for a political decision whether the classical schemes be maintained or whether mixed study programmes be preferred. The call for broad, mixed programmes is easy to announce but extremely difficult to be translated into reality. The list of desired subjects is long: engineering, ecology, hydrology, chemistry, geology, meteorology, economics, social sciences and many more. The resulting question so far is unsolved whether a student should remain within one of the classical disciplines and through supplementary studies acquire knowledge in other environment-related disciplines or whether generalists be produced. Again, governments when deciding on these options should consult the labour market. Some of the study programmes are academically nice but the product, the generalist, may have problems to be integrated in the labour market. The question, only briefly touched in this document, needs more than discussions in academic circles. But even more profound reflections are needed within the political world. It would, however, be a great mistake if the politicians would follow populist streams without making an in-depth analysis of purpose and potential of the institutions of higher learning and without taking into account that in a globalized labour market where only the best trained graduates will ultimately have a chance.

Nobody will contest the need for continuing education and training (CET). It is well acknowledged that the knowledge acquired during the university studies is subject to natural aging, to forgetting, but it also gradually becomes obsolete. CET is the remedial measure but there are only a few structured programmes available. The bulk of services, governmental ones as well as the private sector, do not seem to be willing to provide funds and time for it or to release the employees. The idea that CET can take place during off time is not realistic. On the contrary, there is a need that the legislator forces the employer to contribute in time and costs, thus implementing the much harangued "learning society".

The above lines give an idea that there are many needs - others certainly could be added - which must be solved outside the institutions for higher education in order to enable these institutions to clearly correspond in their programmes to what politics and the practice would actually need. The work done so far by governments or by the potential employers must be considered insufficient. It is certainly wrong to leave the institutions of learning in an area of uncertainty and then to criticize the outcome with the statement that the universities do not deliver the product actually required. To sum up, politics and economy are called upon to clearly define which knowledge, skills and competencies they require, to elaborate the necessary frame for the respective study programmes and to accord the necessary funds for them. In this discussion, one should be aware of the fact that in a time of high specialization, the universities can deliver only basic and theoretical knowledge, although at a very high level. The specialization then to follow in order to fully satisfy an employer's specific requirements, must be left to subsequent studies, whether CET or postgraduate or enterprise-specific and there seems no other way than to ask the employers to contribute considerably.

### 3.2.2 Needs at National Level

Despite the trend towards financial and economic globalization, education and training is likely to remain a national domain as part of the governments' sovereignty tasks. For the time being, there is no indication that the countries intend to relinquish the responsibility for education and training of their subjects. This responsibility includes the definition of the national education framework and the actual funding of the training activities, at least at basic levels. There are good reasons for keeping this responsibility at national level. Governments raise taxes enabling them to finance education and training activities. Governments, on the other hand, are supposed to know best their own (actual) needs. Education and training in many countries builds on long traditions and these traditions express the cultural, social, climatic, etc. background. Even under changing conditions caused by economic development or changing political systems, there is always a nation-specific component. Also, education and training cannot be separated from the language(s) spoken in the country, even though in some cases in higher education, it may be difficult to provide training material and teaching aids in national idioms. The problem is not only of logistics but also of financial nature. Training a small number of students (in small countries) is doubtlessly a national problem, the solution of which however seems only be possible within regional and even global provisions. Therefore, it will be discussed there.

While the need for education and training can usually be satisfied at national level (with the few exceptions just mentioned) input from outside may be indispensable. To recognize the need for external advice or even teaching material or intellectual assistance is the task of the governments. No outside body can (or should) become instrumental unless invited to assist. IHP and other intergovernmental organizations or NGO's therefore can provide general guidelines as it has been done so in the past through publications on general aspects of organizing training programmes at various levels. However, in many cases, relevant international organization can go further and assist to solve specific national problems through country-related analyses and recommendations. Education and training as national concerns imply that the results reflect the national educational character. The results are the degrees obtained and as a rule the national degrees are fully acknowledged within the country. A national diploma however may fail to obtain international recognition. At a time of globalization, this may exclude graduates from at least part of the world labour market. International Organizations may help to remedy the situation and, of course, only upon national request, may advise how to raise the national educational profile in order to comply with world standards and seek certification. An often-quoted example is the effort of former socialist countries in Eastern Europe to adapt their universities to standards prevailing in the European Union.

### 3.2.3 Needs at Regional Level

Each region and sub-region consists of countries. Whereas the countries of a region may greatly differ (in Europe, Norway versus Greece, for example), the concept of a sub-region suggests a certain uniformity as far as, population, language, culture, history, are concerned.

In the field of water, sub-regions have considerable significance as similar hydrological conditions or a large, often international catchment (or sub-catchment) offer a regional view at problems that can be best solved regionally. The Nile basin is an excellent example where some hydrological events or problems can only be considered in the context of the whole basin.

Since education and training cannot be separated from the language, each regional or sub-regional venture conditions that the same language is in regional use.

Most of the regional initiatives were so far rather ad hoc, reflecting as much donor priorities as real regional needs. The lesson learnt from the ad-hoc courses was that they were relatively expensive and that once closed there was no follow-up and the whole costly project somehow dissolved in the air. Therefore the establishment of institutionalized training centres at regional level is encouraged. It is to promote regional thinking and regional activities also will include the creation of regional training activities on a sustainable, financially secured, fully institutionalized basis.

#### 3.2.4 Needs at Global Level

The previous two sections have attempted to show that education and training are basically national tasks and obligations, that however for reasons of economy and efficiency some educational tasks can be better addressed at a regional or sub-regional levels.

Yet in the age of globalization, global aspects of education and training should not be ignored. General curricular orientations, syllabi and the inherent credit assessment are global issues. In this regard it can be pointed out that IHP of UNESCO or HWRP of WMO for example as global, international programmes are ideal for the development of global educational and training strategies and contents. These programmes therefore must think of mechanisms how to improve their impact. These require an in depth analysis of the problems, a preferably quantified forecast on likely developments and a formulation of the findings for planners, political and administrative decision-makers and the educational professional world.

Among the different levels, the postgraduate degree awarding programmes can be identified as those, which could be conceived even in a global context. In the past, for example, a number of postgraduate courses have been offered under UNESCO's sponsorship by a few countries, mainly in Europe. The general trend at present is to invest less into education has lead to negative effects on these courses. Some courses are no longer held annually, others have significantly reduced their duration and a few ones have been closed down. At the same time, the progress of science and technology, increasing demands for development in many countries but also the ecological-environmental challenge of our age are calling for a larger number of highly trained water experts. While the political dimensions can clearly be recognized, the available qualified manpower remains behind the needs.

Large, developed countries seem to be able to cater for these new requirements although the debate on how and with which funds to do it cannot be overheard. These needs have also been identified in smaller and poorer countries and, even, the poorest ones acknowledge that a sound environment in the best provision for forthcoming generations. However, these countries even with their best intention will not be able to build up the academic infrastructure in order to train sufficient personnel with the required knowledge and skills.

It appears to be one of the greatest challenges to look into the future and to design networks for postgraduate studies. Such networks must be international because only a limited number of countries have the academic potential and infrastructure to establish highly advanced postgraduate training courses of such a duration and intensity that the ambitious goal can be reached. The lesson learnt from previous phases of UNESCO IHP is that international

courses of truly global appeal seem to be the optimal set-ups for postgraduate education and training.

In spite of its validity, this assertion is very difficult to be materialized. A network of courses, each course with a specific priority will have to be developed so that a student can select the one that best fits his aspirations. Such a network - if well designed and coordinated, using "best practice" methodology - could cover the whole range of water- and environment-related subjects.

Up to now, the host country had to bear practically all of the financial burdens, classrooms, teachers, accommodation of students, eventually fellowships. Governments (and the tax payers), at a time of increasing difficulties of the public finances, less and less agree to the role of an eternal payer and the support given to international training visibly is regressing. Therefore, a potential future strategy would be that the beneficiaries of the international courses in future must contribute financially to their own education/training. In the past, the course system almost entirely relied on fellowships, in first line from the host countries of the training course, less from international organizations. It appears that this situation is no longer sustainable and a financial contribution on the side of the students but also on the side of their home countries and employers is indispensable. It should not be forgotten that training abroad means savings made at home by the home government by not being obliged to run a national course. Politically, it is apparently difficult to accept, but it would also be wrong to ignore the present situation and the obvious trend. Here, intergovernmental organizations can help by developing at least models how international, global training could be organized in the future. Ideally, UNESCO IHP or other organizations with a global mandate could administer a world fund of contributions from those who do not train for compensating the costs of those who do train. In the context of international postgraduate studies, the term "sustainability" quite simply means that some sort of financial recognition must come from the beneficiaries of studies abroad. If international training and education is not to disappear, joint efforts of all stakeholders are indispensable.

### 3.3 Review of Problems

#### 3.3.1 The Image Problem

Neither the natural sciences nor engineering enjoy the social recognition they should deserve. The lack of social and financial appreciation of the related professions: hydrologist, geologist, ecologist, water resources and hydraulic engineers, etc. leads to substantial brain-drain. Beyond the actual loss of relatively young, bright and mobile professionals through their shift to more attractive and lucrative employment, this tendency keeps away the most brilliant students to choose explicitly their future profession in the water sector. On the long run, this could lead to a sustained downward intellectual spiral damaging in first instance the water-related research and teaching capabilities of societies. Through globalization, the general trend of brain drain towards more attractive professions (law, business, economics, informatics, medicine) is aggravated by international brain drain depleting the intellectual base of the less developed countries.

The loss of image of scientists and engineers is not confined to the water sector but, it is more and better visible there than in many other disciplines. There is an unease of feeling, at least in the industrialized countries, that scientists and engineers are able to develop more and more sophisticated solutions, products or procedures but it is perceived that their thinking is

exclusively scientific and technical. Many people doubt that the water problems inherent to the rapid growth of the world population can entirely be solved by technical means. There is even some fear that they might find purely technocratic solutions. The trend is much more mistrust whether all these solutions by scientists and engineers are human, whether they assist nature or violate it, and whether, in the end, rather than improving the situation they would destroy the planet. Although most people are convinced that scientists and engineers are able to find solutions, at the same time, they are no longer ready to accept these solutions without questioning them. Hence, politically the support to scientific and technical solutions is modest. This is both a credibility and image problem. It is obvious that large water projects are more and more facing public reluctance or even opposition and that large parts of the population prefers "softer" solutions. As a matter of consequence, the initiative has shifted from the professional into the socio-political sphere. Paradoxically situation has arisen that persons with lower educational profile (say, in the water sciences) have a higher credibility. The crisis in the reputation of scientists and engineers is inherent in today's society. It is a societal problem and it is useless to argue whether it was the fault of science and engineering, or not. It is to be acknowledged that water problems have strong political and societal aspect and their solutions must be acceptable to the society. Since the profession of hydrologist, engineer, etc. suffers from a lack of attraction within the society, the funds that the society is willing to spend on their education are decreasing.

The mistrust against science and technology has even been enlarged because it coincides with strong commercial globalization tendencies. Profit orientation as sound and as necessary has lead to a feeling that the individuals and even national governments are increasingly becoming powerless. While much of this thinking is unfounded, it touches a human feeling of being frightened and leads to frustration, resignation, and silent but occasionally also to explosive opposition. The W-E-T Vision must be aware of this societal background. An educational programme on the one hand must satisfy objective needs but it also must seek harmony with societal streams.

### 3.3.2 The Disciplinarity Problem

The acknowledged need for integrated, interdisciplinary approaches to address water resources assessment and management problems, to consider environmental aspects, etc. has lead to the ill-conceived response of several institutions of higher education to offer programmes to form "environmental experts" already at undergraduate level. Instead of creating a programme to provide a strong disciplinary basis with appropriate curricula of basic sciences and an appreciation of other disciplines, these programmes prematurely enforce interdisciplinarity. This can only be accomplished at the expense of profound knowledge of the inherent disciplines. The "product" is often a graduate, dangerously superficial in his/her knowledge and ultimately unable to engage in true interdisciplinary work, thus failing to fulfil the expectations associated with the respective study programme. The consequences are quite alarming as this type of semi-trained professional is usually successful in mobilizing the general public and politicians, manipulating the media through well presented but superficial conclusions without having been trained to implement them.

### 3.3.3 Problem of Recognition

The recognition of an educational programme and the certificate received upon its completion is a critical issue, in particular when the validity of the degree, diploma or certificate awarded should be made accepted in a different country. Persistent problems of this type, while they may look secondary, could ultimately undermine the viability of the respective

programme. No training programme should be started without an evaluation of the credits system and to what sort of acknowledgement it would lead. While some countries export their academic over-production and thus successfully fight their own unemployment problems, other ones protect themselves by not acknowledging foreign degrees. Although most manpower surveys have failed, one should not lose sight of the quantitative problems and realistically assess the country's needs.

#### 3.3.4 Problem of Budget

In a more general perspective, the basic problem of education and in particular that of higher and postgraduate education appears to be that it is frequently considered as an expense and not as an investment. Since research is in many cases also considered as a luxury, the education of new generations of scientists is frequently perceived as superfluous too.

A subtle problem of education is associated with the false expectation that educational programmes (courses, CET activities, etc.) will become self-sustainable. Education is fundamentally a social service. Even if education as a service is offered against tuition fees, the infrastructure of this service needs sustainable funding. Usual economic indicators cannot measure the feasibility of this basic funding. In particular, CET activities for less developed countries can only be sustainable if financially supported by long-term commitment. Despite the world-wide acknowledgement of the importance of water, it appears unlikely that training activities at any level and at any intensity become financially self-supporting or even profitable as it may be in some other fields commercially exploited with success.

In many countries, not only the basic education, but also the secondary and tertiary ones are socialized, thus providing education virtually free-of-charge. As far as equal opportunity was concerned, this was a welcome development. However, the sustainability of these schemes became frequently questionable as government educational budgets began to shrink. Anyhow the separation of paying for education and enjoying its benefits is not without risks. While it provides equal opportunities it also contributes to sinking appreciation and ultimately it can threaten quality standards.

#### 3.3.5 Problem of Educational Methods

While some basic instruction in water aspects can be provided during primary education (very basic in primary schools, a bit more in secondary schools), the bulk of water subjects can and will be taught at professional level only at different levels of formal higher education. At non-academic level one important branch is the vocational training, much more however through technician training programmes. The introduction of the classification of junior and senior technicians has proven useful and successful. However technician training in water subjects remain a weak point, particularly in many developing countries. Traditionally professional water-related teaching occurs at university level. The situation worldwide certainly needs improvement but, based on a long tradition, it has also its momentum.

A further classical domain of specific, water-related education is at postgraduate level (both degree and CET). However, the results achieved up to now are far from satisfactory. Neither is there a consent on contents and duration, on structure and outcome nor is there a reliable infrastructure serving for satisfying the global needs. It is certainly an important task in elaborating suitable frameworks for postgraduate education starting from the contents of such courses, their structure, their financing and, last but not least, ending with the recognition/diploma problem. Until now, postgraduate education in water subjects still is in a

development and test phase but consolidation is required. However, an important unresolved problem is the actual level of postgraduate education. It appears much meaningful to orient postgraduate courses towards the Masters' degree as the starting point. But this statement is often contested.

Next to formal education trajectories knowledge transfer often follows non-formal channels. Here the situation is much more difficult since this set-up includes most of the CET activities. In view of their great importance, a number of CET-related problems shall be discussed.

From a formal point of view, CET and CPD (Continuing Professional Development) face problems with respect to planning, design, implementation, delivery, evaluation and quality assessment, certification, recognition, reliability, validation and accreditation. Who is responsible for all these aspects? What are the procedures to adopt and to implement in a rational way, avoiding excessive bureaucratic methods? All stakeholders, including CET and CPD providers, sponsors, students and employees, employers should work together for setting up and approving the procedures. While this joint effort is indispensable, the initiative must come from the organizer of the respective training activity after having studied the requirements of the labour market.

Re. OECD, *"Assessing and certifying occupational skills and competences in vocational education and training"*, 1996, 206 pp. ISBN92-64-14690-3.

Many initiatives in the area of continuing education and training, professional development, etc., seem to have ad-hoc characteristics. Given the numerous problems related to water resources management and the associated training needs, this "ad-hoc" nature usually does not imply that the respective initiatives would be superfluous. However, the proactive behaviour of the CET provider(s) could reflect individual interest or available expertise rather than being response to in-depth need assessments with identified priority areas. It has to be added, however, that the lack of comprehensive, authoritative needs assessment and well-established prioritization is also to be blamed.

A further difficulty is related to financing. Frequently, the concepts of CET activities are crippled by financial constraints. Instead of drafting an educational programme to respond to the perceived needs, length, scope and other features are fixed to fit within the available budget constraints.

Many CET activities were conceived with considerable course duration (and associated absence of the participants from their jobs). Courses with duration of several months became less attractive to attend unless they lead to an academic (or professional) degree instead of certificate of attendance. By drafting course programmes, CET providers should carefully weight the trade-off between the absence of a potential participant from job and family and the anticipated benefit. In this regard, unfortunately, the question of appreciation of the course certificate (diploma, degree) and its acceptance as basis for professional promotion upon completion of CET sometimes seem to be more important than the knowledge gained. Consequently, the best (most aspiring) candidates were likely to target either short intensive (specialized) CET programmes or longer academic degree programmes. While formal training is normally characterized by two parameters or partners, the trainer (training institution) and the trainee, the picture is more complicated in the case of CET. As experience shows, a third

parameter: personal commitment, (dedication, initiative), is equally important. What often is being neglected is the fourth parameter, the employer. Whether directly (the employer orders CET for one or a group of trainees), or indirectly (working conditions, changing work programmes and levels, innovations), the enterprise is frequently, if not always, the driving force. Since personal commitment or job/work conditions are always individual cases with individual solutions, the W-E-T Vision probably cannot go beyond providing some guidelines or pilot solutions for frequent cases.

### 3.3.6 Problem of Sustainability

The fundamental problem of both formal and informal education is sustainability. The most paradoxical situation is emerging: while the principle of sustainable development is more and more accepted, the sustainability of education and training, the basis of the sustainability of human civilization itself is more in jeopardy than ever. This scenario is further aggravated by the simultaneously increasing demand for education and training as a consequence of population growth, environmental concern, and the explicit requirement of the operationalization of the principle of sustainability. The globalization of the finance and production market has implications on education and training. Enterprises will recruit their staff where they find the best-trained personnel. However, this does by no means imply that the person will be engaged where he/she has been trained, and another country may benefit from the knowledge and the income taxes paid by this person. The situation is highly paradoxical: a country that provides best training must not necessarily benefit from it. Globalization could separate human investments from the results and gains. The decades after formerly colonized countries gained independence saw a stream of well-educated persons leaving these developing countries and seeking employment in the industrialized countries, often in the one where they had been trained. Today well-trained persons originating from industrialized countries are often employed in developing regions because the enterprise has decided to set up a production site there for various reasons. These migration tendencies shed light on the unsustainability of the principle of free-of-charge education since the classical assumption is no longer valid that a country investing in education later will benefit from that investment. The principle of "free-of-charge" education, once a highly praised achievement, is in danger and self-participation in the educational and training costs may result. Unless a large fellowship system would be created, this could end for many, even gifted persons to materialize the academic aspirations.

This vicious cycle can perhaps be broken by the concentrated efforts of all stakeholders and donors, by launching long-term financing schemes to enhance sustainability of educational and training programmes and to stimulate their quality assessment. It is obvious that globalization of finances and production must have a repercussion on training and education.

Current donor attitude and assistance policy are in general not favourable for sustainable educational and training programmes either. While schools, academic institutions and CET courses need time to develop and to improve curricula, to obtain recognition and to fulfil their educational mandate, the usual short-, or medium-term financial assistance, project-oriented mentality and quantification-oriented success indicators of bi- and multilateral donor agencies are not only counterproductive for the educational efforts, but could even render the otherwise provided short-term assistance to become ineffective itself.

Educational and academic institutions thrive on the dynamic balance between tradition, quality assessment and renewal. Any disturbance of these complementary components would gravely deteriorate the performance of the affected institution.

## **4. Principles of the W-E-T Vision**

### **4.1 Principle of Integrated Water Resources Management**

The importance of interdisciplinarity, transdisciplinarity and multidisciplinary in the education of the future water resources expert is an accepted paradigm. However, these principles are too vague to make specific recommendations as the respective disciplines to be actually focused on might change from case to case. Therefore, it is recommended to conceive educational policies by putting the principle of integrated water resources management into the focal point of efforts. By doing so, the W-E-T Vision will not only be in line with the acknowledged approach of the water resources management worldwide, but this focal point would sufficiently imply the interdisciplinarity among the water-related disciplines: surface and groundwater hydrology, water quality and quantity assessment, management and their perturbations, hydraulic and civil engineering, water law, as well as the external interdisciplinarity inherent in other sectoral approaches, such as agriculture, urban development, environment protection, industries and mining, tourism development, physical planning, public health, etc.

Water resources-oriented education should thus be conceived by keeping in mind the specific contribution of each subject (sub-discipline) to the overall scope of integrated water resources management. This statement is crucial as far as the entire educational infrastructure is concerned, but it certainly becomes more than a "guiding principle" as far as the different forms of continuing education and training, on the job training, etc. are concerned. The principle of integrated water resources management does not negate the importance of the individual disciplines and the academic virtue of the in-depth teaching of and research in particular subjects, however it clearly states and accepts the applied characteristics of water resources-related research and education. The acceptance and observation of this social demand would not only enhance the efficiency of the educational efforts but will certainly trigger a positive feedback in general.

### **4.2 Principle of Environmental Awareness**

Environmental awareness is reflected, at present, in the additional requirement of environmental statements, impact assessments and action plans associated with the "real" water resources development plans or management activities, but usually not as an integrated part of them. As future generations of water resources experts will emerge, this duality should disappear. Environment-mindedness must become one of the basis of engineering, resources management and scientific concern. Unless this new "attitude" is incorporated into the - at present still rather disciplinary - approaches, the concept of integrated water resources management and the overall requested environmental remediation could not be fully implemented. The education of environment mindedness cannot be seen as an *ad hoc* action but as a task for a generation to gradually train academic and professional teachers and trainers. First to enable them to appropriately convey principles, techniques and above all the mentality to their students and trainees. Consequently, the W-E-T Vision should make provision to concentrate on means and intellectual input towards the environmental education of educators in order to launch a "snowball effect".

In a broad sense the environment mindedness implies the principle of conflict resolution between the objectives of mankind and the requirements of nature in order to secure sustainability. The principle of a "new water ethics" (as defined by Federico Mayor in 1997 during the first World Water Forum in Marrakech, Morocco) extends this environmental mindedness with additional dimensions, including the basic human right to safe drinking water, the principle of equity in water-sharing, the conflict mitigation in the use of transboundary waters, etc.

Like environment mindedness, the "new water ethics" has also important educational implications. Both of them can be seen as the primary features to be incorporated in immediate, public awareness raising campaigns. No doubt that this is necessary, as early success could enhance the adoption and acceptance of these principles. However, the professional "breakthrough" can only be achieved through the educational "operationalization" (activation) of these principles. Therefore, the W-E-T Vision should give due emphasis to sensitize educators, to develop respective material, to provide case studies, both success stories and negative examples. As education is the key towards sustainability, this key should "match the lock" and produce graduates, trainees, etc. who absorbed the above-mentioned principles and able to translate them into practice. To set this mechanism into motion requires the prior training of educators.

#### 4.3 Principle of Solidarity

The principle of solidarity in the context of W-E-T is the expression of the profound human companion for problems which can influence any of us. Water issues are global ones, crises, shortages, ecological disasters, floods and droughts may be regional or local phenomena. Yet, solidarity implies that water is everybody's business and a water problem, anywhere in the world, matters everybody. Consequently education and training related problems, as being closely associated with our aspiration of a common sustainable future are challenges to be faced together. The principle of solidarity implies first of all help, assistance for self-help. Solidarity is one of the emotional basis for co-operation. International IGO's and NGO's have predominantly been created to translate the solidarity principle into practice. In terms of education and training solidarity can be emphasised and implemented through scholarships, co-operative frameworks, exchange programmes, monetary and in-kind donations and soft loans.

However solidarity should not be interpreted as a mandate to create uniformity, imposing educational and training programmes, curricula and syllabi. Solidarity is neither a right to be convoked seeking external help without appropriate efforts and contributions by the beneficiaries themselves. Therefore the principle of solidarity can not be separated from the principle of subsidiarity.

#### 4.4 Principle of Subsidiarity

Education, especially that of the children is a very intimate relationship between educators and those to be educated. Therefore any initiative, which ensures education within a uniform cultural and linguistic set-up, should be given priority. Thus education in national framework is likely to be more efficient than international ones.

On their part, international organizations programmes and initiatives derive their justification from the fact that they fulfil tasks and provide services and fora that the Member States alone would not be able to deliver. International organizations may also assist Member States to achieve the status of self-sufficiency and ability in providing services like professional education, training, etc. themselves.

As complementary to this general mandate, international organizations should not execute tasks national governments, NGO's or other organizations wish and can adequately perform.

Therefore, to the exception of tasks like training needs and programme assessment, quality control, accreditation or advice to their respective water resources educational activities international organizations should not be involved in educational activities in the water sector at the national or subnational levels. Even international educational and training modules, courses, degree programmes, etc. can be organized by national institutions, NGO's, universities, private companies, etc. They could, however, be conceived as a national endeavours seeking moral endorsement and professional acknowledgement of international organizations. In spite of these connections, such endeavours may remain fully within the sovereign competence of a government as far as concept, financial support and execution of the respective programme are concerned.

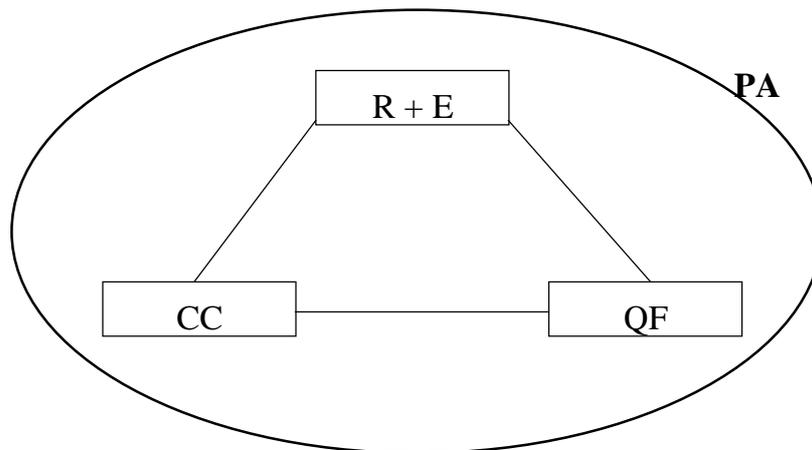
The principle of subsidiarity implies that any E&T activity should be executed at the "lowest possible" level. Intergovernmental organizations should get involved in the implementation only upon request by national governments.

## **5. Structure of the Water-Education-Training (W-E-T) World**

### **5.1. Introduction**

An educational and training vision is based on the synthesis of different aspects highlighted in the preceding chapters. Education-related problems have to be solved in order to be able to respond to actual educational needs. However, both problems and needs must be viewed at within the prevailing societal context, which in turn, reflects present day's political, economic and ethical constellation. The analysis of today's overall cultural situation cannot be the purpose of the W-E-T Vision but one must be aware that a vision can only be understood as an expression of the prevailing intellectual perception and aspirations. By considering the timespan of the W-E-T Vision covering a period of 25 years it will be obvious that this statement cannot outline in detail what in one generation's time might be appropriate. But the W-E-T Vision should devise concepts, steps, elements that are flexible enough to accommodate changes and aspirations beyond our present perception.

The W-E-T Vision is not aimed to become just one more paper written on education but it should be seen as a tool and guide for Water for Educators and for those to be educated, conceived by representatives of these groups and by those having a stake in sustainable water management.



**Fig. 2: *Interaction of different clusters of educational efforts.***

Since a vision emerges as a realistic dream, something worth to strive for, based on the synthesis of problems, needs and concepts of solutions, it cannot be expected that the subsequent implementation of this dream is then a simple, straightforward action. On the contrary, interdependent aspects of quite different nature need to be harmoniously integrated. It is acknowledged that water education and training do not and should not take place in an academic ivory tower. Yet it is also futile to deny that there is an educational world, existing within society, interacting with it, but still following its own “rules” developed through tradition and through the very nature of education. That is that of a transition, a process of enhancement of mind, with knowledge skills and competencies, which are ultimately needed in the “outside” world. To analyze the inherent processes of the Water-Education-Training World and its interactions with its surroundings, the model of the ideal W-E-T-World will be drafted as shown in Figure 2. The triangle of Figure 2 illustrates these guiding issues that require

careful strategic thinking for effective implementation of intended activities. While the element R+E (Research and Education) refers to higher and continuing professional education, similarly Practice and Education (P+E) could be considered for technician education and so forth. Figure 2 also indicates that any element of water-related educational or training activity has a broader social context. This is expressed by the embedding circle representing the interface with the public. Public Awareness (PA) describes in this context both the need for education of non-professionals but also the obligation to inform policy makers and lobby for the educational content within the shell of PA.

## 5.2. R+E: Research and Education

Research and (higher) education are two faces of the same coin and they always go together. Under ideal circumstances, a university will keep a sound equilibrium between the two. Research and technological development are both producers of new knowledge and skills and, therefore and necessarily must be linked with education and training. Education and training activities in turn are for the benefit of the end-user that pays for the research. The R+E approach foresees:

- Exploitation of research results through pilot and demonstration projects;
- Quick transfer of new knowledge and skills through short courses and seminars or workshops;
- Production of teaching materials using both classical and new learning technologies and methods.

The linkage between research and education therefore cannot end with the publication of research results in a scientific journal but these results must find their way into the teaching process (formal, informal and public information). This approach goes parallel with the globalization of science, which implies both competition and co-operation among different stakeholders, such as universities, research institutes, public and private, companies and the end-users in general.

In this respect the answer to competition is QF "Quality First" and that to co-operation is CC "Collaborative Clusters".

## 5.3. CC: "Collaborative Clusters"

Collaborative clusters can be defined as groups or organizations located in different places (countries). They are likely to be similar structure, but even different organizations could be clustered to achieve common goals. It does not matter whether these groups are as different as, say a government and a private company as long as they join forces and efforts for the same aim. In the context of the W-E-T Vision, the common goal is "Research and Education" in a "Quality First" perspective. Collaborative clusters facilitate and enhance the cooperation for research and education following the above-described systematic approach. The type of cooperation, the level of commitment, the regional extension, the kind and size of partnership, the structure of the collaborative cluster, are dependent on the declared aims, objectives, means and funding potential. Collaboration requires mutual trust among partners but also certain diversity of means and of the ways of execution. In a cluster, the partners may follow parallel ways, however the rule is rather complementarily, a symbiosis. As an example, a governmental agency and a private company have quite different ways of operation, different

structure and funding, different limitations but in sharing the specific capabilities of each, they will be able to develop a powerful partnership.

A collaborative cluster may be an ad hoc measure for a clearly defined purpose and outcome. In many cases, an ad hoc set-up will not suffice and the partners will look for a long-term solution in form of a network. A network needs more than a momentary understanding or working agreement, it conditions:

- A code of conduct with clear aims and identified objectives;
- Trust and transparency in operation and activities;
- Minimization of duplication of activities;
- A "flat" structure, possibly without hierarchy (unless some sort of steering mechanism) and with little bureaucracy;
- An efficient and cost-effective operation
- Flexible, innovative and "open" mindedness
- Generating income and financial support from different sources.

These principles sound easy and quite normal. In regarding networks existing over a longer period, one cannot ignore the danger of loss of flexibility and innovative character and, on the other hand, the danger of institutionalization and establishment of bureaucracy with the inherent loss of momentum and creativeness. The collaborative clusters then risk to become inert, to exist for themselves rather than for the envisaged goals. By sustaining interactions through the PA interface enabling CCs to identify societal needs and trends and to respond to them in the formal, informal and public educational domains.

#### 5.4. QF: Quality First

The R+E systematic approach and the collaborative cluster or network structure cannot be successful if the "quality first" principle is not applied. It is the guarantee for long-standing results and continuing improvement. Quality assessment generally starts with a "self-assessment" on the basis of the analysis of education and training needs among the target groups, of the design, implementation and delivery of the "products" and their evaluation for efficiency and effectiveness. Yet, a self-assessment is rarely fully sufficient. Much more effective is an assessment by an outside auditor, provided neutrality and independence are fully given. If fully independent, the external auditing will deliver results with a high degree in reliability.

Depending on the nature of the activity, the quality assessment will not only help to achieve better results, it will foster for reliability of the quality of the "product", the graduate of educational or training efforts. Ultimately it will pave the way towards certification and possibly also for accreditation. If an education or training activity is to be attractive, it should not only increase knowledge and skills, or eventually provide competencies; it should also deliver tangible results in the form of accreditation, for example, through degrees.

The general description of the combination of (a) research and education R+E, (b) collaborative clusters CC, and (c) the "quality first" principle QF should serve as a common denominator for all educational activities conceived or executed within the framework of the W-E-T Vision. This approach will support competitiveness, effective networks and a quick transfer of research results and also ensure highest quality standards. (As already indicated in

Section 5.1 similar triangles can be drawn for technician education, school education, vocational training, etc.).

## 5.5 PA: Public Awareness

Public Awareness creates a "shell" of educational and training world. As such, it serves the purpose of exchange. In an outward-oriented flux, educational efforts should target the general public, translating scientific results and information into common, understandable messages and techniques to communicate them to the target groups, among them principally to political decision-makers and the youth.

A virtual, inward flux should influence research and education, respective networks and quality assessment. This flux can be interpreted as public inquiries, social needs, political tendencies, research priorities, etc. set by the contemporary society.

The present W-E-T Vision has repeatedly stressed that educational issues and training activities are not only the concern of education specialists, teachers and students. The whole education and training field forms part of the societal environment and - certainly to different degrees - concerns everybody. Educational problems may be somehow remote for the normal citizen: for many people, the educational world is a stable matter outside their daily business and life. However, politicians, decision-makers, public and private employers, production and finance, all influence but are also influenced by the educational patterns and by the quality of the products of the educational system. One cannot expect the "outside" world to deal with educational problems. The educational world has to create an interest in and awareness of itself. In discussing the clusters, reference has been made to the societal environment of all educational matters and training activities. Hence, the clusters must exceed the confines of education and incorporate the representatives of relevant external activities in the cooperative clusters. Thus, public awareness means much more than interest in water problems. It implies to raise profound interest of politicians and decision-makers, to convince them that society's ability in mastering future water problems is directly proportional to today's investment in training water-related professionals at all educational levels. Such investment includes the infrastructure (buildings for teaching), staff for research and training, funds for research, and also for the trainees. Awareness means to be conscious that today's policy in terms of staff and funds has a slow payout rate but that investments in education and training are the only ones, which never fail. Therefore, the permeability of the PA shell in Figure 2 is the key for success.

## 5.6 Stakeholders

The W-E-T Vision is obviously addressed to the "citizens" of the "Water Education and Training World", first of all educators, trainers and those to be educated and trained. The W-E-T Vision is aimed to be general and universal; any organization, agency or programme could base its activities (in the water sector) on this vision. But beyond these direct stakeholders the W-E-T Vision is addressed to a broader audience.

Without completely enumerating all possible stakeholders, one group would consist of governments and their agencies. "Governments" mean those agencies having a mandate for sovereignty tasks, competencies in the water sector (in federal systems, this must not necessarily be the central government). Closely related are district or municipal authorities.

Connected with the governmental level, one has to mention the IGO's both within the UN system and outside.

Water-related education, the formation of professionals is traditionally the domain of institutions of higher learning (universities, polytechnics, academies, technical colleges, etc.). Given the previous emphasis on the unity of research and education (R+E), universities are certainly in the forefront of this group. They are expected to be among the first to respond to emerging societal needs, to develop and to propagate new concepts and teaching techniques. Furthermore through outreach activities and CET programmes universities are expected to keep a strong link with the professional world and in particular with their own alumni.

Though the subsequent batches of graduating students and through the alumni contacts, universities may disseminate of new water resources management concepts, techniques and principles and ethics into different educational levels: primary, secondary, vocational, and into the informal educational tracks, including public awareness raising.

A very special group consists of the NGO's. Their input is crucial for the implementation of educational projects. Although the majority of NGO's active in the area of water by their very nature is science-oriented, the NGO's in the field of education and training and in particular in public awareness raising, can also play an important role. The W-E-T Vision should appeal to grass roots and community service oriented NGO's and those dealing with the youth.

The above summary shows that a large number of stakeholders of very different nature might get involved and interact with the W-E-T Vision.

## **6. From Vision to Action**

### **6.1 Overarching Priorities**

Section 2.3 summarizes the analysis of the expected educational and training implications of the three reference scenarios and the inherent drivers. This section presents those educational and training activities that seem to be necessary irrespective of the occurrence of any of the reference scenarios or in-betweens. These activities will then be analysed, whether they cater for the needs and/or alleviate (some of) the problems discussed in Chapter 3. This chapter will also be reviewed whether there is any obvious measure to be considered. Finally Chapter 4, the principles of the W-E-T Vision will be used to identify those activities, measures, programmes that should have priority in the implementation of the W-E-T Vision, emanating either from Section 2.3 or Chapter 3.

Based on Section 2.3 the following issues can be mentioned as the basic set of potential overarching priorities:

- Public awareness raising, especially in rural context.
- Technological education, training and technology transfer.
- Negotiation and conflict resolution and mitigation techniques.
- Integrated water resources management.
- Explore the potentials of the new media, learn to use them.

Based on Chapter 3 the following activities can be identified as essential needs and problems:

- Regional education, networking.
- Sustainable funding of education and training.
- Educational methods and organisation.

Chapter 4, ‘The Principles of the W-E-T Vision’, focus on:

- Integrated Water Resources Management (IWRM), and
- Environmental Awareness,

as central features of the present and future educational activities.

Consequently the highest priority within the W-E-T Vision should be accorded to IWRM. However the reoccurrence of IWRM both as “principle” and as immediate “consequence” in Section 2.3 implies also that IWRM should not remain at conceptual level as far as W-E-T is concerned. Rather it is a call for a new paradigm to be consequently pursued at different levels of water management practice and thus also that of education and training.

Given that along with IWRM Section 2.3 emphasized the importance of PA; technological aspects and negotiation skills the three major thrusts within an IWRM dedicated education are clearly defined.

The “W-E-T World” faces also the challenge emanating from the vastness of its global task (to be implemented however at regional, national and first of all at local levels!). Parallel to organizing and funding to sustain and to accelerate the educational drive, educators have to select among the existing or even develop new appropriate educational methods along with exploring the proper use of new media.

Needless to say that funding is the “a” and “o” of the “W-E-T World”. This political appeal or better the appeal of the “W-E-T World” to the political decision-makers controlling national and international budgets and donor priorities is more than a priority. It is the prerequisite to shape a desirable Sustainable Water World (SWW) through E&T.

However a W-E-T Vision of educators and those to be educated should not remain limited to express needs, appeals and requests. It must show the contribution of the “W-E-T World” itself. The solution of common problems, but also solidarity, dictates that the “W-E-T World” joins forces, combines knowledge and finds the most efficient and cost-effective ways to address the issues in E&T. In this respect, networking is not a buzzword, but it describes the best possible contribution of the “W-E-T World” itself.

## 6.2 Priorities within the Clusters

### 6.2.1 General Comments

Chapter 5, while focusing on professional education at different levels and in different forms outlines the triangular structure of the “W-E-T World” (see Fig. 2). In Section 6.2 the inherent priorities of R+E, CC, QF and the shell PA will be discussed in some detail.

### 6.2.2 Research and Educational Cluster

A first group of topics is related to the "Research and Education" cluster. While continuing to promote a high scientific level of teaching programmes, stress should be given to assessment of research results with a view to their practical relevance and possible teaching techniques to introduce them into curricula. This goes in parallel with an anticipation of research areas likely to come up and of their possible impact on training. Problems can be foreseen in frequently modifying university-teaching programmes in order to include last scientific findings or in order to satisfy special needs. CET is the appropriate instrument. The W-E-T Vision should advise on fields, subjects, level of treatment, teaching modalities and methods for CET activities. Such activities may be related to scientific problems, to specific professional needs but also hydrological or economic peculiarities of a region or even only a country.

The W-E-T Vision will hardly be able to interact directly with all target groups. In promoting the idea of teacher's or trainer's training, it will improve the multiplier effect and thus become a truly worldwide venture.

The "Research and Education" area would also include the development of new teaching technologies. Many of them are being developed outside the water sector in other economic or scientific fields but can be adapted to the water sector. New teaching technologies go hand in hand in the preparation of (new) teaching material and sets of it for selected (new) subjects.

The last topic within the Research and Education Cluster is related to PA. Programmes need to be developed for the general public, for politicians and decision-makers.

If a new understanding of water problems is to change the attitude of governments, population, industry and trade, the problematic issues of water, the risk of collapse of entire water systems, is to enter into the mind of humankind. Hence, the group of decision-makers and of politicians should be considered the top priority target group for the W-E-T Vision for PA. The vehicle to reach them but also the general public is not scientific reports published in a few thousand copies but the full engagement of the mass media. In this respect, we are still at the beginning. A worldwide breakthrough of a new "water philosophy" stands and falls with the acceptance by and the cooperation of the mass media. The constructive involvement of the mass media is the key to the success to the vision and, subsequently, for a sustainable water world. The R+E cluster has a particular mandate here to interact with the media, to provide it with appropriate input.

### 6.2.3 Collaborative Cluster

The Collaborative Cluster is based on the idea that the complex water problems to be addressed need the integrated efforts of many partners. Beyond academic partners, an educational programme should rely on other stakeholders as well. Substantial input from the clients (future employers), politics (role of water, national goals), research (what to teach) and the executing bodies, the training institutions, at different levels are needed.

These networks of interested partners will rarely exist in an organized form, yet they are indispensable. The W-E-T Vision should identify possible avenues to identify and link potential partners. Existing international organizations and programmes: IHP of UNESCO, HWRP of WMO, ETNET Environment-Water, TECHWARE, etc. are indispensable to facilitate this process.

More specific to education, one training institution never stands alone. Universities have their collaborative fora and they also often exist at faculty level. IGO's and NGO's form international bridges not only within political groupings (European Union) but also between industrialized and developing areas. Collaborative arrangements (twinning, arrangements for work distribution) can largely improve efficiency and effectiveness of teaching efforts.

The first possible group under this section covers partners of different nature. The second group acts horizontally by forming collaborative arrangements between similar partners within one country, group of countries or even worldwide. However, there is still a third group of collaborating clusters, within inter- or multi-disciplinary approach. Today's vision of water problems is not the classical one, bound to one scientific discipline. The ecological and environment-oriented age calls for interdisciplinarity exposure, not only in the solution of actual, concrete problems, but also during the training period of a student. In the field of teaching, inter-disciplinarity has its limits if a proliferation shall be avoided; the nature of today's water problems requires multidisciplinary solutions; what is needed is the fine, delicate compromise between in-depth studies within one discipline and the opening towards a wider view. While the call for inter- or multi-disciplinarity is extremely popular, it is difficult to materialize and the W-E-T Vision here has one of its most important task and mandate to provide guidance.

Among the four clusters, the Collaborative Cluster is probably the one which could benefit more directly from the activities of IHP, ETNET Environment-Water, TECHWARE and other international initiatives and NGO's. Therefore, a more in-depth elaboration of the

concept of the suggested "umbrella organization" 'GOUTTE of Water' (Global Organization of Universities for Teaching, Training and Ethics of Water) is needed. It could evolve on the basis of existing networks and UNESCO chairs in water sciences as part of UNESCO's UNITWIN programme. With the inclusion of ethical aspects, the integrated, holistic approach is emphasized.

For capacity building in its multitude facets (human, institutional) the CAPNET initiative offers an excellent networking framework.

#### 6.2.4 Quality First Cluster

In case of nationally oriented and government-guided mono-disciplinary teaching programmes, a quality assessment was relatively easy. Many study systems were conceived to be quite static. In deciding for a specific university, the student practically had made his/her choice concerning the expected result at the beginning.

The present situation is quite different. There is competition among universities internationally, but also within one and the same country. Globalization is also observable in education and training. Mobility of students is customary. Multi-disciplinarity adds to the colorful picture of a global training market. The "Quality First" approach has become extremely important for the training institutions. The way to "Quality First" leads through quality assessments which concern the teaching as such but also choice, composition, sequence and intensity of subjects. The W-E-T Vision should consider in developing criteria for the assessment of study programmes, study management and examination procedures. Credit systems are in use but certainly could be improved. Inherent is the problem of (a different) quality of the degrees and their recognition in one and the same country but much more internationally. There is an evident need for much more transparency in international training.

#### 6.2.5 Public Awareness Cluster

As far as prioritization is concerned, the W-E-T Vision is well advised to concentrate on target group(s). In order to avoid to spread thin, it is foreseen that active involvement in PA raising programmes, events and courses should concentrate to government officials, economical, financial and political leaders in order to provide the maximum support to other sectoral and regional visions. It is understood that only scientists themselves could explain to this target group the different facets of the water problems and the role science may play to solve them. Policy relevant research is thus an important segment in the R+E cluster. It can be communicated to this target group, via PA.

As far as other target groups of PA are concerned: youth, women, general public, realism dictates that partnerships are sought in these interactions. Grass root organizations, NGO's, youth clubs, schools are better equipped and trained to communicate with this large part of the public than universities or international organizations, scientific NGO's and programmes.

### 6.3 Examples

The present section presents a few examples. Initiatives which have been conceived, or actually launched indicate the readiness of the “W-E-T World” to explore new educational approaches, in content, target group and organizational form.

<b>Initiative</b>	<b>Initiator/Donor</b>	<b>Target Groups</b>	<b>Features</b>	<b>Status</b>
<b>CAPNET</b>	UNDP/The Netherlands, GWP Associated Programme	Regional networks of IWRM training institutions, Professionals active in various fields of water management	IWRM-dissemination, capacity building for IWRM through HRD	Conception
<b>GOUTTE of Water</b>	UNESCO-IHP	Universities and postgraduate degree education	Umbrella organization of UNITWIN and other educational networks	Conception
<b>WaterNET</b>	IHE/The Netherlands	SADC, South African Universities MSc Programme	IWRM-oriented MSc Degree	Operational
<b>L'eau et la vie</b>	SID (NGO)	Youth between 10-18 years	4-year-programme, off-curricular education, journalistic approach	Completed
<b>ETNET Environment-Water</b>	Free University of Brussels/SOCRATES Programme of EU	Universities, students, CET-providers, end-users	Interuniversity and intersectoral network	Operational
<b>TECHWARE</b>	European Commission	Students, professionals	University/enterprise training partnership	Operational

*NOTE: The present form of Section 6.3 is not considered to be a draft. It is rather a sample, an invitation to present YOUR initiatives in a brief, tabular form. The W-E-T Vision may be supplemented by Annexes describing the initiatives presented here in more detail and enabling interested parties to establish contact, launch a dialogue or eventually join (some of) the initiative(s). Depending on the echo, Section 6.3 could be further structured, having tabular displays for initiatives such as networks, youth programmes, high tech (CAL, multimedia) research and application, curricular development scholarship schemes, etc.*

### 6.4 Outlook

The W-E-T Vision is conceived to counteract the present trend of diminishing funding and political support for E&T while water issues are otherwise given –at least verbally-ample consideration at the political level (UN General Assembly, CSD, Conference on Water and Sustainable Development, Paris, March 1998, etc.).

It is linked to the ongoing World Water Vision project as one of its sectoral visions. As such the W-E-T Vision is focused to be presented at the 2<sup>nd</sup> World Water Forum 17-22 March 2000 in The Hague, The Netherlands.

Nevertheless the W-E-T Vision aims much more. It should be the expression of the conscience of the “W-E-T World”, a rallying point to have its reference function well beyond the “active”, elaboration phase of the World Water Vision.

Without saying it explicitly the W-E-T Vision opts for the SWW Scenario as the vision worth to work for. It implicitly acknowledges that the world can not afford WAC or similar scenarios to become reality. E&T is the basis for sustainability, but once the dynamic balance of development would tip, the manifold feedbacks of WAC to the “W-E-T World” would paralyse the later one, thus ripping off its ability to help reverse the trend. Instead a vicious downward spiral could be triggered with less funding, less infrastructure, less teachers and trainers and less people to be educated, while the population may explode. In this WAC-like scenarios stabilization would only be reached at an almost unimaginable low level, entirely unattractive for human aspirations.

The present W-E-T Vision’s focus is on higher education. The structure of the “W-E-T World” as shown in Chapter 5 for R+E could be repeated for Practice and Education (P+E) or skills and training (S+T) as well. This focus has been selected, as it is understood that trainers and educators for P+E and S+T are formed in the R+E context. Should R+E, CET and CPD collapse the deterioration would propagate like an avalanche along P+E and S+T and PA.

The “W-E-T World” is thus synonymous with SWW. We are all challenged, educators and those to be educated, to make this happen.

*We have to tell what the W-E-T World can do,  
We have to tell what the W-E-T World needs and  
We have to tell what the “outside” world must do to achieve our common goals  
for a sustainable common future Water World.*

# ANNEX 1

## **References**

The W-E-T Vision Document is considered a statement based on abundant literature on education and training in the water sector. The present list of References however goes beyond those titles having been cited or used in the text. As the W-E-T Vision Working Paper is to initiate consultation, rather than being an academic treatise. Thus no strict citation is exercised in the text.

Literature covers the whole spectrum of water techniques, hydrological aspects, general issues of education and training, guidance material for course organizers, teaching aids and study materials. However, the Vision Document does not see W-E-T problems only from the pedagogical viewpoint. It rather integrates them in the context of environment, ecology, economy, social aspects, societal problems, political issues and the general problems of the development of humankind during the next generation. It thus appeals to the whole society, its members and leaders and agents regardless to their functions.

The literature cited in this Annex by no means is considered complete: The choice of publications and documents is deliberate, arbitrary and it relates to the immediate printed background which is required for fully appreciating the present draft. The intention is to guide the reader to find those references which are helping to deepen the understanding, to draw the necessary consequences and to embark on action.

### List of Publications and Reference Documents

#### A- Relevant Declarations

- Dublin Declaration of 1982 (International Conference on Water and the Environment)
- Prague Declaration of 1994 (UNESCO Convention on Postgraduate Education in Hydrology)

#### B- UNESCO/IHP Publications (Thechnical Documents in Hydrology)

- **Evaluation of the UNESCO-Sponsored Post-Graduate Courses in Hydrology and Water Resources.** By N.B. Ayibotele, with contributions from L.J. Mostertman and U. Maniak. IHP-III Project 13.1. UNESCO, 1988. English. (SC.88/WS/33).
- **The Sahel Forum. Seminar on the State-of-the-art of Hydrology and Hydrogeology in the Arid and Semi-Arid Areas of Africa.** *Forum du Sahel. Séminaire sur l'état de l'art en hydrologie et en hydrogéologie dans les zones arides et semi'arides d'Afrique.* (Ouagadougou, Burkina Faso, 13-18 février 1989). UNESCO, 1990. Bilingual: English/French. (SC.90/WS/1).

- **Integrated Planning and Management of Water Resources.** Guidance Material for Courses for Engineers, Planners and Decision Makers. Edited by S. Dyck. IHP-III Project 14.3. UNESCO, 1990. English. (SC.90/WS/53).
- **25 Years of UNESCO's Programme in Hydrological Education under IHD/IHP.** Compiled by W.H. Gilbrich. UNESCO, 1991. English. (SC.91/WS/5).
- **Effective On-the-job Training in Hydrology.** A Guide for Supervisors of Hydrology Technicians. By R. Allaburton. IHP-III Project 14.1 ( c ). UNESCO, 1991. English. (SC.91/WS/6).
- **Education Systems for Hydrology Technicians.** By M. Bruen. IHP-IV Project E-1.1. UNESCO, 1993. English. (SC.93/WS/23).
- **Continuing Education in Hydrology.** By A. van der Beken. IHP-IV Project E-4-1. UNESCO, 1993. English. (SC.93/WS/27).
- **Curricula and Syllabi for Hydrology in University Education.** By U. Maniak. IHP-IV Project E-2-1. UNESCO 1993. English.
- **Water Resources Management: Focusing on Sustainability.** By P. Loucks. IHP-IV Project M-4-3. UNESCO, 1994. English. (SC.94/WS/15).
- **Hydrological Education During the Fourth IHP Phase (1990-1995).** Compiled by W.H. Gilbrich. UNESCO, 1994. English. (SC.94/WS/25).
- **Applied Hydrology for Technicians.** Vols. I to IV. By J. Balek, M. Bruen, W.H. Gilbrich, G. Jones, D. Lundquist and E. Skofteland. IHP-IV Project E-1-2. UNESCO, 1994. English. (SC.94/WS/26).
- **Postgraduate Education in Hydrology.** A Statement Of-the-art Report. By P. Kovar and W.H. Gilbrich. IHP-IV Project E-3-1. UNESCO, 1995. English. (SC.95/WS/7).
- **Education of Hydraulic Engineers.** By H. Kobus, E. Plate, H. W. Shen and A. Szöllösi-Nagy. Co-edition UNESCO/IAHR UNESCO, 1996. English. (SC.96/WS/4).
- **N°4. Past, Present and Future of Postgraduate Education in Hydrology.** Proceedings of the Prague Workshop (29-31 August 1994). Edited by H. Salz. IHP-IV Project E-3-1. UNESCO, 1996. 216 pp. English. (SC.96/WS/47).
- **The World's Water: Is There Enough?** UNESCO/WMO, 1997. ISBN 92-63-10857-9 (English). ISBN 92-63-20857-3 (French). ISBN 92-63-40857-2 (Russian). 22 pp.
- **Water: A Looming Crisis?** Summary and Recommendations of the International Conference on *World Water Resources at the Beginnings of the 21<sup>st</sup> Century*. Paris, 3-6 June 1998. UNESCO, 1998. 28 pp. Available in English and in French.

### C- Co-Editions IAHS/UNESCO

- **Sustainability of Water Resources Under Increasing Uncertainty.** Edited by D. Rosbjerg, N-E. Boutayeb, A. Gustard, Z. W. Kundzewicz and P. F .Rasmussen. IAHS/UNESCO, 1997. 528 + x pp. IAHS Publication n°. 240. ISBN 0-901502-05-8.

### D- Other Pertinent References

- **Guide to Educational Terminology.** W. H. Gilbrich, ETNET. ENVIRONMENT-WATER series. October 1997.
- **The Education of Hydrologists.** J. E. Nash, P. S. Eagleson, J. R. Philip and W. H. van der Molen. Hydrological Sciences Journal, Volume 35, 6, pp. 597-607, 1990.
- **Assessing Engineering Education in Sub-Saharan Africa.** J. Sparks, Quality in Engineering education, In: Marel Zymelman, ed. World Bank Technical Paper n°. 197.
- **Towards the Learning Society in the Water Industry.** Proceedings Euro-Workshop Antwerp, 12 June 1998. A. van der Beken and Hedwige Daenens.
- **Paradigms in Water Management.** Proceedings of a Workshop on New Paradigms in Water Management, RBA Centre, Delft 5 March 1999. J. Wessel, H. G. Wind and E. Mostert.
- **Matching Research and Policy in Integrated Water Management.** J. Wisserhof. Delft, 1994.

## **ANNEX 2**

### ***ACRONYMS and ABBREVIATIONS***

<b>ADB</b>	Asian Development Bank
<b>ASEAN</b>	Association of South-East Asian Nations
<b>CAL</b>	Computer-aided Learning
<b>CET</b>	Continuing Education and Training
<b>CSD</b>	UN Commission on Sustainable Development
<b>CPD</b>	Continuing Professional Development
<b>CWW</b>	Conventional Water World
<b>EPD</b>	Educational Policy Document (of UNESCO's International Hydrological Programme)
<b>ETNET</b>	
<b>Environment-Water</b>	European Thematic Network of Education and Training
<b>FAO</b>	Food and Agricultural Organization
<b>GWP</b>	Global Water Partnership
<b>HWRP</b>	Hydrology and Water Resources Programme (of WMO)
<b>IAHR</b>	International Association of Hydraulic Engineering and Research
<b>IAHS</b>	International Association of Hydrological Science
<b>IGO</b>	International Governmental Organization
<b>IHD</b>	International Hydrological Decade (of UNESCO)
<b>IHE</b>	International Institute for Infrastructure Hydraulic and Environmental Engineering (Delft Courses), Delft, The Netherlands
<b>IHP</b>	International Hydrological Programme (of UNESCO)
<b>IRTCUD</b>	International Research and Training Center on Urban Drainage
<b>IWRM</b>	Integrated Water Resource Management
<b>NGO</b>	Non-Governmental Organization
<b>OIE</b>	Office International de l'Eau
<b>SID</b>	Society for International Development
<b>SWW</b>	Sustainable Water World
<b>TECHWARE</b>	Technology for Water Resources
<b>UN</b>	United Nations

<b>UNEP</b>	United Nations Environmental Programme
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>WAC</b>	Water Crisis Scenario
<b>WHO</b>	World Health Organization
<b>WMO</b>	World Meteorological Organization
<b>WWW</b>	World Wide Web

## **ANNEX 3**

### **GLOSSARY**

This section attempts to introduce and to describe briefly the most important terms and conceptual elements of the present report. It relies on respective literature (Gilbrich, 1997, Bogardi et al, 1995, Delors et al, 1996, etc.) and accepted terminology in the area of water-related education and training. The annexe is, however, not a glossary, as it does not contain all possible entries, but confines itself to the elements relevant in the context of the W-E-T Vision.

#### **GENERAL CONCEPTS AND TERMS**

**Bottom-Up Approach:** describes proposed or implemented actions conceived, initiated and executed by those groups which are most affected by the respective action (beneficiaries, service providers, etc.) These “grass roots” initiatives usually need “top-down” encouragement, acceptance and funding to develop their full potential.

**Business Enterprise Sector:** includes all firms, organizations and institutions whose primary activity is the production of goods or services for sale to the public. Private, non-profit institutes mainly serving them are also included.

**Environmental Awareness:** describes the process and product of the sensitization of concerned citizens, the affected public, the individual professionals and professional, educational and administrative organizations with regard to environmental issues. Environmental awareness can thus be interpreted as (part of) public awareness, but it covers also a professional attitude (to be strengthened) towards a more conscious approach towards resource development and management. In this regard (institutional and professional) environmental awareness is a pre-requisite of integrated water resources management. Towards the implementation of this concept in the daily practice of water affairs, the environmental awareness of educational institutions and concepts play a vital role.

**Government Sector:** is composed of all Ministries, departments, offices and other bodies which furnish, but normally do not sell to the community, those common services which cannot otherwise be conveniently and economically provided, and administer the state and the economic and social policy of the community.

**Higher Education or Tertiary Sector:** is comprised of all universities, colleges of technology, and other institutes of post-secondary education, whatever their source of finance or legal status. It also includes all research institutes, experimental stations etc. operating under the direct control of, administered by, or associated with, higher education establishments.

**Integrated Water Resources Management (IWRM):** broad paradigm of the (new) philosophy of water resources management calling for a holistic approach. In the broadest sense IWRM means the simultaneous considerations of water quantity and quality aspects of both surface and groundwater resources embedded into a systems analytical approach with reference to other sectoral activities such as industries, aquaculture or agriculture, public health, environmental protection, etc. IWRM needs inter- and multidisciplinary approaches, corresponding legal frameworks (like river basin management authorities or similar agencies), public participation, public awareness raising etc. There is an obvious education and training need to “produce” the experts who will be able to implement IWRM in practice.

**Public Awareness:** describes the process and the product of the sensitization of concerned citizens and the affected public and their “grass root” representation of the different issues related to the consequences of (water resources) development, management, strategies etc. Public awareness reflects the (expected) response of individuals, irrespective of the nature of the issue (political, economic, ecological, etc.)

**Stakeholder:** the general term to describe an agency, interest group, company, individuals, water users, bulk water suppliers and communities or representations thereof, taking part in IWRM or in the related participatory process.

**Sustainable Development:** a much-used term of the recent years, having many definitions. In the broader sense it is described as (actions towards) the fulfillment of the aspirations of the present generation without jeopardizing the future generations to achieve their own (perceived) objective.

**Sustainability:** generalised concept of the previous entry, describing the perception of a state or an action to have lasting effects (usually benefits). While it is seldom found, sustainability should be associated with an (estimated) time scale, to be used as a true quantified indicator.

**Top-Down Approach:** describes proposed or implemented actions conceived, initiated and executed following legislative or executive orders (hierarchical approach).

## **EDUCATIONAL AND TRAINING CONCEPTS AND TERMS**

**Accreditation:** is the recognition of an educational institution as maintaining standards that qualify the graduates for admission to higher or more specialised institutions or for professional practice.

**Certificate (of Attendance):** document issued by an organiser of an educational or training event (usually CET), attesting the participation and eventual successful completion of the respective programme. In contrast to degrees and diplomas, certificates are not recognised as professional qualification and are usually ineffective to foster career prospects.

**Competency:** specified knowledge and skill to fulfill a given job.

**Continuing (professional) Education and Training (CET):** any formal or informal education and/or training activity conceived for recipients who possess an accredited vocational, professional or academic qualification in the respective or related field.

**Continuing Professional Development (CPD):** CET activities in a specified profession.

**Curriculum:** is the totality of an organised learning experience; it provides the conceptual structure and sets the time frame to acquire a recognisable degree, and describes its overall content, e.g. the curriculum of a five-year degree programme in “Mechanical Engineering” at a certain higher education institution; the curriculum is the choice of the student out of the programme which is the totality of what the University offers. The programme is usually identical to the university catalogue. In some cases programme and curriculum are identical because the training institution offers only one curriculum which constitutes its programme, e.g. one specialised training course. A course is the totality of an organised learning experience in a specific area, e.g. the course on “Fluid Dynamics” within the curriculum “Mechanical Engineering”; courses may consist of course units to form a totality.

**Degree, Diploma:** nationally recognised documents of professional and academic qualification issued by an accredited institution or ministry.

**Donor:** in the sense of education and training (E&T) an individual or organization providing means (in cash and/or kind) to support E&T activities without being involved in the implementation otherwise.

**Education:** formal and informal processes being associated with the transfer of knowledge to an individual. Any action leading to increasing one's knowledge.

**Formal Education and Training:** E&T which is carried out by accredited private or public institutions (schools, universities, colleges, vocational training centers, etc.). Traditionally formal education relies on classroom teaching, tutorials, examinations, etc. along a fixed curriculum. Formal education and training, once successfully absolved, leads to acknowledged vocational and/or academic qualifications (diploma, academic degree, etc.).

**Informal Education and Training:** describes E&T activities conceived to respond to imminent or latent needs, focusing more on the transfer of necessary knowledge and skills than their normal accreditation. Informal education (and training) relies traditionally on on-the-job training, self-study, mentoring in-house CET activities, etc.

**Knowledge:** is the ability in understanding and rational, scientific and strategic thinking. It is a universal and time independent ability that fulfills the puzzle-solving mind of mankind and allows the individual to adapt more easily to a changing environment.

**Learning Society:** a paradigm with various definitions, describing the broad social acceptance that the principle of lifelong learning should penetrate all walks of life. In a more focused sense, "learning society" implies that companies, industries (the economic world), incorporate learning (CET) into their regular activity programme, thus abolishing the "pejorative" duality of productive work and CET. In more philosophical terms, "learning society" assumes a general desire to raise everybody's educational level and a general proactive attitude. In the ideal case, the whole society participates in this learning process and not only (the upper) part of it.

**Lifelong Learning:** a recently emerging concept acknowledging the increasing pace of knowledge renewal and additional skills to be acquired, thus rendering one's professional life to become a continuous process of formal and informal education, training (CET) and eventually retraining.

**Post Graduate Education and Training:** in some publications this is equated to all types of educational activities following the first (professional, academic) degree. Thus M.Sc. and Ph.D. programmes are considered together with CET activities leading to certificates of attendance. In the context of this report the term "post-graduate education" is used with reference to additional degree programmes only.

**Recipient (beneficiary):** in the sense of E&T, individuals, groups and organizations being the subject of E&T activities. Those knowledge and skills are expected to increase as a consequence of E&T measures.

**Retraining:** concentrated formal process (including informal CET elements) enabling an individual to continue vocational and professional activities in a different (disciplinary) field other than the one determined by his/her primary qualification.

**School:** formal educational institution providing services at primary and secondary level. Graduates of the secondary school level are usually qualified to enter the academic or higher professional

educational institutions and programmes. Schools (secondary level) may adopt professionally orientated curricula, thus providing specialized, skill-orientated knowledge.

**Service provider:** in the sense of E&T, institutions (universities, schools, training centers or other organizations) and individuals actively involved in the planning and implementation of E&T.

**Skill:** is the ability in mental and/or physical performance. It is generally a local and time dependent characteristic and strongly linked to the so-called technologies available in a given environment. It fulfills the problem solving-mind of mankind and is essential for the individual to operate efficiently in a given society.

**Syllabus:** is the prescription of details on a specific course, such as what will be learned (and when), the texts to be read, the areas in which expertise is expected to be demonstrated. It may contain descriptions of methods of teaching and assessment to be used.

**Train-the-Trainers:** educational and training concept describing the effort to transfer the necessary knowledge and skills to individual(s), enabling them to transfer special abilities, information, knowledge and awareness to certain target groups. Along these lines “trainers” are usually trained to deal with marginalised groups, rural communities or other groups usually cut off from regular educational and training programmes due to geographical distances, language barriers, educational disadvantages, etc.

**Training:** formal and informal process being associated with the transfer of abilities and skills to an individual. Any action leading to increasing one’s skills.

**Training Centre:** educational and training institution focusing on (usually non-degree) CET activities for vocational and professional training and retraining. Training centres may operate as independent educational entities or as part of an enterprise or agency.

**University:** formal educational institution of higher learning providing services at academic (scientific) level. The central mandate of universities is to provide academic degree(s)-orientated educational programmes, relying on the interaction of research and teaching. Traditionally, university programmes are discipline-orientated. At higher academic levels there are many promising interdisciplinary initiatives. Universities usually provide educational programmes at different levels:

- undergraduate: B.Sc., B.Eng., BA
- graduate honours class degree
- Master of Science, Master of Engineering
- research degree Ph.D. (doctorate)

In a modern learning society universities are expected to increase their outreach activities by providing consulting services, CET, etc.