WATER ETHICS

Water Ethics

Marcelino Botín Water Forum 2007

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Presentation

By the Marcelino Botín Foundation

In the context of the current financial crisis, and at a time of deep global change, growing attention is being paid to the global norms and ethical values that could underpin future global policy. In this context, water is increasingly perceived as a key global resource, which has special value due to a number of key characteristics: it is the only global resource that has no economic substitute, yet supports most global economic development, and it is fundamental to human livelihoods. Equally water, it is often argued, mediates the successful achievement of the *Millennium Development Goals* on poverty alleviation. In many world cultures and religions water carries special significance and symbolism, as well as cultural value. Water is also a precondition for life in the planet. All these special characteristics are progressively making people recognize the need to reflect on clear norms and values that cement global water governance. *Water Ethics* is a fundamental, almost unavoidable ingredient, for robust global water governance.

This book on *Water Ethics* presents the results from the *3rd Marcelino Botín Foundation Water Workshop*, held in Santander (Spain) between the 12th to the 14th of June, 2007. The book deals with the role of ethics, and the potential values that could frame global water policy. Experts from different cultural, geographic and religious backgrounds met to discuss a range of ethical perspectives and positions, with the intention not necessarily to reach a common declaration or moral blueprint, but rather to stimulate discussion and exchange ideas, in order to enhance the debate on how ethical considerations can play a more significant and explicit role in water development and management.

The Marcelino Botín Foundation is very pleased and proud to have benefited from the participation of three cooperating institutions: the Division of Water Sciences at UNESCO, the United Nations University and Transparency International, all leading organizations in furthering our understanding of water ethics, and key to educating and promoting ethical values to help bolster global water policy. Equally these organizations gave us the benefit of their knowledge in helping to identify individuals on the basis of their expertise, to prepare and present manuscripts that represent the bulk of this book's content.

The common starting point and framework for discussion to all contributing authors was the 1948 *UN Declaration on Human Rights*, and more precisely, basic aspects related to water ethics: the inherent dignity and worth of every human being, and the equal and inalienable rights of all members of the human family, i.e. solidarity among all human beings, present and future.

The starting point was to have an open stance in relation to the issues under discussion, in order to stimulate a fruitful exchange of opinions. This is reflected in the richness and diversity of the views presented in the chapters of this book. The Workshop was led by Professor Ramón Llamas, based on a number of key topics related to Water and Ethics. The book includes a foreword written by Professor Llamas, Luis Martínez-Cortina (IGME) and Aditi Mukherji (IWMI), and is divided into eight sections (nineteen chapters), which correspond to the papers presented and discussed at the Workshop. Dr. Martínez Cortina has taken the main responsibility for editorial completion. The topics included in the book are wide-ranging and highly transferable to the main ethical questions on water governance, namely: Cultural Traditional Approaches on Water Ethics; Ethical Aspects of new Water Management; Water as a Human Right and as an Economic Resource; Water and Poverty; Ethical Aspects of Groundwater Use; Ethics of Water Ownership and Management; Corruption, Transparency and Participation in the Water Sector; Ethical Aspects of Unforeseen and

Inaugural speech of the *3rd Marcelino Botín Foundation Water Workshop*, by Dr. Rafael Benjumea, Director of the Marcelino Botín Foundation. On the right, Professor Ramón Llamas, Coordinator of the Workshop (Santander, 12th June 2007).

Participants engaged in discussions during a session of the *3rd Marcelino Botín Foundation Water Workshop* (Santander, 13th June 2007).

Extreme Events such as Floods and Droughts. A consensus emerged as a result of the Workshop (as reflected in this book) that global water governance has to be supported by clear normative values and policy principles, for example, information, transparency and participation, as well as the relevance and timeliness of social ethics in a changing world, i.e. the worth of human beings (current and future).

The Marcelino Botín Foundation has had prior involvement in providing the platform for discussing and researching global water issues, with a project on Groundwater (*PAS Project*, 1998–2003), which run for four and a half years, two previous *Marcelino Botín Foundation Water Forum*, conducted in 2001 and 2004, which dealt with critical contemporary water issues; *Intensive Use of Groundwater, Challenges and Opportunities* (published in 2003 by Taylor & Francis), and *Water Crisis: Myth or Reality* (also published by Taylor & Francis in 2006). The success of these books is reflected in the fact that they have been already sold out.

The Marcelino Botín Foundation is also currently sponsoring a project on the *Water Footprint of Spain*, under the senior direction of Professor Llamas, and undertaken with Professors Alberto Garrido and Consuelo Varela from the Department of Agricultural Economics at the Madrid Polytechnical University. This project will be an important contribution to a future 4th *Marcelino Botín Foundation Water Workshop* to be held in Santander in 2009 under the theme: *Re-thinking water and food security*, which will include as one of its topics an innovative conceptualisation of the water footprint, which for the first time integrates an economics analysis into the water footprint, and which is already contributing to re-thinking basic policy assumptions and inertias on water scarcity. However, the next Workshop, like the previous ones, also includes other related topics presented by twenty experts from all over the world.

The Marcelino Botín Foundation is very proud to have sponsored the *Workshop on Water Ethics*, and to be able to present this book as the end result of a very rich academic discussion. We hope that this book, in the context of current issues facing the world in relation to global water governance and decisions on water allocation, can help shed light on ethical questions that will increasingly have to be made more explicit and transparent in decisions and policy making processes and at all scales, local, national, regional or global.

Considering the success of all previous activities related to water resources, in September 2008 the Marcelino Botín Foundation decided to create the *Water Resources Observatory*. This will be think-tank and analyze the main global water issues. It is located in the Complutense University of Madrid and its Director is Professor Llamas. It is integrated in the wider *Observatory of Global Trends* of the Marcelino Botín Foundation.

Foreword

M. Ramón Llamas, Luis Martínez-Cortina & Aditi Mukherji

INTRODUCTION

The *Third Marcelino Botin Foundation Water Workshop* took place in Santander (Spain) from 12 to 14 June 2007. The topic was *Water Ethics*. The list of the twenty participants, including their *curricula vitae* is given at the end of this book. The draft manuscripts had been previously shared among all the participants and were orally presented and discussed during the workshop. After this debate the participants sent their final manuscripts which constitute the chapters of this book.

Two previous *Marcelino Botin Foundation Water Workshops* dealing with fundamental and critical contemporary issues of water have been conducted in 2001 and 2004. The topics of these were: *Intensive Use of Groundwater: Challenges and Opportunities* (published in 2003 by Taylor & Francis), and *Water Crisis: Myth or Reality?* (also published by Taylor & Francis in 2006). Both books have been already sold out.

SCOPE AND AIM OF THE WORKSHOP

The main goal of this *Third International Workshop* was to discuss the role of ethics in the deep roots, values, and the potential commonalities of the global water policy. To achieve this goal the invited participants were selected from different professional, cultural, geographic, and religious backgrounds. The selection of the participants was done by the coordinator of the workshop in agreement with the three cooperating institutions, namely: *Division of Water Sciences of UNESCO*, *United Nations University*, and *Transparency International*.

From the inception of the activity, all the participants took the stance that no idea or position was politically correct or incorrect. Freedom of speech and rigor were strongly recommended to all of them. Therefore, it was clear that the intention of the workshop was not to produce some kind of common declaration or moral blueprint which would have universal validity. Consequently, different opinions can be found in the different chapters of this book written by different authors. However, the organizers think that all the participants got a better understanding of the others' ethical points of view, independently of their agreement or disagreement with them. As such, the book intends to contribute to and enhance the debate of how ethical considerations can play a more significant and explicit role in water development and management today.

U.N. 1948 HUMAN RIGHTS DECLARATION AS A COMMON PRINCIPLE

All the workshop participants considered that the UN Declaration of 1948 was a common ground for most of the existing codes of behaviour related to water management. The two basic aspects of the UN Declaration in relation to water ethics are: 1) the dignity of every human being; and 2) the necessity of solidarity among all the human beings, present and future.

However, the UN Declaration does not pay adequate attention to the relations of human being and nature. This was possibly because in 1948 the impact of the modern technology on some ecosystems was small and/or unknown.

SOCIAL ETHICS AND ENVIRONMENTAL ETHICS

Today most of the discourse on freshwater ethics is related to social ethics, i.e. to the moral aspects concerning the relations among human beings and their access to water and related services. Under this concept may be included at least the current debates about: a) the *right to water and the right to food*; b) the *public-private partnerships in water management*; c) the *Millennium Development Goals* (MDGs) related to water and food; and d) the need of improving people's participation and of integrating a top-down approach with a bottom-up one. These topics usually are covered in most water conferences and also in this book.

Nevertheless, since the 1960s or 1970s the problems related to the impact of human developmental activities on the environment became more important and the need was felt for new codes of behaviour. In most industrialized countries, one consequence of this new situation is the requirement of an environmental impact assessment before the sanctioning of any new water related developmental project. However, in most developing or poor countries, the problems related to social ethics still override those related to environmental ethics.

THE ROLE OF SCIENCE AND TECHNOLOGY IN WATER ETHICS

The advances in Science and Technology during the last century have contributed to solve many water problems or conflicts in ways that were unthinkable just a few decades ago. Among the advances that are now cheap and easily available in most countries are: 1) the technology of membranes (reverse osmosis) that may, *inter alia*, solve the urban water problems in most coastal cities; 2) the development of a maritime transport system which is fast and cheap, facilitates virtual water trade,[1] and is changing the former paradigms of water and food security; 3) the intensive use of groundwater facilitated by the relatively cheap drilling and pumping technologies; 4) the Internet that facilitates the transfer of knowledge and technology, and the participation of the concerned stakeholders in water management.

Other probable advances with future relevant impact in water policy are biotechnology and solar energy, but today they are not cheap and easily available in developing countries. Science and Technology can contribute to dispel some pervasive obsolete or false paradigms, such as relevance of climate change *versus* global change, groundwater scarcity or groundwater over-exploitation, which often prejudice policy makers and general public.

However, in spite of tremendous contribution of Science and Technology in solving many problems, it is not realistic to expect that these advances alone would be enough to solve all the water related problems.

THE ROLE OF RELIGION TO PROMOTE WATER ETHICS

The goal of the *International Conference on Water, Ethics and Religion* (Stockholm, August 14, 2007) was to foster greater cooperation between the leaders of religious groups and the UN family, in order to improve the achievement of the MDGs in relation to drinking water, sanitation

[1] Virtual water trade refers to the facility of transferring water equivalents embedded in commodities, typically food grains and other foods. By doing so, water-scarce countries may alleviate stress on water by importing water-intensive food products.

and malnourishment. This conference was organized by *UNESCO International Hydrological Programme*, jointly with the *International Water Academy*, the *Stockholm International Water Institute*, and the *European Council of Religious Leaders*. The basic point of this initiative was that in 2007 the political and scientific leaders were conscious that without the cooperation of these religious leaders it will not be possible to achieve these (modest) development goals.

It is too early to assess the results of that conference but in any case it emphasizes the relevance of the ethical and moral issues in water resources management.

THE BOOK

Before the 19 chapters of the book, distributed along eight sections (each dealing with a specific aspect of *Water and Ethics*), it is included a keynote address by Ana Palacio. She was *Senior Vice President and World Bank Group General Counsel* at the moment of the workshop. In her text, written for the inauguration of the workshop, Ana Palacio discusses about the different facets of the water crisis, the need of an ethics code for water, and the role of the World Bank in the global response to water problems and its contribution to this water ethics code.

The first section of the book deals with *Some Cultural Traditional Approaches on Water Ethics*. It contains three chapters. In the first one, Sison analyzes the ethics of human action involving water, taking the teachings and work by the ancient philosopher Thales of Miletus as a starting point. In the next chapter, Gyawali explores the link between the ethical system of South Asia in general and Hinduism in particular and the water conflicts therein. The third chapter, by Magdy Hefny, tries to understand Islamic water ethics within the general framework of environmental ethics and apply it as a tool for sustainable water resources management.

The second section of the book is related to *Some Ethical Aspects of New Water Management*. Sampford's chapter is devoted to water rights and water governance. He focuses on considering some lessons that might be learned for water governance using Australia as an example. Kindler examines the ethical questions related to uncertainty that affect most the decisions related to water resources management. He discusses this issue considering an *Integrated Water Resources Management* approach. Kindler also deals with these ethical issues and uncertainty in transboundary water management. In the last chapter of this section, Villholth deals with the issue of water ethics from the point of view of food production and food security. In particular she pays special attention to the huge influence and responsibility that the developed countries have in ensuring food security for the poorer nations.

The third section of the book deals with the issue of *Water as a Human Right and as an Economic Resource*. Veiga da Cunha analyses these two aspects of water: the human right approach, particularly in the context of the *Millennium Development Goals*, and the water as an economic resource, in order to ensure a balanced consideration of water. Marín *et al*. address the same topic, but focusing on the shortfalls of adopting water as a human right for marginalized communities. Their chapter describes an example of water governance in the State of Guanajuato, Mexico.

Water and Poverty is specifically considered in the fourth section of the book. Sullivan discusses in her chapter the ethical dimensions of development and the links between water and poverty. In this regard she provides an example of the *Water Poverty Index*. Jiménez *et al*. contribute to this issue with the vision from development practitioners. Their chapter focuses on the need of an adequate monitoring of water poverty and water access, considering the increased investments expected for the next decade in the water and sanitation sector for developing countries. In their chapter, Polak & Fry discuss the challenge of feeding the increasing population of the world and ending rural poverty, and in the process refute some existing poverty eradication myths. They suggest some solutions for ensuring easy access to water for the poor, and illustrate case where such access had a very positive impact on the lives of the rural poor.

The fifth section of the book is related to *Groundwater Use and its Ethical Aspects*. Llamas & Martínez Cortina deal with the spectacular increase of the use of groundwater during last decades (which they call a *silent revolution*), and some associated ethical aspects, including

its socio-economic benefits (frequently ignored) and the also existing problems (frequently exaggerated). Mukherji focuses on the role of groundwater irrigation in sustaining high agricultural growth rates in countries like India, paying special attention to the economic and politic aspects. She shows practical examples in India of how political decisions about groundwater regulation are often inadequate in relation to the resource conditions.

Section 6 of the book is devoted to the *Ethics of Water Ownership and Management*. The chapter from Lock & Shandling examines emerging business, legal and institutional models, such as public-private partnerships, in addressing the challenges facing both public sector providers and private operators in providing adequate, reliable and sustainable water services. Moss, in the other chapter of this section, examines the relative roles and boundaries of the areas of activity related to water and wastewater management that are appropriate for governments, businesses and civil society. He combines practical and ethical considerations in order to clarify questions about private ownership and management of water.

The seventh section of the book deals with *Corruption, Transparency and Participation in the Water Sector*. In his chapter, O'Leary focuses on identifying the sources of corruption in the sector and the best practices for combating it. He shows, with several examples, the importance of multi-stakeholder approaches involving government, regulators, utilities, private sector and civil society organizations to fight corruption. Cosgrove deals with the importance of the public participation in order to promote transparency and reduce corruption in the water sector. Starting from the ethical considerations that *water is different and humans are different*, and using some practical examples of Canada, he examines how public participation can be encouraged in order to help in the process of decision-making in the water sector.

The last section of the book contains two chapters that tackle the *Ethical Aspects of Unforeseen and Extreme Events Management such as Floods and Droughts*. In his chapter, Bogardi explores ethics in the context of water disaster. He analyzes if there is a comprehensive and common ethics to cope with disasters and establishes some practical principles of water disaster management. The chapter from Cabrera & Roldán is devoted to droughts. Taking an example from Spain, the authors discuss different aspects related to impacts of droughts and try to promote actions and strategies designed to mitigate or reduce these impacts.

Keynote address

Ana Palacio[1]

I would like to extend my sincere thanks and appreciation to the organizers of this Workshop—Rafael Benjumea and Ramón Llamas—for inviting me to deliver the inaugural keynote address. It would have indeed been a great honor and pleasure to be with you to discuss the challenges facing humanity's most precious resource: water; and to think together and deliberate on how we can address those challenges. Unfortunately however, due to pressing institutional matters that need my personal attention as General Counsel of the World Bank Group, my efforts to make myself available have been unsuccessful. Nevertheless, I would like to share with you my insights.

THE DIFFERENT FACETS OF THE WATER CRISIS

Water is a scarce resource. It is a finite resource with no substitute and upon which there is total dependence. The fact that humanity is facing a water crisis is evident. The crisis manifests itself in a number of areas. I will address three of those areas: scarcity, quality and management.

With regard to scarcity, the *World Commission for Water* in the 21st Century alerted us all to what it called "the gloomy arithmetic of water" reiterating facts that we all now know: more than 2,000 million people are affected by water shortages in over forty countries; 1,100 million do not have sufficient drinking water; and 2,400 million do not have provision for sanitation. With the steady increase in population (from 1,600 million at the beginning of the last century, to 6,100 million by the end of the century), this situation will certainly get worse.

Even where there is adequate water, the resources are getting increasingly polluted by human and industrial waste and economic activities. Furthermore, the poor quality of water is compounding the problems of scarcity. More than half of the world's lakes and rivers are seriously polluted; and half the world's wetlands have disappeared in the last century. Water borne diseases are a major cause of death. Seven million people die annually of such diseases.

The crisis of management is prevalent in most countries, with overlapping responsibilities on water resources between the different state ministries, agencies, and utilities, at the central, provincial and local levels. Conversely, in a number of countries, major elements of water resources management are left unregulated and with no institution responsible for them.

More than 300 rivers, 100 lakes and a similar number of aquifers are shared by two or more states. The bulk of those watercourses are not regulated by any agreement encompassing all the states sharing the watercourse. As a result, most of them also lack joint management institutions. Furthermore, there is still no universal treaty regulating the uses and protection of international watercourses. The *UN Watercourses Convention*, adopted by the *UN General Assembly* in May 1997, has not yet entered into force and effect. Indeed, shared water resources are the only major area that still does not have a universal treaty in force regulating their use and protection. One of the

[1] These are the remarks of Ana Palacio at the *Marcelino Botín Foundation Workshop on Water Ethics* (Santander, 12–14 June 2007). At the moment of the Workshop, Ana Palacio was *Senior Vice President and World Bank Group General Counsel*.

consequences for this situation is the emergence and persistence of conflicts and disputes between the states sharing the same watercourse.

We are all following, and some of us have participated in, the global efforts to address the water crisis. The *UN Mar del Plata Water Conference* of 1977, the *Dublin and Rio Conferences* in 1992, and the four *World Water Forums* of 1997, 2000, 2003 and 2006 are all worthwhile efforts. They have raised the concerns about the challenges facing water resources, energized the debate on water resources issues, and have all drawn road maps for addressing those challenges. The *Millennium Development Goals* (MDGs) attempt to address part of the crisis by calling on states to stop the unsustainable exploitation of natural resources, and reduce by half, by 2015, the proportion of people who are unable to reach or to afford safe drinking water. The *United Nations Committee on Economic, Social and Cultural Rights* issued *General Comment No. 15* in 2002 recognizing a human right to water, and calling on states and international organizations to fulfill that right. Yet, the problems persist and are getting worse in large parts of the world, such as in Sub-Saharan Africa, the Middle East, and good parts of India and China.

AN ETHICS CODE FOR WATER

The different facets of the water crisis require new approaches for addressing them. One such approach would be to get global consensus on an *Ethics Code for Water*. This *Ethics Code* would include some basic principles and rules for dealing with water resources. The Code would impose duties on all the different actors—individuals, associations, NGOs, public and private entities, governments, as well as international organizations—at all levels, for dealing with water resources in a responsible and sustainable manner. Such duties would require, among other things, a genuine participatory approach for planning and management of the resource, which would involve users, civil society organizations, and government agencies. The *Ethics Code* would in essence, *make water everybody's business*. In turn, every one, particularly the poor, the needy and the vulnerable group of the society, would have the right to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic use. The *business as usual* approach for dealing with water would be a major breach to the *Ethics Code*.

At the international level, the participatory approach would include all the riparians of the river, the lake or the aquifer in managing, sharing and protecting the said watercourse. Every riparian would have rights on, as well as duties towards the shared watercourse. This would help in managing and addressing riparian differences before they erupt into major disputes and conflicts, threatening regional and international peace and stability.

ROLE OF THE WORLD BANK

The World Bank, with its convening power, technical knowledge, global networking and financial resources, has played a major role in the global response to the water crisis, both at the international and national levels.

More than fifty five years ago, the World Bank intervened, on its own initiative, and mediated the complex and difficult dispute that erupted between India and Pakistan over the Indus River, following the partitioning of the sub-continent. After careful, patient and effective mediation that spanned over ten years, the two parties concluded in 1960 the *Indus Waters Treaty*. Indeed, the Bank is itself a co-signatory to the *Indus Waters Treaty*. This is the only international water treaty co-signed by a third party. The Treaty and the extensive funding that the Bank managed to put together, not only resolved the dispute, but assisted in the provision of water and hydropower to millions of peoples in both countries. Consequently, it also assisted in bringing some peace and prosperity to that part of the world.

The Bank still has some responsibilities under the Treaty. In 2005, for the first time in the forty five years since the Treaty was concluded, the Bank was called upon to exercise some of

those responsibilities. Pakistan approached the Bank and asked for the appointment of a *Neutral Expert* to address a difference that erupted with India over the Baglihar power plant that India was constructing on one of the rivers of the Indus basin. The two parties tried but failed to resolve the difference themselves. Again, the Bank was able to play a fair, transparent and constructive role in resolving the difference. After a thorough study of the issue, and following extensive consultations with both parties, the Bank appointed a *Neutral Expert* to address the difference. The Bank also provided major support for the *Neutral Expert's* work through designation of the *International Center for Settlement of Investment Disputes* (ICSID) to coordinate of the process. The Bank is also managing the trust fund established in 1960 to finance the *Neutral Expert* and the assistance he may need. The *Neutral Expert*, after a series of meetings with the two parties and careful study of the extensive documentation furnished by them, and after visiting the plant site, issued his decision in February 2007. The decision of the *Neutral Expert* was welcomed and accepted by the two parties. Thus, the Bank succeeded in getting an acceptable resolution to a bitter and prolonged dispute.

Over ten years ago, the World Bank offered its assistance to the ten Nile Basin countries. The offer was accepted and the Bank started facilitating meetings and workshops for officials from all the riparian states. That effort resulted in 1999 in the establishment of the *Nile Basin Initiative* which include the ten riparian states. It also resulted for the first time in history in getting the water ministers from the ten riparian states to meet and discuss the pressing Nile issues. Such meetings are now regularly scheduled and routinely attended by the ten ministers. The Secretariat of the *Nile Basin Initiative* has been established in Entebbe, Uganda, and is headed by an Executive Secretary, and includes diverse staff from the different riparian states. The Bank is also managing a large trust fund contributed to by a number of donors. Investment projects are now ready for implementation, following extensive preparation and consultations with all the riparian states. Unilateral decisions by the different riparians are now gradually being replaced by collaborative programs and projects undertaken after consultations and discussion. Currently, negotiations have gone a long way, and the riparian states are getting close to agreeing on an inclusive legal and institutional framework for the Nile encompassing all of them.

Similarly, the Bank was able to get the four riparians to the Guarani Aquifer (Brazil, Argentina, Uruguay and Paraguay) to meet and discuss the issues related to the sharing and protection of the aquifer. As a result of the Bank initiative, the four states agreed to establish an *ad hoc* committee as a starting point. Through the Bank technical assistance, it was realized that the Guarani Aquifer is a large aquifer, indeed one of the largest in the world, shared by the four states, and not simply small patches of local aquifers, as was initially thought by each of them. Work is now underway for preparing a legal framework and establishing a permanent institution for the Guarani Aquifer.

The Bank is also involved with similar facilitative efforts on the Mekong River, the Zambezi River, as well as the Aral Sea Basin.

At the national level, the *Bank Water Resources Policy Paper* issued in 1993, strongly recommends a participatory approach to water resources management involving users, planners and managers. Through implementation of this approach, users of the water resource are increasingly realizing that they are actually owners of the resource, empowered to make major decision on the use and management of the resource. This is resulting in a more efficient and responsible utilization of water in most of the countries that are adopting this approach. Establishment of water users' associations for operation and maintenance of water facilities is now a major component of the Bank irrigation and water supply projects world-wide.

The Bank has increased its lending to water projects to US$ 2,000 million in fiscal year 2006, representing 8% of the total Bank lending. The Bank water and sanitation projects helped provide access to more than 43 million people during the period 2000–2004. Those projects include components for institutional and legal reform, positioning water resources in country development plans, and building multi-donor investment programs. The Bank welcomes the visibility given to the notion of the human right to water by *General Comment No. 15*, issued by the *UN Committee on Economic, Social and Cultural Rights* in 2002. The Bank's efforts and operations in the water supply and sanitation sector will assist the countries in increasing access to water and sanitation,

and consequently meeting their obligation under *General Comment No. 15*, as well as under the *Millennium Development Goals*.

The World Bank is thus well placed to contribute to the water *Ethics Code* through its technical knowledge, convening power, global networking and financial resources. The Bank has contributed considerably in the water resources sector, and stands ready to do more.

Participants in the workshop[1]

Janos J. Bogardi
Janos J. Bogardi graduated in Civil Engineering with special emphasis on water resources and agricultural water resources development at the *Technical University of Budapest*, Hungary. After obtaining a post graduate Diploma on Hydrology from the *University of Padua*, Italy, he earned his PhD in Civil Engineering at the *University of Karlsruhe*, Germany. He was honoured to receive the title of *Doctor Honoris Causa* from the *Agricultural University of Warsaw*, Poland, the *Technical University of Budapest* and the *State University for Architecture and Civil Engineering* in Nizhny Novgorod, Russian Federation. After his activities as Assistant Professor at the *Institute for Water Resources Management* of the *Technical University of Budapest*, his professional activities took him as scientific staff to the *Federal Institute for Hydraulic Engineering* in Karlsruhe, and the *University of Karlsruhe*, respectively. He alternated these posts with expert assignments for German consulting engineers in Darmstadt and Essen. In the following three years he was then seconded by the *German Agency for Technical Co-operation* (GTZ) to the *Asian Institute of Technology* (AIT) in Bangkok, Thailand. Subsequently he became professor for Hydraulics and General Hydrology at the *Agricultural University of Wageningen*, the Netherlands, for almost eight years. Janos Bogardi's trajectory at the *United Nations* started at the *United Nations Educational Scientific and Cultural Organization* (UNESCO) in Paris, France, as Senior Programme Specialist and then Chief of the Section on *Sustainable Water Resources and Management*. In 2003 he was appointed Director of the *United Nations University Institute for Environment and Human Security* (UNU–EHS) in Bonn. Since 2007 he also serves as Vice Rector *a.i.* of the United Nations University. He has authored, co-authored, and edited more than 170 publications including books, journal papers, research reports, lecture notes, as well as numerous articles for the media.

William J. Cosgrove
Mr. Cosgrove's career began in 1955 with consulting engineering firms in Montréal, Québec. From 1973 he was employed by the *World Bank* as Water Resources Specialist in the North Africa/Middle East Region; then Division Chief, Energy, Water Resources and Telecommunications for West Africa; Director of the *Bank's Administrative Services and Personnel Departments* and Vice-President Personnel.

In 1990 he joined *Monenco Consultants* as Senior Vice-President responsible for *Strategic Planning and Corporate Development* and Senior Vice-President Environment. From 1993 he practiced under the name of *Ecoconsult Inc.* a company specialized in sustainable economic development. From 2000 he served as Director of the *Water Vision Unit* of the *World Water Council* and in 2003 was elected President of the Council. Among his many publications are *World Water Vision: Making Water Everybody's Business* and *Water Security and Peace: A Synthesis of Studies* prepared under the *PCCP–Water for Peace Process*.

He received the *Council's Gold Medal* for Service to World Water in 2000, a D.Sc. (*hon. causa*) from his *alma mater McGill University* and the *Prix International de Cannes for Water and Economics* in 2001 and was made Honorary Fellow of the *UNESCO–IHE Training Institute* in 2004.

[1] The *Marcelino Botín Foundation Workshop on Water Ethics* (*Marcelino Botín Water Forum 2007*) was held in the Marcelino Botín Foundation headquarters (Santander, Spain) from June 12 to 14, 2007. The draft manuscripts of the chapters of this book were discussed during this Workshop.

Mr. Cosgrove was named President of the *Bureau d'Audiences Publiques sur l'Environnement* in 2005.

Dipak Gyawali

Dipak Gyawali has been involved with the water and energy sector in Nepal since the late 1970s, initially as a government engineer and since 1987 as an independent, interdisciplinary analyst. Trained in hydropower engineering at *Moscow Energy Institute* and in the political economy of resources at the *University of California* at Berkeley, his research agenda focuses on the interface between technology and society. He works in Nepal as research director of the *Nepal Water Conservation Foundation*, and is an academician of the *Nepal Academy of Science and Technology*, but travels extensively as advisor, *inter alia*, to *Chiang University's Mekong Program on Water, Environment and Resilience*, to *Coca Cola's International Environmental Advisory Board*, and others. In 2005/06, he chaired the European Union's review of its international water research for the period 1994 to 2006. He also served briefly as Nepal's water resources minister in 2002/03, and was a member of the international advisory board of *Oxford University's James Martin Institute for Science and Civilization* as well as *Battelle Pacific Northwest Lab* (USA) for its four-volume study *Human Choice and Climate Change*. He has written extensively on natural resource management, technology and societal change, a recent synthesis being *Rivers, Technology and Society* (published jointly in 2003, by Zed Books, London; and Himal Books, Kathmandu) as well as the chapter *Hype and Hydro (and, at Last, Some Hope) in the Himalaya* [in Marco Verweij and Michael Thompson (eds.), *Clumsy Solutions for a Complex World*. Basingstoke: Palgrave/Macmillan Press, 2006].

Magdy A. Hefny

Director of the *Regional Center for Studies and Research of Water Uses Ethics*, Cairo, since 2003. Vice Chairman of the *Egyptian Council on Ethics of Scientific Research* since 2004. Advisor to H.E. the Minister of State for Environmental Affairs, 2002/2003.

Diplomat by Profession: Ambassador to the Royal Kingdom of Norway (1997–2000), and Ambassador of Egypt to Ethiopia (1991–1995). Vice Chairman of the *Egyptian Association of Strategic Thinking* (EAST), since 2002.

Visiting Professor at the *Mediterranean Academy of Diplomatic Studies*, University of Malta, since 2004. Visiting Professor at Cairo University, *African Studies Institute*, 2001/02. Professor of *Negotiation Skills Cross Culture*, for MIBA program at the *Arab Academy for Science and Technology* (*Advanced Management Institute*), Cairo (2001 and 2002). He is lecturing in the *Egyptian Diplomatic Institute* on various issues on *Diplomacy and International Affaires* as well as on *International Water of the Nile*. Guest Researcher at the University of Bergen, Norway, (fall semester of 2000). Chancellor for Africa, and Member of the *International Water Academy*, Oslo, Norway, 2001 and 2002, and member of the Advisory Committee of the Board of the *International Water Academy*, Oslo (Norway).

Member of *Global Society of Organizational Learning Network*, Boston, USA. Hefny is the coordinator of SOL Egypt within the *Global SOL Network*. Facilitator, Consultant and Trainer in areas of: International Trade, International Relations, International Waters of Africa and the Nile, Water Conflict Management and Negotiation Skills, Human Resources Management, Knowledge Management, Organizational Learning.

Member of the Egyptian Permanent Delegation to the United Nations-Geneva, as Counselor of Economic Affairs (1981–1985) and Part of Egyptian Delegations to the United Nations Economic Fora in Geneva and New York.

Hefny participated in the Summit Conferences of the *Organization of African Unity*, and Ministerial Conferences of the *Economic Commission for Africa*. He was the First Chairman of the *Central Organ of Conflict Prevention, Management and Resolution* within the *Organization of African Unity* (1993/1994).

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M. Ramón Llamas
Prof. M. Ramón Llamas is emeritus professor at the *Complutense University of Madrid*. Fellow of *Spain's Royal Academy of Sciences* (1986). Fellow of the *European Academy of Science and Arts* (2005). Dr. Llamas has a Ph.D. in Civil Engineering and another Ph.D. in Geology.

First tenured Professor of Hydrogeology in Spain (1972). He is author or co-author of nearly hundred books or monographs and about three hundred scientific papers. He received the *Cannes International Great Prize for Water* (2006). Member of the *French Academie de l'Eau* (2006). President of the *International Association of Hydrogeologists* (IAH) (1984–1989). Honorary Fellow of the *Geological Society of the United Kingdom* (1992). Vice-President of the *International Association of Water Resources* (IWRA) (2001–2003). He has been coordinator of the *UNESCO Working Group on the Ethics of the Use of Freshwater Resources* (1998–1999).

Member of the Executive Committee of the Spanish NGO CODESPA (1986–1998), a charity to promote sustainable development in developing countries. Member of the Scientific Advisory Committee of the International NGO *Action Against Hunger* (1999–2004).

Director of a large research program, launched (1999–2003) by the *Marcelino Botin Foundation*, on the role of groundwater resources on water policy. A total of nine books and thirteen monographs have been published within this project. In 2004, on behalf of the *M. Botin Foundation*, organized a Workshop on *Water Crisis: Myth or Reality?* He chaired the Scientific and Organizing Committees for the *International Symposium on Groundwater Sustainability* (Alicante, Spain, January 2006), promoted by the *Interacademy Panel*.

Reinier Lock
Reinier Lock has extensive experience in the fields of infrastructure project finance and development, and in the related fields of sector restructuring and reform, privatization and regulation, primarily in the fields of energy and water, and also in the fields of mining and transportation. This work has included extensive experience in working for private sector developers and investors, for host government entities and regulators, and for the international financial institutions such as the *World Bank* and the *International Finance Corporation* (IFC).

A special recent emphasis of this work has been the challenge of establishing effective mechanisms for corporate governance, combating corruption, and for ensuring corporate social responsibility of both private sector companies and State-owned enterprises, in the energy and water fields, especially in Sub-Saharan Africa.

Reinier has been active in leadership positions in bar associations and industry sector and non-profit organizations such as IPWA and the *Partnership to Cut Hunger and Poverty in Africa* (PCHPA) since the early 1980s, including the *American Bar Association* and, since the early 1990s, the *International Bar Association* (IBA), in which he has recently completed his term as Chair of the *Section on Energy, Environment, Natural Resources and Infrastructure Law* (SEERIL).

A native of Zimbabwe, Reinier has degrees in law from *Rhodes University* (South Africa) (BCL), *Oxford University* (BCL) and the *University of California* at Berkeley (LLM) as well as a B. Comm. from *Rhodes University*. Mr. Lock has been admitted to the Bars of South Africa, England, California and the District of Columbia.

Luis E. Marín

Luis E. Marín is a Professor of Geology at the *Instituto de Geofísica of the Universidad Nacional Autónoma de México* (Geophysics Institute, Mexican National Autonomous University). He was chair of the Water Network of the *Mexican Academy of Sciences*. Currently, he is co-chair of the Water Program of the *Inter-American Network of Academies of Science*. He co-chaired, with Prof. Henry Vaux, a joint *National Academies of Science/Academia Mexicana de Ciencias Workshop on Science-Based Decision Making for Sustainable Groundwater Management*. He has published more than 60 papers in the peer-reviewed literature (including *Nature* and *Science*), and has served as Associate Editor for *Hydrogeology Journal* and *Ground Water*. He was a member of the Board of Directors of the *Association of Ground Water Scientists and Engineers*.

He has conducted extensive research on the hydrogeology of the Yucatan Peninsula, including some of the initial work on the characterization of the *Chicxulub Impact Crater*, believed to have caused the demise of the dinosaurs. His current research interests lie in improving water-related decision making using science. He is currently finishing a sabbatical leave at *UNESCO's International Hydrology Program* headquarters in Paris, France.

Luis Martínez-Cortina

Luis Martínez-Cortina is Ph.D. in Civil Engineering at the *University of Cantabria*, Spain. He has worked as a researcher of several European Union Research Projects, and also of the *Groundwater Project*, launched in 1999 by the Spanish *Foundation Marcelino Botín* (four years long), and focused on the role of groundwater resources on water policy. He has carried out hydrogeological studies, groundwater flow numerical models, other empirical tools and its application to the practical management of water resources. He is co-author of four books and monographs, and is the author or co-author of about forty scientific articles. He was the Coordinator of the *Spanish Association of Groundwater Users*. Currently, he is a full researcher of the *Spanish Geological Survey* (IGME), at the *Department of Groundwater Resources Research*.

Jorge Molinero

Born in Lanzarote (Canary Islands, Spain, 1972). Geologist (*University of Barcelona*, 1995), M.Sc. Hydrogeology (*Technical University of Catalonia*, 1996), Ph.D. Civil Engineering (*University of A Coruña*, 2000). He works as Associate Professor in the *Technical University of Catalonia* (UPC) and as project Director in the consulting company AMPHOS 21. He is the author of more than 50 scientific publications in the field of groundwater. The main research interests of Dr. Jorge Molinero are comprised in the framework of *Quantitative Hydrogeology and Groundwater for Human Development*. Currently he is President of the *Spanish Chapter of the International Association of Hydrogeologists* (AIH–GE). He was the recipient of the *Alfons Bayó Award* in 2002, a distinction of the AIH–GE for young scientists (under 35), as well as the groundwater research award *Carlos Ruiz Celaá* from the *Spanish Association of Mining Engineers*. Dr. Jorge Molinero is a member and volunteer of the NGO *Engineers without Borders*. Nowadays, he is in charge of two projects related with groundwater exploration and water resources assessment for *Water and Sanitation Development Programs* at: 1) the Saharian Refugees Camps of Tindouf (Algeria), and 2) the Same district of the Kilimanjaro region (Tanzania).

Jack Moss
Trained as a geographer and then as a professional project manager, he worked for 15 years as a construction project manager on a wide variety of projects. Awarded a prize in the *Building* project manager of the year awards.

Transferred to new business development and urban renewal projects in the UK.

Managing director of Franco-British joint venture in water services management in the UK, in the period preceding water privatisation.

Joined *Lyonnaise des Eaux* with initial responsibility for commercial development in Australia and New Zealand, playing a major role in the successful bid for the *Sydney Prospect Water Filtration BOOT project*, and for commercial development in Turkey. Commercial director for Asia region, where he played an important role in establishing the Jakarta water concession.

Water division director for marketing and strategy, participating and speaking in many major water conferences (Bonn, The Hague, Johannesburg, Kyoto, etc.) Co-author of *Valuing Water for Better Governance*.

Senior water advisor to *Group President for International and Institutional Relations*. Project manager on major *Change Management and Knowledge Management Project*, which won group innovation prize.

Initiator and water specialist in WBCSD water project.

Seconded to *AquaFed* as senior staff member.

Member of *International Programme Committee of Stockholm Water Week*.

Aditi Mukherji
Dr. Aditi Mukherji is a Researcher (Social Scientist) at the *International Water Management Institute* (IWMI), Colombo. IWMI is a CGIAR center dedicated to research on water, food and environment. Aditi received her PhD degree from the *University of Cambridge*, United Kingdom, in 2007. Her doctoral study at Cambridge was funded by the prestigious *Gates Cambridge* scholarship. In her doctoral dissertation she has looked into the functioning of informal groundwater based irrigation services markets in West Bengal, India. She has written around 20 academic papers on social and economic aspects of groundwater irrigation in South Asia. She has also participated in a number of national and international conferences on groundwater issues. In 2006, she co-edited a special issue of the *Hydrogeology Journal*. This theme issue of the *Hydrogeology Journal* was dedicated to social and economic aspects of groundwater governance. In 2008, she was awarded the coveted *Global Development Network Award* for best paper under the category of *Natural Resources Management*.

Donal O'Leary
Since July 2005, Dr. Donal O'Leary has been a Sr. Advisor to the *Secretariat of Transparency International* (TI) in Berlin. He currently represents TI on the *Steering Committee* of the *Water Integrity Network* (WIN). From 1982–2005, Dr. O'Leary, an Irish national, was a Senior Power Engineer with the *World Bank*, working primarily with the *Energy and Water Groups* for the South Asia and Africa Regions. During 1997–2002, he worked with *Siemens AG* in Germany under the *World Bank Staff Exchange Program*. In this context, he represented *Siemens* in the *Industry Group* associated with the *World Commission on Dams* (WCD). Dr. O'Leary's doctoral dissertation from the *University of Texas* at Austin was entitled *The Optimal Expansion of a Water Resources System*.

Paul Polak
Paul Polak, a psychiatrist and entrepreneur, is the Founder of *International Development Enterprises* (IDE), an organization that has ended the poverty of more than 12 million dollar-a-day farmers by enabling them to access low-cost water resource technologies and participate effectively in markets. With IDE's help, rural families typically increase their income by US$ 250 a year. IDE and Dr. Polak's work have been recognized by the *Scientific American Top Fifty Award for Agriculture* (2003), the *Ernst and Young Entrepreneur of the Year Award for the Rocky Mountain Region*

(2004), and the *Tech Museum Award* (2004). Articles about IDE and Dr. Polak have appeared in *National Geographic*, *Harpers*, *Forbes*, and *Scientific American*. Trained as a psychiatrist, Dr. Polak received his M.D. from the *University of Western Ontario* in 1958 and certification from the *American Board of Neurology and Psychiatry* in 1978. Dr. Polak was also Founder and Executive Director of the *Southwest Denver Community Mental Health Center*, which played a prominent national and international role in advancing the concept and practice of community-based care for severely mentally ill clients. He has published more than seventy articles in *Psychiatric Research*, *Psychiatry*, and *Community Mental Health*.

José Roldán

José Roldán received in 1974 his degree in Agricultural Engineering and in 1979 his PhD degree also in Agricultural Engineering both from the *University of Córdoba*. His PhD dissertation was devoted to *Stochastic Hydrology*. He was appointed as Assistant Professor in 1975 and as Full Professor of Hydraulic Engineering in 1988 in the same university. Between 1979 and 1981 he was Faculty Affiliate at *Colorado State University*, Fort Collins, Colorado, USA.

He has researched in the following fields: Stochastic Hydrology and Water Resources; and Irrigation Engineering and has around 70 publications between journals, books and chapters of books. Most of the international papers are in *Water Resources Research*, *Journal of Irrigation and Drainage Engineering* and *Agricultural Water Management*. He has attended more than 70 Symposia and has presented more than 140 communications. Professor Roldán has tutored 8 PhD Thesis and has participated in near 40 Research Projects many of them as Research Head.

He has been Scientific Editor of *Ingeniería del Agua Journal*, head of the research group Hydraulics and Irrigation included in the *Andalusia Research Plan*, adviser of the *National Hydrologic Plan* (2000) and, at the present, member of the *Spanish Committee on Drought* to advise the *Environmental Ministry*.

Charles Sampford

Charles Sampford graduated at the top of his class in each of politics, philosophy and law at *Melbourne University* then completed a D.Phil. in Oxford in 1984 which was published by Blackwells as *The Disorder of Law*. He worked in the law and philosophy departments at *Melbourne University* before being invited to apply for the *Foundation Deanship of Law* at *Griffith University*. This is widely regarded as the most innovative and most successful of Australia's new law schools and was hailed by Sir Ninian Stephen as a "revolution in legal education". In 1999, he was appointed Foundation Director of the *Key Centre for Ethics, Law, Justice and Governance* (the only Australian centre in law or governance to receive centre funding from the *Australian Research Council*). In September 2004, he became the Director of the *Institute for Ethics, Governance and Law*, a joint initiative of the *United Nations University*, Griffith, QUT and ANU. At the same time he took on the role of Convenor of the *Australian Research Council* funded *Governance Research Network*.

Professor Sampford has written eighty articles and chapters in Australian and foreign journals and collections ranging through constitutional law, legal philosophy, legal education, politics and applied ethics and has completed twenty one books and edited collections for international publishers including *Oxford University Press* (including *Retrospectivity and the Rule of Law* in 2006), Blackwell, Routledge, Cavendish and Ashgate.

Foreign fellowships include the *Visiting Senior Research Fellow* at *St. John's College Oxford* (1997) and a *Fulbright Senior Award* to *Harvard University* (2000).

Alejo José G. Sison

Alejo José G. Sison, Ph.D., is the Rafael Escolá Chair of *Professional Ethics at the School of Engineering* (TECNUN) of the *University of Navarre*. He also holds appointments from the *Philosophy Department* and the *Institute for Enterprise and Humanism*. Previously, he had worked at IESE (Barcelona) and at the *University of Asia & the Pacific* (Manila).

In 1997, he was appointed Fulbright Senior Research Fellow and Visiting Scholar at *Harvard University*. Since then, he has received other fellowships from the *21st Century Trust Foundation* (London), the *Academic Council on the United Nations System* (*Yale University*), the *American Council of International Law* (Washington, D.C., USA), the *Salzburg Seminar* and *Bentley College* (Waltham, Massachusetts, USA). He was appointed Referee of the *Journal of Business Ethics* (*Philosophical Foundations of Business Ethics*) in 2004 and elected Member of the Executive Committee of the *European Business Ethics Network* (EBEN) in 2006.

His research deals with the issues at the juncture of Ethics with Economics and Politics. His latest book: *The Moral Capital of Leaders. Why Virtue Matters* (Cheltenham, UK, and Northampton, Massachusetts: Edward Elgar, Ltd., 2003), has been translated to both Spanish and Chinese. He is currently working on a volume that brings Aristotle's ideas in the Politics to bear on issues of corporate governance.

Caroline A. Sullivan

Caroline A. Sullivan is a *Distinguished Research Fellow* at the *Oxford University Centre for the Environment*. She is an environmental economist with extensive research experience in Africa, Asia, Europe and Latin America. She has worked in economic development for almost 30 years, most recently focusing on development—environment linkages, with particular reference to water and forestry, both in developing and developed countries.

Her current research interests are in improving water management for both humans and ecosystems. In addition to climate change, IWRM, and integrated indicators, she has worked on ecosystem values and services, tourism and forestry, water economics and transboundary water management. She is currently involved in several international interdisciplinary research projects. She has worked for a number of years on the development of integrated indices for water resource assessment, most notably the development of the *Water Poverty Index*, and *Climate Vulnerability Index*.

In addition to this research, she has taught economic development and environmental economics and policy for many years at both undergraduate and postgraduate levels, and is external examiner for a number of UK universities. She is also a *Fellow* of the *UK Centre for Ecology and Hydrology*, where she worked for 8 years as *Head of Water Policy and Management*.

Luis Veiga da Cunha

Luis Veiga da Cunha is a Professor at the *Department of Environmental Sciences and Engineering* of the *Universidade Nova de Lisboa*. He has developed research, teaching and international consulting activities in areas related to environmental policy, with emphasis in water resources management and planning.

Previous assignments include positions as research officer and Head of Division at the *National Laboratory of Civil Engineering* in Lisbon (1963–1983) and Science Administrator of the *Scientific and Environmental Affairs Division of NATO* in Brussels (1983–1999), where he has launched and directed various programs in the area of the environment, in particular the Special Programs on *Environmental Security* and *The Science of Global Environmental Change*, each of them having developed a large number of projects and published 60 books. He was a Lead Author of the *Third Assessment Report of the International Panel on Climate Change* (IPCC), 2001.

He was founder and the first President of the *Portuguese Water Resources Association* (1977–1978) and Director of the *International Water Resources Association*. He is author of numerous scientific and policy-making books, book chapters and articles on environmental maters.

He is a member of the *Portuguese National Water Council* and of the *National Council of Environment and Sustainable Development*. He is a member of the *Academy of Sciences* and of the *Academy of Engineering* of Portugal and a member of the *Water Academy* of France.

He was Minister of Education of Portugal in 1979–1980. He was awarded the *Portuguese Order of St. James of the Sword* (Grand-Officer) for scientific and cultural merit, and the *French National Order of Merit* (Grand-Officer).

Karen G. Villholth

Karen G. Villholth is associated with the *Geological Survey of Denmark and Greenland*, Denmark, as a senior researcher with primary responsibilities related to groundwater research and management in a developmental context. She has a strong academic background combining chemical engineering, environmental studies and hydrological, hydrodynamic and numerical disciplines. Her technical scientific interests and experiences emphasises themes like soil and groundwater hydraulics and contamination. Karen Villholth has collaborated broadly, with a host of international partners, resulting in several scientific papers.

Since 1999, Karen Villholth has been involved in broader issues of water resources management. She was responsible for introducing the first course on *Integrated Water Resources Management* at the *Technical University of Denmark*. She has been assigned to several international projects concerning water resources management, focusing on river basin and groundwater management, institutional revisions, hydrological and water resources decision support modelling, capacity building, data collection and *Geographical Information Systems*.

Karen has ample experience in teaching and training, from the *Technical University of Denmark* and the *Asian Institute of Technology* for M.Sc. and Ph.D. students, and short term courses for professionals within water, water quality, and environmental disciplines.

From 2004 to 2007, Karen joined IWMI, Sri Lanka, as a senior researcher within groundwater modelling and management. In this position, she developed work related to the physical impacts of the tsunami on groundwater and the rehabilitation and coping strategies in coastal areas of Sri Lanka. She also directed the development of a large training and research capacity building program on groundwater governance in Asia, encompassing five South and South East Asian nations. She was involved in the *Comprehensive Assessment of Water Management in Agriculture* and was co-editor of the book *The Agricultural Groundwater Revolution: Opportunities and Threats to Development.* Lately, Karen Villholth is devoted to integrated and interdisciplinary climate change and water resources research and management.

I
Some cultural traditional approaches on water ethics

CHAPTER 1

Water and wisdom as embodied in the works of Thales of Miletus

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ABSTRACT: According to Thales of Miletus, water is the *arché* or primary principle from which all things originate and to which all things ultimately return. We begin this chapter by analyzing this teaching in light of the state of philosophy and science during Thales' time. We continue by focusing on the possible relations between water as the *arché* and wisdom. After establishing that, strictly speaking, there can be no *ethics of water* as such, but only an ethics of human action involving water, we shall put forward some proposals that connect water and ethics under the influence of Thales' discussion. The ethics of water use and water technology should be analyzed within the context of human beings manifold relation with nature. A balance has to be struck between an attitude of contemplation (*theoria*) or respect (*epimeleia*) and one of dominion and control as is proper of technology (*techne*); and within the latter, between the perspective of water as an element in life-sustaining biological exchanges and the perspective of water storage, treatment and distribution that makes the biological exchanges involving water possible. In the end, suggestions on how human excellences of virtues come into play in each of these actions are offered.

Keywords: Thales of Miletus; Water as the arché; Water and wisdom; Ethics of water use; Water technology

1 INTRODUCTION

The first thing that comes to mind to a Filipino whenever he or she hears the name Thales is *Kabesang Tales* (Thales, the Head), the *nom de guerre* of one of the characters of *El Filibusterismo*, the second novel written in 1891 by the Philippine national hero, José Rizal. Aside from being the head of his hamlet, *Kabesang Tales* behaved very much like the country sage to whom people would turn seeking advice in almost anything and everything. He was also well known for speaking in aphorisms and his conversations were a popular source of folk wisdom.

There is, however, another Thales—Thales of Miletus—generally considered to be the first philosopher of the West (O'Grady, 2002) and it is on him and on his teachings that this work will focus. We shall begin with a presentation of the character himself and the attribution of his being the first ever *lover of wisdom* in this hemisphere. This leads us to pause and ponder on what wisdom meant to them then, to those who started using the word *philosopher*, and on what wisdom means or should mean to us now, to those of us who still haven't put that word into disuse. In this regard we cannot help but examine the reliability and verifiability of the different sources of our knowledge about Thales, especially since not even his doctrine is for some a settled issue.

Secondly, we shall dwell on Thales' teaching regarding water, which he called the *arché* or basic principle of everything that exists. In order to understand this epigram properly, we will have to consider it within the context—the full breadth and depth—of Thales' thought. For although he is best known for his ideas on cosmology, he had also purportedly written extensively on mathematics, astronomy and theology. Or perhaps we should rather say that Thales elaborated his cosmological doctrine at a time when its limits with mathematics, astronomy and theology were yet unclear. In fact, the only break that Thales had successfully carried out was the one between myth and philosophy, between imagination and reason. During the period in which he lived, the *tree of*

knowledge had just broken from the seed and formed a single shoot; it had not yet developed into the different branches with which we are now familiar.

In third place, once again making use of the ideas attributed to Thales, we shall try to find out what is the connection between water and wisdom. What does water reveal to us about wisdom? Aside from taking Thales in his literal sense, we would also attempt a metaphorical reading of his thoughts concerning water. In the same way that Thales' search for wisdom ultimately led him to water as the *arché* or basic principle, it may likewise be the case that our search for water may now lead us to realize our need for wisdom. In the final analysis, could it not be that wisdom is what really quenches human thirst and that water is merely a pale reflection of it?

Finally, we shall put forward some proposals relating water and ethics in light of Thales' discussion. Strictly speaking, there can be no ethics of water as such—no more than there could be an ethics of air or an ethics of soil as such—for ethics requires above all human action. Ethics is the body of knowledge that studies human action from the perspective of human perfection, or, from the viewpoint of what it means to be a *good human being*. For the greater part of the history of ethics, human perfection or the human good has always been identified with what we normally call *happiness*. Therefore, there could only be an ethics of human action involving water.

Human action on the natural elements such as water has always been understood in mainstream western philosophy as an instance of *techne* or technical knowledge. Therefore, our query regarding the relationship between ethics and water could be better rephrased as the search for an ethics of water use or water technology. After a brief review of the ongoing conversation in the past 30 to 40 years on the ethics of water use—with the heightened ecological consciousness or environmentalism in the background—we shall then show that there are certain lessons from Thales that we would be far better off not forgetting. Namely, that water—and by extension, the whole of material nature- is not only an object of dominion and control on the part of human beings, but that it should also be for them an object of respect and contemplation; not so much because of the value that it has in itself, perhaps, as for its intimate relation with life and human life in particular. An ethics of water use must be premised on the value of water as a necessary element of the human good.

2 THALES OF MILETUS: THE FIRST WESTERN PHILOSOPHER

There is a widespread consensus that Thales was born in the prosperous Greek Ionian city of Miletus, facing the seaboard of Asia Minor, in the mid 620s BC and that he died in 546 BC. Reputed to be the founder of western philosophy and science, he was also the first among the members of the *Milesian School*, dedicated to the study of nature and of change. Among his followers were Anaximander and Anaximenes, who refined his method and broadened its scope, while proposing their own version of the *arché*, the *apeiron* (the unlimited) and air, respectively. This indicates that instead of slavishly repeating the founder's theories, the members of the School engaged in the critical discussion of each other's thoughts, submitting their conclusions solely to reason.

Thales of Miletus was the only pre- Socratic philosopher to be counted among the *Seven Sages of Ancient Greece*, as relayed to us by Plato (*Protagoras*: 342e-343a, see Plato, 1953). However, it seems as if this honor was accorded to him more because of his practical advice rather than because of his theoretical achievements (*The Republic*: 600a, see Plato, 1953). When the Lydian King, Croesus, continuing his father Alyattes' efforts, tried to subdue the Milesians in 560 BC, we know from Diogenes Laertius (see Diogenes Laertius, 1970–1972: I. 25) that Thales thwarted the plan. We are likewise told by Herodotus (*The Histories*: I, 170, a4, see Herodotus, 1982) that upon Thales' suggestion, the different Ionian cities formed a political alliance in order to more effectively resist Persian aggression under Cyrus.

Although several works have been attributed to Thales by ancient sources, none of his writings ever reached even Aristotle, leading some scholars to doubt whether he actually wrote anything. Our information on Thales, therefore, entirely depends on what others say of him, much of which is unreliable given his legendary status. Reports on Thales' works have been afforded us—apart from Aristotle—by Simplicius (Diels, 1958: 475), Diogenes Laertius (see Diogenes Laertius,

1970–1972: I. 23), Plutarch (*De Pythiae Oraculis*: 18.402e, see Plutarch, 1990) and Hesychius (see Diels & Kranz, 1952: 11a2), among others. Many more second-hand references from Lobon of Argus, Callimachus, Choerilus, Xenophanes, Herodotus, Heraclitus and Democritus reach us through Diogenes Laertius and Eudemus.

Aristotle deserves a place of honor among our sources on Thales because of his wording in *De Anima* (see Aristotle, 1985), "from what is recorded about [Thales]" which denotes access to a written work, probably from Thales himself. Later we shall focus on his account in the *Metaphysics* of Thales' discovery of water as the *arché*.

Up to now, we have simply taken for granted that Thales was the first philosopher of the western world without looking into the reasons in support of such a label. In fact, the very term *philosopher*, meaning *lover of wisdom*, was supposed to have been introduced by Pythagoras, a character who lived much later than Thales. Nonetheless, Aristotle unequivocally states that Thales was the first philosopher, the founder of natural philosophy (*Metaphysics*: 983b21-22, see Aristotle, 1985). Why is this so?

First of all, we would have to take into account Aristotle's definition of wisdom or philosophy as a kind of knowledge based on certain principles (*archai*) or causes (*aitiai*) (*Metaphysics*: 982a2-3, see Aristotle, 1985). It then follows that Thales was the first philosopher in so far as he explained natural phenomena rationally, through principles and causes, thereby eschewing traditional thinking based on myths and theogonies. At this point, philosophy stood for, or indeed was identified with, science itself.

Certainly Thales could have been familiar with Egyptian and/or Babylonian myths such as that of the *Enuma Elish*—according to which the land or the earth arose from the primeval waters through the agency of the gods. This is because Miletus had commercial relations with the Near East and he could have even visited Egypt. Likewise, he was surely familiar with Homer's attributions of the origins of the world or cosmos to the Olympian gods, such as Oceanus or Tethys. Yet Thales broke away from both of them and what we have is, at most, a similarity, not a dependency on them. His explanations have been demythologized and are instead scientific conjectures based on the observation of natural phenomena mediated by reason. Here is where Thales' originality as the first philosopher rests. He chose the side of philosophy, science, reason and observation over that of myth and imagination as the place where truth and wisdom lie.

3 WATER AS THE *ARCHÉ* OR PRIMARY PRINCIPLE

In the same way that Aristotle established Thales as the originator of philosophy, Eudemus, Aristotle's student, considered Thales to be the first Greek mathematician and astronomer. While mathematics may have begun in Egypt, where it was used by surveyors to determine the boundaries of properties after the Nile's periodic flooding, Thales was credited with having imported it to the West and developed it in a more theoretical manner. Five Euclidean theorems are supposed to trace their ancestry to Thales and he purportedly applied two of these in successfully solving practical problems (*On the First Book of Euclid's Elements*, see Proclus, 1970). A more nuanced view is that he discovered certain spatial relations and employed them in practical problem solving, but he did not formulate any strict mathematical proof, much less devise any Euclidean axiomatization. At most, he observed similar results from his calculations, showed through repeated experimentation that his propositions or theorems were correct, and in the absence of contradictory outcomes, felt reasonably justified that those propositions or theorems were "proven". The proofs that Thales constructed were really more of *inductive demonstrations* (O'Grady, 2002).

Thales' most outstanding contribution to the field of astronomy would have been his prediction of the solar eclipse that occurred on 28 May 585 BC. Here is Herodotus' account: "On one occasion [the Medes and the Lydians] had an unexpected battle in the dark, an event which occurred after five years of indecisive warfare: the two armies had already engaged and the fight was in progress, when day was suddenly turned into night. This change from daylight to darkness had been foretold to the Ionians by Thales of Miletus, who fixed the date for it within the limits of the year in which

it did, in fact, take place" (*The Histories*: I.74, see Herodotus, 1982). A total solar eclipse did occur on that day, as confirmed by modern astronomy. Not having today's methods of prediction, Thales could only have used information from Egyptian, Babylonian and Assyrian records on the Saros and Exeligmos lunar cycles. However, Thales' hypothesis was that the eclipse was due to natural causes, knowable through observation and reasoning, rather than the result of the action of the gods.

Corollary to having predicted the eclipse, Thales was also said to have discovered that its period with respect to the summer and winter solstices was constant. In like manner, he would have identified the relationship between the solstices and the seasons, with their climactic changes, due to the relative positions of the sun in the sky as the year advanced. Moreover, certain accounts relay that Thales was able to calculate the diameters of both the sun and the moon by observing and measuring their trajectories. And finally, we have also received reports that Thales recognized the advantages of navigating by the constellation Ursa Minor instead of by Ursa Major, which was more common among the Greeks. We could relate this *discovery* to the story in Plato's *Theaetetus* (174a, see Plato, 1953) wherein Thales was supposed to have fallen into a well. It may not even have been an accident at all; it could simply have been an experiment where Thales was testing the benefits of observing the stars from a well.

Thales was indeed a polymath like very few others could ever be; yet he is most famous for his teaching on water. As Aristotle tells us in the *Metaphysics* (983b20, see Aristotle, 1985), for Thales, the first philosopher, water was the *arché*, the originating principle of nature. This could also be reworded so as to convey that for Thales, nature was composed of a single material substance, water.[1]

Sense observation reveals that nature or matter undergoes constant transformation into a myriad of things (*Metaphysics*: 983b22, see Aristotle, 1985). The *arché* then would have to be not only the origin of everything that is in nature, but also its terminus, after going through a series of transformations. Water is capable of doing precisely this, continuously moving from meteorological, geological, botanical and physiological states, not to mention adopting the various forms of liquid, vapor and ice, when varying intensities of heat is applied. Hence Aristotle's assumption that Thales could have observed "that the nature of all creatures is moist, and that warmth itself is generated from moisture and lives by it; and that from which all things come to be is their first principle" (*Metaphysics*: 983b23-25, see Aristotle, 1985); and as if to dispel all doubts he adds: "Besides this, another reason for the supposition would be that the semina of all things have a moist nature" (*Metaphysics*: 983b26-27, see Aristotle, 1985). What is of utmost importance is for us to realize that according to Thales' account the Olympian gods had no role to play in the generation and reduction of all things into water.

Not only is everything made up of water, according to Thales, but likewise, the earth itself floats on water, as Aristotle attests in the *Metaphysics* (983b21, see Aristotle, 1985) and in *De Caelo* (294a28-30, see Aristotle, 1985). The earth is bouyant because it is of a similar substance to wood that floats on water but not on air. Thales may have drawn this conclusion from observing the wooden ships that called on the busy sea port of Miletus which did not sink despite bearing heavier cargoes than water. Once more, Thales takes no recourse to the gods in order to explain how the earth is sustained.

What role, then, does Thales attribute to the gods, if any at all? Aristotle offers us a response in his treatise *De Anima*: 405a20-22 (see Aristotle, 1985): "Thales, too, to judge from what is recorded of his views, seems to suppose that the soul is in a sense the cause of movement, since he says that a stone [magnet or lodestone] has a soul because it causes movement to iron." Several lines later Aristotle adds: "Some think that the soul pervades the whole universe, whence perhaps came Thales' view that everything is full of gods" (*De Anima*: 411a7-8, see Aristotle, 1985). In other

[1] Later commentators are quick to point out that Aristotle seems to have interpreted Thales in a manner too favorable to his own purpose: What Thales simply declared to be the *arché*, Aristotle had converted into the *material cause*, just one of various other causes.

words, Thales equates the gods to the soul, the invisible principle which is, however, responsible for producing observable moment. In a limited sense, therefore, the gods, like the soul, permeate the whole cosmos, *enlivening* it.

4 WHAT DOES WATER REVEAL ABOUT WISDOM?

Thales came to affirm that water is the *arché* or the primary, originating and final principle of nature, of everything that is, thanks to a keen sense of observation and equally fine reasoning skills. Unlike his predecessors and contemporaries, he did not take recourse to myths and theogonies in order to explain naturally occurring phenomena. To this extent we could rightfully call him the first western scientist. However, we also consider him to be the first western philosopher in so far as he was moved in his inquiries by a desire to "get to the bottom of things", so to speak, to understand the world in itself and for no other ulterior end. In this quest Thales clearly went beyond partial and intermediate accounts and did not rest until he found ultimate causes and reasons. This, in effect, is what characterizes wisdom: it is a form of knowledge based on the first principles and final causes, as Aristotle so aptly declared in the *Metaphysics* (982a2-3, see Aristotle, 1985).

Therefore, we would be authorized to say, to some degree, that water was for Thales also a metaphor of wisdom. We could go beyond the strict, literal meaning of water as the *arché* to consider its transferred meaning: precisely because water is the *arché*—according to Thales—whoever discovers this also discovers the true and supreme knowledge or wisdom. Water then would be something like the *material image* which reveals or unveils to us immaterial wisdom.

What features does water as the *arché* share with wisdom? In the first place, water, like wisdom, is one; each of them forms a unity. Water is one and the same wherever and in whatever state it is found; so it is with wisdom. Both of them are undivided, that is, inseparable from itself. In second place, water, like wisdom, is found both in the beginning and in the end of all things; indeed, it is present and identical to itself despite the myriad of transformations it undergoes. The substance of water, like that of wisdom, is therefore the unchanging first and last, underlying the whole series of changes which are in truth merely accidental. Consequently, we could affirm—in third place—that both water and wisdom, in the measure that they are indestructible, are also eternal. Unaffected by change, they are likewise unaffected by time, which is but the measure of change. Being the beginning and the end, they themselves have neither beginning nor end.

As the first philosopher, Thales' search for wisdom led him to the discovery of water as the *arché*. In our present circumstances, perhaps we should allow that our search for life-giving water eventually make us realize an even deeper need for wisdom as the *arché* or fundamental principle. In reality, it is wisdom, more than water, that which could ultimately quench our human thirst. Because of this, the following passages from the *Book of Wisdom* which develops the parallelism between water and wisdom should come as no surprise: "He that feareth God will do good: and he that possesseth justice shall lay hold on her, and she will meet him as an honorable mother. With the bread of life and understanding she shall feed him and give him the *water of wholesome wisdom to drink*: and she shall be made strong in him, and he shall not be moved: and she shall hold him fast, and he shall not be confounded" (see Ecclesiasticus, 15: 1–3).

5 WATER, WISDOM AND ETHICS

As we earlier explained, there is room for the consideration not so much of the ethics of water as of the ethics of water use or water technology. But before proposing any guideline on the ethics of water technology, we would first have to clarify what technology is and its ascent in the Modern Age.

From the viewpoint of the theory of knowledge, *Modernity* is characterized by a profession of faith and absolute confidence in the powers of reason. Through the unprecedented use of reason in the experimental sciences and mathematics, nature is expected to steadily yield its secrets to human

inquiry. Reason, expressed through technology, affords humans an ever increasing dominion or control over the natural world.

When Francis Bacon, the English thinker and essayist said "knowledge is power", he was referring above all to technology. Unless otherwise demonstrated, technology is a kind of knowledge exclusive to human beings. It is a practical kind of knowledge that allows us to alter our physical environment, producing what at first was inexistent from pre-existing materials, effectively and efficiently, in order to satisfy our various needs and wants. Common to all forms of technology is the capacity to *objectify* things, that is, the ability to consider them in a manner different from their natural surroundings. For example, the trees and logs that we find in the forest may initially be converted by technology—by human activity or work—into timber, and then finally, into tables, beds and chairs, if not into our very homes. Notice that there is no one-to-one correspondence or univocal relationship between things in their natural state and the objects into which they have been transformed by technology: the same wooden plank may equally serve for making a bed or for fabricating a door. Human beings freely determine through technological know-how the use of things as they are found in nature. Only human beings can do this—use instruments or employ technology—because they alone are able to conceive means-end relationships imaginatively and creatively in the abstract.

Technological progress may largely be traced through improvements in the series of instruments used to produce certain artifacts. In the beginning, human beings limited themselves to using simple machines which minimally transformed or multiplied inputs of energy, from human or other sources, into a capacity to do *work*, that is, the controlled application of force through a distance. Afterwards, this purely mechanical phase was overcome with the introduction of electricity and other forms of energy which greatly increased our work output. For some years now, we have already entered into a cybernetic era in which we have begun to produce self-regulating machines equipped with a remarkable functional autonomy, closely resembling living beings. Human life and human society has been overrun by some form of technocracy, which is a pragmatic version of scientism. The *brave new world* is now.

However, technological progress also brought along with it a retinue of unwanted side-effects, such as widespread pollution and the depletion of natural resources. But none more terrifying than the invention of weapons of mass -or even total- destruction: human beings arrogance has come to produce artifacts capable of annihilating his own species and almost any other life form on the planet. This is, in part, what Hannah Arendt (1958) had denounced in her book on *The Human Condition*. In her reflections, she begins by expressing a deep sense of fear and insecurity. Up until now, human life has been inextricably linked to the earth, the support of our *human* (which comes from the Latin word for earth, *humus*) *condition*. But what would happen if, because of our own doing, the earth were to turn into a hostile environment for human life? Even if, as the current state of technology already allows, we humans were to colonize another planet, would we still continue to be *human beings*? Would we not have become *de-humanized* by leaving the earth which is our home?

These are but a few of the questions that technological advances have raised, the answers to which could only be supplied by ethics. From the viewpoint of ethics, we should not do certain things even if it were within our technological power to do so. Ethics is called upon to guide and direct technology, sometimes imposing restrictions on the latter's sphere of action. Technology is not capable of establishing its own limits and thereby needs ethics, which is a prescriptive form of knowledge, to fulfill this purpose. Ethics, therefore, is a necessity; and as the aforementioned example may show, it could even be one that greatly conditions our own survival.

It is within this historical setting that the contemporary phenomena of ecological consciousness and environmentalism have arisen and flourished. Traditionally, people with such concerns were called *conservationists*, championing causes such as the protection of wildlife and plant species on the verge of extinction, if not of particularly scenic environments; they could have also worked in favor of the prevention of cruelty to animals or of the adoption of abandoned household pets. Nowadays, however, environmentalism and the green ideology have turned into a broad church that welcomes no-nukes, feminists, pacifists, anarchists and so forth. Their exponents tend to associate

the destruction of habitats with the economic system of capitalism, from its ravenous methods of obtaining raw materials to its heartless means of production and distribution of goods through the market. There is an urgent need, therefore, to establish a clear dividing line between a proper and balanced concern for the environment or the ecology and radical green ideology.

As early as in June of 1972, more than thirty years ago, the United Nations had already sponsored a worldwide conference on the environment (Sison, 1993). Held in Stockholm, Sweden, the meeting ended with the drawing up of the following conclusions; the recognition of:

1. The right of every human being to keep a certain *quality of life*.
2. The need to preserve the earth's resources for future generations.

Implicit in these findings were certain beliefs that greatly require our attention:

– The human person is the end of all economic activities and as such should be considered, independently of the culture from which she/he comes or represents.
– The earth's resources are not only limited—as is the case of all material things- but also scarce, that is, with respect to human wants and desires.
– As long as the economic criterion remains the prime interest of governments, these scarce and limited resources will always end up being concentrated in the hands of a few and their equitable or just distribution remain a utopian dream.

1972 was also the year in which the *Club of Rome* met, prodded by practical worries over the possible adverse effects of population growth on our natural environment (Sison, 1993). The Conference centered once more on the theme of the finitude of the planet earth and the scarcity of natural resources—including water—relative to human needs and wants, problems which were aggravated by population increase. The conclusions of the *Rome Conference* were tremendously pessimistic in contrast with those of another international meeting which took place two years later, in 1974. That year, the *World Food Conference* held in Bucharest, Romania, reached the conclusion that a country's human population is its main and most valuable resource, also for the purpose of food production.

We have cited these conferences celebrated in the early 1970s to trace the beginnings of environmentalism as a mass movement and to review its major claims and arguments of an ethical or anthropological nature. Followers of a radical green ideology allege that it is a grave error on the part of the individual human being to separate himself or herself from the rest of nature, considering the latter merely as a store or a source of useful goods. They allege that this anthropocentric vision reeks of an intolerable arrogance on the part of human beings. The remedy to most environmental and ecological problems basically consists in a change of attitude among human beings, from one of sense of superiority to another in which we realize and accept our proper place in the world. Human beings represent just a single component among many others found in the biotic community; what's more, they account simply for one which is relatively recent and to that extent, still *immature*. No single organism or life-form—not even humans—have the right or reason to assert its superiority over all the other inhabitants of this planet.

In what follows, we shall attempt to dialogue with and respond to each of these objections or claims. Let us begin with humans' purportedly misplaced effort to distinguish and separate himself from the other elements of his physical environment. With all due respect to Descartes and his followers in the rationalist and dualist schools of philosophy, human beings are essentially *corporeal beings* or *ensouled bodies*: we are neither *pure minds* nor *pure reasons*, nor are our minds or souls found in our bodies in the same way that ghosts could be said to inhabit a machine. We are inseparably composite beings of mind or soul and body. In so far as I do not only *have* a body but actually *am* my body, I am a being naturally belonging to the world, a *being-in-the-world*, as Heidegger (1962) would say. Human beings are unique in comparison to their other companions in this world because apart from recognizing themselves to be a part of nature, they are also able -through a highly developed consciousness evidenced by their use of language—to distinguish them from the surrounding world. But this distinction from the other beings in the world

on the part of humans should never amount to a complete separation or total severance; without the world, humans would not only cease to exist, she/he would also be unintelligible.

In his work *Dependent Rational Animals*, Alasdair MacIntyre (1999) explores the various grounds that could account for the similarities and the differences between human beings and other intelligent species found on earth, paying special attention to the facts of vulnerability, disability, dependence and language. Although he succeeded in bridging the rift which many philosophers including Aristotle, Descartes and Heidegger have somehow presumed or introduced between human beings and other intelligent species, it was never his intention, however, to establish what definitively set human beings apart from other life forms.

Within the context of Judeo-Christian tradition, the response to this query lies in that humans area the only creatures made and beloved for his own sake, that is, made and beloved not for the sake of any other. Here lies the root and cause of all privileges enjoyed by human beings over the rest of creatures found in nature. According to this worldview, the other natural beings have been *willed into existence* for human being's sake. Humans therefore occupy the zenith of nature. The whole world, even the whole universe has been designed and constituted in such a manner so as to provide a suitable home for humans, to make human life possible and to allow it to flourish. The world then is best understood as a *home-for-humans* rather than the reverse (that is, *humans-for-the-world*). Herein lies the true meaning of humans as a *being-in-the-world*: that humans needs to relate or co-metabolize with the world in order to exist.

Humans relates to nature, to the rest of creatures found in the world other than himself or herself, including water, in several ways. One is expressed through an attitude of wonder or admiration (*thaumazein* in Greek), which later on leads to respect (*epimeleia* or careful attention) and contemplation (*theoria*). Such an attitude prevailed among ancient Greek philosophers, among Ionian physiologists, in particular, and pre-eminently, in Thales of Miletus, as we have already seen. An exigency of our nature or particular manner of being is to be able to admire and contemplate nature, finding in it rest, recreation and the revival of our spirit. This is a dimension that is often overlooked if not completely forgotten, unfortunately, due to a highly technological and mechanistic view of the world.

A second manner in relating to the world is conditioned by an attitude of absolute dominion and control. This signifies that human beings deal with nature exclusively as an instrument to be used for whatever end they wished. As we have said earlier, the world is but a store or source of goods to satisfy human needs and wants. This point of view, in turn, could be further subdivided into two:

a. The dominion exercised by humans over nature through the different biological exchanges required to sustain life, such as nutrition, respiration, reproduction, and so forth.
b. The control manifested through technology, the design and construction of artifacts, whereby an idea (structure or form) in the artist's or artisan's mind is impressed on a piece of matter.

There is a delicate balance to be sought between the contemplative and the controlling attitudes on the part of human beings with respect to nature. Usually, there is an inverse proportion between them, such that technological progress brings with it a decrease in the wonder and respect for nature. Modernity has sought to eliminate the contemplative attitude towards nature, retaining only the relationship of dominion and control, and even further reducing biological exchanges into some sort of technical instrumentalization. Postmodern green ideology, on the other hand, has run the contrary course in an effort to achieve human being's absolute identification with nature, without admitting any distinction whatsoever between the two. This need not occur necessarily, however.

This outline does not exactly match the economic perspective according to which the goods of nature are simply divided into renewable and non-renewable resources. Renewable resources refer to those that can be used over and over again without being exhausted, an example of which is water, which can be renewed through a natural cycle. Non-renewable resources are those apt only for a single use. Perhaps this classification is too simplistic. It would be better, then, to distinguish between consumer goods and non-consumer goods. By consumer goods we mean those resources which are subject in their acquisition to the principles of justice and the laws of the free market, and in their use, to the right as established by the virtue of temperance. And by non-consumer goods

we indicate those which are not negotiable nor subject to instrumentalization or manipulation, such as human lives and human beings.

6 CONCLUSION

Where then lies wisdom in water use and water technology? Perhaps we shall find it only when we realize that water use and water technology are but particular instances of the relationship of human beings to nature in general. It is within this framework that the proper ethical analysis of this class of actions should be undertaken.

We should also do well in recovering Thales' insights with regard to nature and water. Above all, this means not losing the attitude of wonder and admiration (*thaumazein*) over nature and the substance of water, which leads us to respectfully leave them alone (*epimeleia*) or to consider them at most as an object of contemplation, not manipulation. How many drooping spirits have been revived at the sight of bodies of water, be it the immensity of the ocean, the power of the waves or the light-heartedness of brooks and rivulets. Water serves human beings need for rest and recreation. In these cases, water represents a non-consumer good that is best left out of the world of commerce and private financial gain.

On the other hand, if the world is in the final analysis a home for humankind, then everything in it has to be in humankind's service. It would only be reasonable, therefore, for human beings to exercise dominion and control over the earth's resources, including water. But he/she will have to do so in the right way, in the proper manner, that is, in accordance with human excellences or the virtues. Human beings manifest dominion and control over the water that they need in life-sustaining biological exchanges. Thankfully, water in these processes is a naturally renewable resource. Given that in many circumstances, water is in limited supply if not in an altogether scarce supply, we should exercise temperance in its use, by not consuming more of it than what we actually need. We could also practice justice by ensuring that all human beings have access to the amount of life-sustaining water that they need: the contrary would be to let them die of thirst. Beyond the biological exchanges, human beings likewise show dominion and control over water when they employ technologies in its storage, treatment and distribution. These actions have to be carried out with utmost prudence, that is, taking care of the appropriateness of the means used with respect to the end envisioned, which is guaranteeing of the necessary water supply to a group of human beings. And finally, courage should come into play because all of these technological interventions entail costs, problems and hardships -take for example, the construction of dams- and it would be easy to be daunted by them and desist from reaching a worthy goal.

Strictly speaking, water may not be a *common good*—that would be the good of the polity and of each and every one of its members, their *human perfection*—but its proper use definitely forms part of it. For this reason, whenever we make use of water, we have to be aware of its *social dimension*, not only with regard to our contemporaries but also to future generations. Hopefully, this would motivate us to deal with water not like a tyrant with his property, but rather as a responsible steward who is answerable to the community. Only by behaving in our use of water with solidarity, could we contribute to that necessary element of the common good which is peace.

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CHAPTER 2

Water and conflict: Whose ethics is to prevail?

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ABSTRACT: The strong connection between water and ethics arises in the course of action, specifically with water projects that some like but others oppose. This chapter explores the link between the dominant ethical system of South Asia and the water conflicts therein.

Keywords: Water conflict; South Asia; Hindu ethics

1 ETHICAL CONTEXT

Because it is vital to life, water and its use (or more often a perceived misuse) evoke emotions that can range from the sublime aesthetic to murderous anger, and at scales from individual and family to basins and nations. It is ultimately these emotional underpinnings that pave the way for particular types of action, despite what cold logic might be saying. Indeed, even logic may not be such a sure compass since we are all too aware of convenient rationalizations that all of us have engaged in at one time or the other, in matters big or small, to justify acting as per our heart's dictates rather than that of judgment in our heads. Perceived short term self interest, peer pressure, social mores that provide grounds for shame if we acted contrary to public beliefs, etc. are all grist to the mill of human action, individual or collective.

Around water and its various uses or manifestations one can identify all the nine emotional moods (*navaras*) of Hindu categorization[1] that poets and artists have captured in their works of art and music. As floods, it evokes terror, as a placid lake peace, to a dam or dyke builder heroic patriotism, as injustice anger, as pollution disgust, as a scientific curiosity wonder and so on. All these emotions are the prelude to action of different types that, not just artists but also politicians, businessmen, religious leaders and civic voices try to encourage or discourage among their votaries.

Like people everywhere, modern South Asians too face a quandary: rich traditions and ideas of the past maybe hallowed ideals, but everyday life today brings forth many different types of pressures that have to be sorted out by the action of individuals and the collectives they belong to. Properly assessed, traditional values can be a beacon in a dark and uncertain valley; thoughtlessly accepted, they can stifle creative initiatives to deal with modern problems. As the sections below will strive to indicate, while traditional Hindu ethics related to water may have lofty ideals, the reality today is that Hindu holy rivers, be it the Bagmati in Kathmandu or the Yamuna in Delhi, are practically miasmic sewers. What has caused this disjuncture between hallowed tradition and everyday life today? Do we have to look for specifics in particular traditions such as *Hindu* ethics, or are there generalities common to all who live today in congested cities as part of the overall modern human predicament, independent of particular religions or mores?

What is self-evident is that various perceptions lead to equally varied actions, and this is where the question of ethics arises, for ethics is ultimately about judging action (*kriya*) that leads to results (*karma*). This is true not only of Hindu tradition but also those of Western and others.

[1] They are: *adbhuta* (wonder), *bhaya* (terror), *bibhatsa* (disgust), *hasya* (humour), *karuna* (pathos or compassion), *rudra* (anger), *sringara* (erotic), *vira* (heroic) and *shanta* (peace).

MacIntyre (1966) argues that the Homeric ethos on which Western ethics was based (and modified with Judaeo-Christian encounter) was to judge a man on how he discharged his allotted function; but that *allotted function* changed as social life changed. So has it been with the modern Hindu, with the question of who decides what that allotted function is becoming a serious issue of modern everyday politics. Because water is manifested in various forms, is used in multiple ways, and produces varied outcomes, the relationship between water and society is equally diverse and prone to disagreements and conflicts. What is the proper use of water? If one community's holy river (*viz*. the Ganga) is the drainage outflow point of several upstream modern cities, on what grounds is a society to decide what to do? And who should decide? With what alternatives in mind? This essay attempts to probe these questions from the perspectives of a South Asian *action researcher*, looking at both the region's traditional cultural baggage and modern needs surrounding *water resources management*.

2 PURITY IN HINDU ETHICS

While South Asia is a diverse place and has within it practitioners of almost all the major religions of the world, the primary civilizational basis is the tradition of five or so millennia that goes by the generic name *Hindu*. It is not an easy term to define as it encompasses practices of different groups and sects within it, which are so different from each other that elsewhere they would be considered different religions. The name *Hindu* itself is foreign, used first by the Persians to describe the denizens to the east across the Sindhu (Indus) river. And Hinduism does not really have a term that is the equivalent of *religion*: the word *dharma* popularly used as an equivalent designation does not quite mean what the word *religion* does in English. There is no one single pope, one single church or even one single book such as the Bible or the Koran. Dharma is a way of life, a sense of duty, a tradition to be maintained, a basic order of things, etc.; and it can vary with station in life, age, stage of enlightenment and so on.

Thus Hinduism is seen less as *a* religion than a supermarket of myriad religious practices. Over the millennia, there have been many reformers and many more sects. The most notable among them have been Siddhartha Gautam who founded Buddhism, Mahavir who founded Jainism and Nanak the first guru of the Sikhs. In addition to these towering figures, there have been many others whose followers dot the South Asian mosaic. Despite this rich tapestry of multi-hued traditions, a shared history, and several common philosophical strands, unites these different practices allowing the use of the generic term *Hindu* (or as some prefer, the *Omkar Parivar*, the family of religions that build their tradition around the sacred syllable OM), and the analysis of the ethical position therein.

It begins with the Vedas that are treated as the source of *dharma*, the word commonly meant to refer to *religion* but meaning in its original Sanskrit *duty* or even *order* of things. The perceived universe is seen as having come into existence as a result of *tapas*, or the concentrated heat of divine fervour, but before there can be a universe, there must be regularity in the behaviour of things (*rta*). And also, before there can be social organization, there must be trustfulness based on truthful (*satya*) speech and conduct (Bhattacharyya, 1953). It is *dharma*, or proper conduct, which sustains the *rta* of the universe and society therein. The bond of unity between man and the higher realms is broken by a lapse in moral conduct.

In the early Brahminical (pre-Buddhist/Jain) phase, this bond was deemed to be re-established by the conduct of proper rituals; but in post Buddhism South Asia, it took a more abstract philosophical turn. The Brahminical rituals consisted of different sacrifices, but that of main interest to us is that related to water, of ablution. Lapsed or immoral conduct (*sin* in occidental religions, but Hinduism is often said not to have the concept of sin, only that of error that can and must be corrected) was seen as a stain removable by washing. Water was a means of purification not only of the body but also of the soul, hence its central role in all rituals from birth to death and cremation by a riverbank. As a result, of the thirty-three millions Vedic gods (and each one of these gods were eventually seen as manifestations of the One in subsequent development of monistic Vedanta), Varun, the deity of

water, came to occupy a central position in rituals together with the other great ultimate purifier, fire and its deity Agni. In this regard, it is worth quoting the primary text of Hindu ritualism, the Manusmriti (from Percival, 1982), how water is seen as a universal purifier:

> "Bodies are cleansed by water; the mind is purified by truth; the vital spirit, by theology and devotion; the understanding by clear knowledge" (5:109).
>
> "A priest, having performed funeral rites, is purified by touching water" (5:99).
>
> "But of all pure things, purity in acquiring wealth is pronounced the most excellent: since he who gains wealth with clean hands is truly pure; not he who is purified merely with earth and water" (5:106).
>
> "By water and earth is purified what ought to be made pure; a river by its current; a woman, whose thoughts have been impure, by her monthly discharge; and the chief of twice-born men, by fixing his mind wholly on God" (5:108).
>
> "The gods declared three pure things peculiar to Brahmanas; what has been defiled without their knowledge; what in case of doubt, they sprinkle with water; and what they command with their speech" (5:127).

In the ritualistic tradition of Brahmanism, a bath in the Ganges was meant to purify the body; but if proper procedures of ritual were followed, the bath purified the mind too. Among some sects, there is the practice of *jalakracchra*, which is the purification of sins by subsisting only on water mixed ground barley for a month, immersing whole day and night in the water followed by 1,008 repetitions of the Gayatri *mantra*. Kane (1991) in his ten-volume monumental work on the history of *dharmashastra* (Hindu religious law) provides the following first quote from the earliest text, the Rig Veda, as well as other quotes from the latter *Smritis*:

> "Whatever creates doubt (whether it is pure or impure) should be touched with water, then it becomes pure".
>
> "Waters are purified by the rays of the sun and the moon and the contact of the wind".
>
> "Rainwater falling on the ground is impure for ten days, first flood is impure".
>
> "Water collected on the ground that is of such volume that a cow can slake its thirst therein, that is in its natural state and is not polluted by anything impure and that has natural colour (is transparent) and taste and odour (either no odour or a fragrant odour) is pure".
>
> "Water collected on a stony surface and water of a flowing river is always pure, so are waters from tanks so deep that they cannot be agitated and lakes that are similar".

Kane, after mentioning the basic Hindu belief that all deities are concentrated in water, also describes the importance of *tirtha*, a holy pilgrimage site, which often happens to be on the banks of a river or at the point of confluence of two rivers called a *sangam*. The most famous of them all is Prayag in Uttar Pradesh near the city of Allahabad, India, which is the site of confluence of the Ganga and the Yamuna. Here, every twelve years at an auspicious conjunction of planets such as Jupiter and Sun in the Aquarius zodiac, the largest throng of humanity (about 30 million in January 2001) gathers to bathe in its waters during the festival known as Kumbha Mela. Lesser sized confluences are also considered equally holy, for instance the confluences in Nepal of the rivers Kali Gandaki and Ridi Khola at Ridi or the same Kali Gandaki with Trisul Ganga at Dev Ghat further downstream, or the mighty Sapta Kosi with Koka Khola at Barahakshetra in the east.

There is a belief that at the *sangam* of two rivers, there is also an invisible third river, the Saraswati, with which are entwined interesting elements of high philosophy as well as modern politics and science. The river Saraswati is often mentioned in the oldest sacred text of the Vedas and is thought by some to be a river adjacent to the Yamuna that flowed in recent geological past along an abandoned channel next to the Indus. Identifying (or proving) its existence has become entwined with right-wing Hindu politics in India. Some others hold the view that the invisible Saraswati at a *sangam* is subterranean groundwater backflow into a river. In any case, there is a strong

philosophical symbolism behind the concept of *sangam* of Ganga and Yamuna with Saraswati, the triad of Ganga-Yamuna-Saraswati being seen as the *ida*, *pingala* and *sushumna* respectively, the three nerve channels in the spine that figure prominently in yogic practices centered around arousing the *kundalini* coiled and sleeping at the base of the spine of the unenlightened. Thus ritual bathing at the *sangam* is seen as leading to spiritual enlightenment that follows the awakening of the *kundalini*. Unfortunately, in modern times, an ideal holy *sangam*, the confluence of two rivers, is also an ideal dam site for storage reservoir with the flood plains of the two rivers providing the storage space and the narrow gorge below the controlling dam (Sharma, 1994).

3 HINDU ETHICS

Since the Vedas were the ultimate source of authority, Brahmanism, and especially its latter evolution in the philosophy of Mimamsa, saw proper *dharma* as that which was prescribed by the religious texts and their proper interpretation by competent authorities. There were three types of proper conduct, the obligatory (*nitya karma*) that had to be done as a physical human being such as eating, procreating and excreting; the desired (*kamya karma*) done to achieve some aim such as wishing for prosperity or progeny; and finally the event marking (*naimittika karma*) which had to be done when certain event occurred such as birth, death, eclipses, etc. As the ritual procedures got more intricate and codified, they gave less and less space to individual efforts and initiatives: they were bound to invite a revolt and they did in the form of Buddhism and Jainism among others. Eventually many of these at that time heretic concerns found their way into reforms of Brahmanical traditions, which we today recognize as the various branches of Hinduism.

The contribution of reforms of around the sixth century BC was the re-introduction of the primacy of individual effort in re-establishing the bonds with the *Ultimate* without the mediation of intermediaries such as ritual performing priests. The concept of *karma* changed to that of actions producing their own fruits without any reference to any divine dispensation. In Buddhism and Jainism, the myriad gods of Brahmanism disappear altogether, but austerities are more demanding while renunciation of earthly attachments denounced more stridently. While the dualists in Hindu philosophical tradition have problems with this—if divine intervention is not accepted in cancelling human sins, it leads to a type of deterministic fatalism—the Vedantic monists ultimately found the Buddhist challenge much to their advantage in dispensing with both priestly intermediaries and a *Beyond* or a *Hereafter* as being the source of moral judgments. Indeed, it saw the rise of the primacy of individual effort in spiritual attainments where the incentive to a moral life is no longer attainment of a blissful celestial life but escape from the inevitable sorrows and tribulations of earthly existence.

However, extreme monism and normal social life stand in contradiction to each other, and the conduct of human affairs becomes impossible. It also poses severe philosophical contradiction between *swarga* (heavenly attainment) and *mokshya* (liberation). This compromise eventually gave rise to some unique features of Hindu ethics. Primary Hindu values were centered around the concept of four basic duties (Hiriyanna, 1953):

> *artha*: instrumental value related to economics, the acquisition of wealth and earthly prosperity.
>
> *kama*: psychological value of personal gratification which is an intrinsic value of human desires, without the moderate fulfilling of which no spiritual enlightenment will follow.
>
> *dharma*: moral value related to preserving social norms as well as personal fitness to lead to the next value of higher spiritual attainment.
>
> *mokshya*: or final transcendental enlightenment and liberation from the world of sorrow and rebirth therein.

These differentiations give rise to an ethical relativity in Hinduism that is vexing to those who prefer a single solution as defined by the interpretation of a sacred text as propagated by monotheistic

religions of the Abrahamic variety such as Judaism, Christianity and Islam. In Hinduism, moral obligations and duties in life are dependent on caste, stage of life and level of spiritual attainment. Each caste group (*varna*) has its own *dharma* to follow and maintain. The *dharma* of the Brahmin lies is pursuing knowledge (defining order), that of the Kshetriya, in maintaining order, that of the Vaishya of colouring or embellishing the established order through arts and allied crafts, and that of the Shudra (which eventually got ossified as the untouchable category) in following the order. It would be a sin (an error, a waste of time and resources) for a Brahmin to take up arms as it would be for a Kshetriya prince to waste time in intellectual speculation when his duty was to keep the scoundrels at bay. Indeed, if a Brahmin householder was to practice non injury, non covetousness and sexual purity, a Kshetriya king was obliged to perform the unpleasant duty of punishing social transgressors even with death to maintain harmony in the kingdom. For instance, when public water bodies were damaged, the king had to punish the perpetrator as per the following injunctions of Manu (Percival, 1982):

> "He who shall take away (unduly) the water of an ancient pool, or shall obstruct a water course, must be condemned to pay the lowest usual amercement" (9:281).
>
> "The breaker of a dam that secures a pool, let him be punished by long immersion underwater, or by keen corporal suffering, or the offender shall repair it but must pay the highest mulct" (9:279).

The ethical obligations also vary during different stages of life. The duty of a student is different from that of householder which is different from that of a retiree. For example, the ideal student maintains *brahmacharya* (abstinence from sex), whereas upon graduation and taking up a householder's duties, this *sin* becomes a sacred obligation. A similar distinction is made regarding levels of spiritual attainments. Those on the lower levels are obliged to follow daily rituals, but the monks and nuns (and indeed even householders who are on an advanced spiritual path) are not obliged to follow them. But the freedom from ordinary rituals does not mean total freedom for them: their ethical obligations are heavier than for householders. They must keep their senses under total control, practicing absolute truthfulness in thought, word and deed. Besides non-injury, they must keep completely away from the six deadly sins of lust, anger, greed, infatuation, pride and jealousy. Indeed, if monks and nuns are to set a pattern of ethical conduct for others, they would be considered legitimate only if they practiced more severe discipline. It is for this reason that higher castes have more taboos to follow than the lower castes, from dietary restrictions of extreme vegetarianism to other social obligations.

Hindu ethics finds its current benchmark in the *Bhagwat Gita*, a section of the epic *Mahabharata*. Indeed it is argued that the entire epic was written only to embed the abstract ethics of the *Gita* within colourful stories that the masses could relate to. The *Gita* argues that, since no one is free from the results of one's actions, that the laws of *karma* are inexorable, the solution is to efface self-reference in the performance of one's duties, which are both universally applicable to all men and women, but also specific to the duties of particular professions. Unpleasant duties cannot be avoided, but what can be avoided is attachment to good and aversion to bad. This is the philosophical implication in the Mahabharata of the divine incarnation Krishna as a charioteer exhorting the Pandava prince Arjun to not be afraid to fight and kill his kinsmen in order to keep evil in a state of check. It is his duty as a kshetriya warrior prince. In one materialist branch of Hinduism, that of the extreme Charvakas who were avowed atheists that recognized no divine authority, the order that has to be preserved is only that of the authority of the king. It is the king's duty to ensure that *deshachara* (conduct befitting a locality), *lokachara* (conduct befitting a community) and *kulachara* (conduct befitting a particular clan) are upheld so that social harmony is maintained.

Picking up from *Samkhya* cosmology the concept of *guna* (or inherent characteristic), the Gita espouses three types of inborn tendencies, that of *satwik* (highest balanced ethical), *rajasik* (active) and *tamasik* (inert or dull). These three are linked to three different types of power—symbolically personified in the trinity of three goddesses, Saraswati (of learning and moral conduct), Lakshmi (of wealth and social status) and Kali (of physical prowess). The ethical incentives and restraints

on these three types of human tendencies is not the same. In order to achieve liberation from the mundane, the Gita advises action without attachment (*raga*) toward the good and aversion (*dvesha*) towards the bad. Both these arise from *moha* (ignorance) and can be countered by different practices, self-control for the *satwik*, bounteousness and gift giving for the *rajasik*, and merciful compassion for the *tamasik*.

According to the concept of *gunas*, human beings are temperamentally different, some meditative, others naturally active, while still others are essentially faithfully devout. Thus Patanjali's yoga system, recognizing this, ceases to insist on a uniform pattern of moral conduct for all. Gita and other spiritual literature of latter Hinduism argue that duties prescribed according to the inherent *gunas* means that those injunctions along the lines of least resistance are easily performed and such prescriptions have a better chance of being followed. These inherent characteristics also mean that man's concept of god varies, some seeing this unknown/unknowable ultimate as a creator (necessitating devotion), some as an impersonal spirit (asking for experimental moral efforts to fathom, such as yoga) while others as transcendent or immanent (requiring meditative philosophical inquiry). This classification has provided latitude in moral choice; and in case one gets the impression that, as such, all is well in a harmonious Hindu world, it has also allowed, at different junctures of relatively modern history, some of the worst examples of blind ritualism as seen in the caste system. Perhaps the best example of extreme caste-bias in forming laws is in the Nepali *Mulki Ain* (civil code) promulgated by Rana *Shogun* Jung Bahadur in 1854. As shown in Figure 1, it classifies the punishment to be meted out for rape and incest, differentiating between the high or low caste of the perpetrator and that of the victim (*tagadhari*, meaning high caste wearing the sacred thread, *matawali* being alcohol consuming intermediary caste between Brahmins and untouchables). These *understandings* have translated also into rules of access to waters of wells and tanks (and punishment for infringement thereof) for the different caste categories. In Nepal, they were done away with only in 1962 with the reforms of King Mahendra and appropriate revisions in the *Mulki Ain* (Gyawali, 1998).

It is these historical and philosophical backgrounds that underpin today's Hindu society and determine its views regarding the degree of freedom of will and the concomitant social obligations

Position of Perpetrator (male) →

Position of victim (female) ↓

	Untouchable B	Untouchable A	Matawali	Tagadhari
Untouchable B	Fine of Rs. 4	Fine of Rs 4 + degradation of the perpetrator to status of women	Fine of Rs. 5	Fine of Rs. 5
Untouchable A	Not specified	Fine of Rs. 4	Fine of Rs. 10	Fine of Rs. 5
Matawali	Capital punishment or killed by husband of woman	4 years imprisonment + enslavement or 8 years of imprisonment	Fine of Rs. 10	Fine of Rs. 20
Tagadhari	Capital punishment or killed by husband of woman	4 years imprisonment + enslavement or 8 years of imprisonment	3 years of imprisonment	Fine of Rs 100 + degradation to caste status of women

Figure 1. Hierarchic justice: Punishment by rank for rape.

that need to be balanced. It argues that, within the limits of one's own inherent tendencies as fixed by karmic patterns of the past, each individual has ample scope, indeed duty here and now, for exercising freedom and determining his future fate. It argues for social obligations through the *mahayagyas* (great sacrifices) as well as *dana* (gifts) all around. Verily, *dana* is not only gifts to priests for performing rituals but is the scattering of bounties all around to human and non-human life, to sentient and non-sentient nature of which we are all part. Since, the karmic position argues, man is not joined only with the fruits of his action but also with those of his gifts, there is merit in scattering gifts all around, by planting trees, digging wells and building rest houses for weary travelers. In the Hindu system, the Vedantic position of the identity of all souls is the basis of the golden rule, of doing unto others what one would have them do unto us.

4 WATER, POWER AND PLURALISM

The pluralism inherent in water makes it an ideal subject to explore the mapping of this plural ethics onto the water world. The question of ethics arises with action, building dams, providing drinking water to the needy, taming rivers for flood control, taking water from one community and moving it elsewhere, and so on. Why do these actions? And if they need to be done, then by whom, why, and how? Since good and evil, argues Vedanta, are two sides of the same coin, every action would have good and bad components. Building a dam to provide irrigation to some would displace others from their ancestral homes. Providing water to the needy would deprive some or all of it to the non-human ecology. Moral conundrums are built into actions regarding water, and because water is so fundamental to life, strong emotions are aroused around it.

Essential to the issue of water is the exercise of power, or water politics. This truth was recognized long ago by the American humorist Mark Twain when he said: "Whisky is for drinking, water is for fighting over". In his classic study of power, Steven Lukes moves beyond Gramsci's hegemony and Foucault's domination to discuss three faces of power that influence public consent to its exercise, "which is best done invisibly" (Lukes, 2005). The first, and most obvious, is the coercion aspect, while the second is the control over resources to create inducements. Lukes is interested in the third face, which is the moral or cognitive dimension that impose internal constraints "wherein those subjected to it are led to acquire beliefs and form desires that result in their consenting or adapting to being dominated, in coercive and non-coercive settings". British political philosopher E.H. Carr, in trying to define the new and emerging field of international relations also talks of three types of power: military power, economic power and power over opinion (Carr, 1939).

It is intriguing to note how classical South Asian thinking on the subject of power (*shakti*, as different from the actors (or *patras*) exercising those powers) maps onto Lukes' pluralistic scheme (Gyawali, 2000). As indicated above, Samkhya philosophy distinguishes between coercive (often military) power exercised by the hierarchic solidarity (*tamasik shakti*), the persuasive (monetary or organizational) power exercised by the individualist solidarity (*rajasik shakti*) and the moral power wielded by the egalitarian ethics community (*sattwik shakti*). It is this third face of power, the ethical dimension, which Lukes talks about and which civic movements behind water conflicts are the vanguards of, that is often behind the power wielded by various ideologies.[2]

This social construction of nature is analysed to some extent by the *Theory of Plural Rationalities*, or *Cultural Theory*. According to this theory, two dimensions of sociality can adequately capture the variability of an individual's involvement in social life: group and grid (in its more recent formulation, the term *grid* has been replaced by *transactions* that are symmetrical or asymmetrical, while *group* has been replaced by *competition* fettered and accountable or unfettered and unaccountable; and this is the nomenclature used in Figure 2). Group affiliation captures the extent to which an individual is incorporated into bounded units. The greater the incorporation, the more

[2] The political actors that wield various powers—especially the egalitarians—have been identified by various institutionalists. See Thompson & Gyawali (2007).

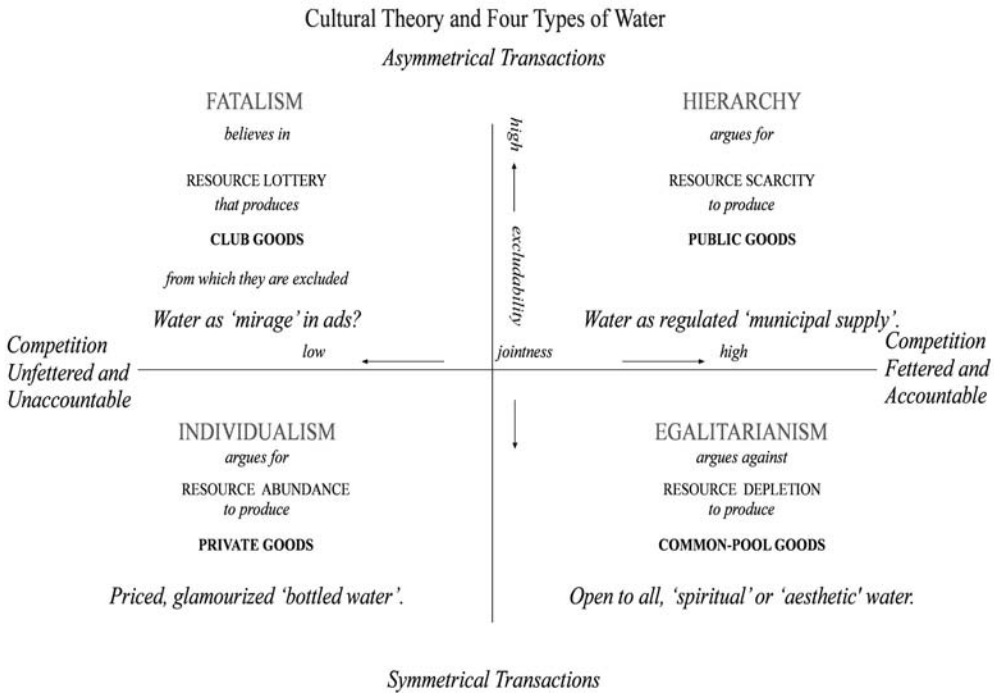

Figure 2. Cultural Theory of resource use: Abundance, scarcity, depletion or lottery?

is individual choice subject to group determination. Grid ascription denotes the degree to which an individual's life is circumscribed by externally imposed prescriptions. The more binding and extensive the scope of the prescriptions, the less of life is open to individual negotiation. In one way, these two parameters are asking the fundamental questions of philosophy in human life: who am I (group affiliation)? And what should I do (grid, or the context of pre-ascribed rules)?

Depending upon a positive or a negative response to these two fundamental questions, the two parameters together generate four basic ways of organizing (also called four social solidarities:[3] *hierarchism* (high group, high grid), *egalitarianism communards* (high group, low grid), *individualism* (low group, low grid) and the *fatalism* of the conscripted (low group, high grid) as depicted in Figure 2.

Hierarchies are characterized by strong group boundaries and binding prescriptions of stratified roles. A hierarchy's overriding concern is *control* and it has an armoury of different solutions to manage conflicts internal and external, including upgrading, transferring, re-segregating, co-opting, etc. It is characterized by unequal roles for unequal members and deference towards one's superiors matched by *noblesse oblige* on the part of superiors. Examples: military, cadre-based political parties, caste defined roles in Hindu villages, hydrocracies such as departments or ministries of water resources.

[3] At the intersection is a fifth solidarity, that of the hermit who has withdrawn from all social interactions (see Thompson, 1996). While the hermit can be skipped in initial foray into *Cultural Theory*, s/he is absolutely essential if one is to understand the dynamics of change within and between solidarities, especially to understand that these are not persons (individualists, hierarchists, etc.) but proclivities (i.e. individualism, hierarchism, egalitarianism, etc.) among which any one individual can find himself or herself depending upon the social context.

Strong group boundaries but weak prescriptions produce *egalitarian* social relations. Because these groups lack internal role differentiation, relations among group members are ambiguous and resolution of disputes is difficult. Because adherents are bound by group decisions but no one has the right to tell others what to do, slow and messy consensual decision-making is inevitable. Schisms are frequent and groups are held together only by *alarmist* causes that highlight the threat from the outside. Examples: activist groups, environmental communes, underground protest movements.

Persons who are bound neither by group incorporation nor by pre-ordained roles inhabit an *individualistic*, or libertarian, social context. In such a social environment, all boundaries are provisional and subject to negotiation: what matters is the richness of network connections that are not structured. *Freedom* to negotiate is the guiding strategy and self-regulation the cherished belief (Adam Smith's famous *hidden hand* of the free market), though such a way of life also requires an extraordinary, and perhaps paradoxical, degree of trust and mutual respect of rights. Examples: a self-made Victorian manufacturer or businessman, individual consultant.

The most unenviable social location on the grid-group map is the low-group, high-grid environment of the *fatalist* in which the conscript finds himself subject to binding prescriptions yet excluded from membership in the group for whose welfare decisions are made. He may have little choice about how he spends his time, whom he associates with, what he wears or eats, or where he lives and works. The fatalist endures the isolation of individualism without the freedom to organize his own network; he suffers the constraint of hierarchy without the support of a loyal group. He just *copes* with everyday living as best as fate allows him. Examples: galley slaves, prison inmates, sales girls at checkout counters of supermarkets, the masses under a totalitarian regime.

A question often asked of *Cultural Theorists* is: where do the people belong? If the people have not organized into one or another of the styles of organizing among the three active solidarities (hierarchic, individualist or egalitarian) they would be the fatalist masses. The moment the fatalists actively organize a cognized strategy (and are not merely strategized upon) s/he is no longer a fatalist. An absolute authoritarian hierarchy would not want to see any other solidarity (pesky social activist or freewheeling individualist) and would want everyone outside of their group boundary to behave as fatalist masses that do as they are told!

Each of these four types of social relations is justified and sustained by an accompanying pattern of shared beliefs and values (or *cultural* biases and myths of nature that is common to them):

- *Individualists* (risk taking *kshetriya hawks*), for instance, often justify their decentralized social relations by blaming the individual for failure and by portraying human nature as invariably self-seeking. They see nature as infinitely resilient (like a ball in an infinitely deep bowl), which will inevitably come back to equilibrium no matter how much you push it. *Laissez Faire* economics is the ideal world for them since it is based on substantive rationality. So dams can be built, profits can be made, rainforests can be felled, because the *hidden hand* of the market will take care of things in the end.
- *Fatalists* (risk indifferent conscripted *shudra donkeys*) reinforce their pattern of social relations through their beliefs that they can do little to help themselves, that life is unpredictable and nature is capricious—like a ball on a flat table which can go any which way—and that the best they can do is to cope with day-to-day instructions and events.
- *Egalitarians* (risk sensitizing *vaishya canaries*) see the world as a ball perched precariously on top of an upturned bowl that may fall anytime if others are allowed to touch it. Their cosmology is based on critical rationality and they see *others* as dangerous and not to be trusted. They sustain group cohesion by blaming the *outside* for unconscionable and socially destructive behavior by arguing that people are naturally good but corrupted by evil institutions. In their benign form, egalitarians uphold and further social values other than profit (such as equity, poverty alleviation, good health for the poor, etc.). Among the social sciences, anthropology with its perpetual discourse and aversion to specific prescriptions (as with economics or law) is most loved by those of this proclivity.
- Finally, *hierarchists* (risk averse *brahminical wolf pack*) think everything is manageable as long as rules and procedures are followed. Like a ball in a cup with down-turned edge, nature can

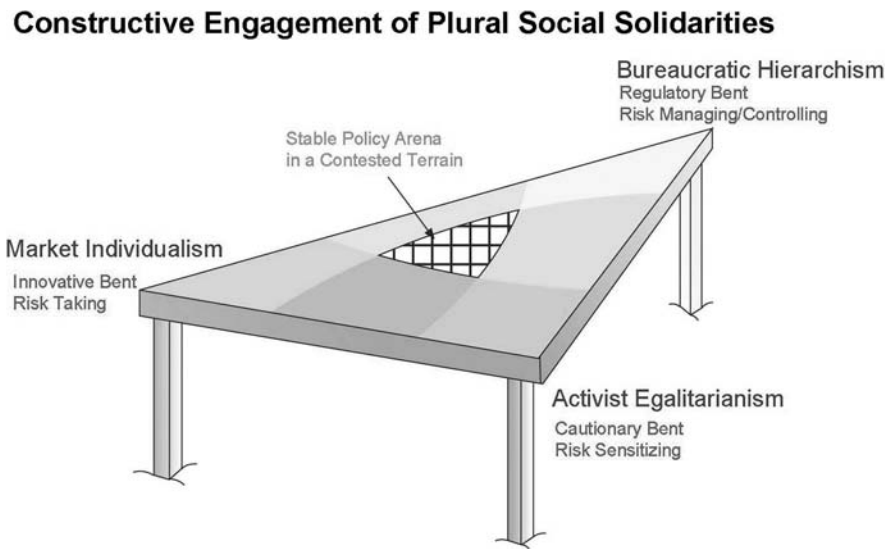

Figure 3. Constructive engagement between hierarchism, individualism and egalitarianism.

be worked on, but within limits set by environmental impact guidelines. They shore up their social relations by blaming deviants when things go wrong and insisting that human beings are redeemable only through institutions. Since they are great upholders of procedural rationality, their favorite social science discipline is law.

The fourfold typology[4] builds on previous research—particularly regarding the dualism of hierarchy and markets—but opens up relatively unexplored but important avenues of cultural expression, specifically fatalism and egalitarianism. *Cultural Theory* bridges the old and new in organizational studies by opting for a three- or four-legged policy stool instead of the previous attempts at one- (pure authoritarianism) or two-legged (bureaucratic socialism and free market individualism) ones. What is the hypothesis that this theory seeks to substantiate and what is the relation to water and ethics?

The hypothesis is that the clumsy arrangements that include the different ways of active organizing—hierarchism, egalitarianism and individualism (fatalism does not strategize but is strategized upon by the other three, and the hermit has withdrawn from all interaction voluntarily)—are the best because they prepare the system as a whole to better cope with surprises. This is something that rigid hierarchies (bureaucratic authoritarianism of rigid hydrocracies) or the libertarian markets (unbridled privatization) alone in an uncontested terrain consistently fail to do. Systems where all the three active solidarities are present in a constructive engagement are less prone to surprises: the minimum for stability being three legs in a policy stool, because those systems that are one- or two-legged stools are bound to be rudely surprised whereas more than three or four legs makes for redundancy (see Figure 3, from Gyawali, 2003).

Cultural Theory also argues that all these four solidarities have their own rationality that makes sense in their own box but not in others. Hierarchists are guided by their adherence to *procedural rationality*, where rules and regulations are the accepted path to follow. Both grid ascription and

[4] The animal nomenclature has been taken from Mars (1982). The mapping of the Hindu caste system is not as elegantly worked out in *Cultural Theory* but it has been tried as transactional strategies that reflect risk perceptions: Brahmin (optimal), Kshetriya (maximal), Vaishya (minimal), and Shudra (pessimal), in D. Ostrander quoting M. Marriott in *One and Two Dimensional Models of the Distribution of Beliefs*, in Douglas (1982).

group cohesion are maintained as long as things are done as per established rules. Individualists, unfettered by the need to uphold pre-defined rules or any established group loyalty, are guided by *substantive rationality*, which seeks richness of networks to further the bottom line benefits to contracting participants. Egalitarians, on the other hand, since they do not adhere to any pre-ascribed order that holds the group together, are engaged in *critical rationality* as it suits their alarmist strategy to uphold group boundedness. Fatalists, of course, can only have a *coping rationality*, wherein they would be the risk absorbers submitting to the risk strategies of the other three active solidarities.

What is of interest to us at this juncture is the relationship between the four social solidarities and the four social constructions of water depicted in Figure 2 (Verweij, 1999). Market individualism would argue for *private water* in the form of private tankers or bottled water: nature is after all bounteously plentiful, so dams can be built and nature will take care of itself. Managerial hierarchism would advocate for *public water* (such as municipal water) governed by ranked rules about who has the right to what: it is the control of caring and knowledgeable institutions that would be able to adjudicate between conflicting needs of society and nature that needs to be monitored (of course by them) and balanced. Activist egalitarianism would champion for *common pool water* (such as groundwater available to all or aesthetic water in the form of religious or scenic water bodies): nature is fragile and needs protection while humans and their institutions, whether markets or big bureaucracies, are inherently corrupting. The poor fatalist masses would have to cope with *club water*, i.e. water that would be a mirage for them as in elegant bottled water ads, inaccessible because they do not belong to the club.

It is also interesting to note that each of these social solidarities would be upholding a different ethical *dharma*. The duty of the merchant is to sell and make a profit, that of the manager to make sure that harmony is maintained, while that of the activist is to critique both. If activists or hierarchs started making profits (NGOs, as money-making business-organized BONGOs, or donor-organized DONGOs; departments of water resources as money-spinning contract outfits) or if the merchants started dictating policy, severe distortions would grip public life. Or as the Nepali farmer would say *dharma bigriyo* (there is disorder, or *order has gone bad*).[5]

5 IMPLICATIONS OF PLURALISM

The *Cultural Theory* approach has an interesting dynamic concept attached to it: in answering the question, what is the proper order, it argues that it cannot be set by bureaucratic proceduralism alone. What is needed instead is a right mix of laws upheld by risk-managing bureaucracies, balanced with the risk-taking individualist's freedom to innovate and profit from the innovations as well as a risk-averse cautionary community of activist social auditors who may be alarmist but provide timely warning of risks.

Indeed, this is one of the criticisms of the *Integrated Water Resources Management* (IWRM) mantra as practiced through toolkits and appeals to the water establishment hierarchy. Such a single solidarity approach is prone to bureaucratic hijacking of IWRM. True integration can only happen through the constructive engagement of all three social solidarities, representing efficient innovation of the private sector dam builders, the governmental oversight provided by dam managers, as well as the much-needed critique from anti-dam activists. It is the argument of *Cultural Theory* that the much sought for integration can only come about through the democratic interaction of all three social solidarities in a constructively engaged, and politically contested terrain, clumsy and messy though it might be, replacing IWRM with CEIWRAM or a *Constructively Engaged Integrated Water Resources Allocation and Management* (Gyawali, Allan *et al*., 2006). It is there, in the dynamism of action and interaction between contending social proclivities that different *dharmas* have to find their social compromises.

[5] The role of *Cultural Theory* in explaining corruption in development aid is discussed in Gyawali (2004).

What this essay has tried to do is to explore for connections between ancient ethical views of South Asia that seem to justify pluralism in ethics and human behavior, and to related them to modern water conflicts using the modern integrative and interpretive social science of *Cultural Theory*. Without going into details of various conflicts discussed in detail in many forums and publications—from Arun-3 and *Mahakali Treaty* in the past to Melamchi transbasin transfer project at present in Nepal, to *Flood Action Plan* or *Arsenic* in Bangladesh, to Narmada, Tehri and River Linking in India—it draws on the different *gunas* of the four social solidarities that uphold different *dharmas* and champion different positions as per their rationalities and ethical biases. The conclusion is that only a constructive engagement between them (as opposed to a destructive impasse), with all voices being heard, all risk options open for ownership, that will enable a stable and sustainable water policy terrain to emerge.

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CHAPTER 3

Water management ethics in the framework of environmental and general ethics: The case of Islamic water ethics

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ABSTRACT: The theme of the chapter is ambitious, in that it tries to understand Islamic water ethics within the general framework of environmental ethics and apply it as a tool for sustainable water resources management. The approach is cultural in that it propagates social learning through *bottom-up* education and communication functions, and at the same time promotes *top-down* high level applied research through industry and technology participation. The chapter examines *how* best Islamic water ethics can contribute to finding solutions for the current and future water challenges. The central question is how we can apply new tools and techniques emanating from Islamic water ethics for promoting the general ethical principles of stakeholder participation in decision making and for knowledge transfer among water institutions and organization.

Keywords: Islamic water ethics; Privatization; Knowledge transfer; Code of conduct; Best practices; Social learning

1 INTRODUCTION

Water issues are among the most controversial, critical and sensitive issues that face governments and nations. Water does not only concern civic uses of clean water for human beings but extends to cover a variety of usages that have a direct bearing on national security. The use of water resources in generating electric power through hydroelectric power stations, the issue of land reclamation and food security, the issue of accessible clean water resources, and the issues relating to the environmental impacts, desertification, climate change, and soil depletion all relate directly or indirectly to *water availability and accessibility*.

Water stress and *water scarcity* are among the major problems that mankind is facing now and will increasingly face in the coming decades. The vulnerability of water resources is sharply accelerating due to many pressures emerging from increasing exploitation. This in turn often has side-effects such as pollution and environmental degradation. These pressures, possibly in many places, lead to social and political instability and in many other locations, cause human suffering to an innumerable number of people.

Generally, the chapter *examines* water uses ethics as a tool for sustainable water resources management. *The central question is how we can apply new tools and techniques* emanating from Islamic water ethics to promote ethical use of water. Due attention has to be given to participation of relevant stakeholders in decision making, knowledge and experience transfer among water institutions through benchmarking and bench-learning of best practices.

The approach is cultural in that it propagates social learning through *bottom-up* education and communication functions, and at the same time promotes *top-down* high level applied research through industry and technology participation. The approach is also based on a holistic and *comprehensive systemic analysis*. This is dependent on examining relationships among different components of the system of water resource management. Such an endeavor requires the choice of appropriate strategies for *an integrated system*. The systems metaphor also embraces the mental model scientists hold about crucial system properties, such as controllability and predictability.

Any strategy must start from an analysis of the coupled *environment-technology-human* system and aim at an improved design of it (Pahl-Wostl, 2002).

Designing *a strategy for actualizing water uses ethics* needs to draw upon the work of UNESCO's COMEST[1] Sub-Commission on Water Ethics reports and recommendations. It is timely to give due consideration to these reports and initiate a process to benefit from such important body of work. COMEST work brought together questions and issues that range from *conceptualizing and building a framework* for localizing regionally the *Global Freshwater Guidelines*, to issues of *capacity building*, *processes of social learning* through better *participation* of different water research centers, educational institutes, water suppliers, water regulators, industrial and agricultural users, and organizations concerned with information and exchange and dissemination (Selborne, 2003).

In this regard the chapter addresses the following parts apart from this Introduction. Section 2 defines concepts of ethics, normative behavior, social responsibility and water ethics. Section 3 describes water ethics in the context of Integrated Water Resources Management (IWRM), and further, links the concept of IWRM to that of sustainable development and emphasizes the soft factors of human dimension and the ongoing institutional reform as one of the key drivers for future course of action. In Section 4 UNESCO's Framework of Water Ethics, are reviewed and ethical principles in water use and management are drawn. Section 5 proposes a cultural approach to actualize Water Ethics, by relating water and culture and elaborating on water ethics in Islam. It also draws on COMEST work on water ethics, and reflects on the proposed elements of a strategy for actualizing water ethics from an Islamic perspective. This section will also introduce action research as a method of work in policy making. The strategy emphasizes learning from each others experiences for knowledge and experience transfer, and using dialogue, shared vision and action on the ground as new tools and techniques. Section 6 highlights Egypt's experience in the last three years for propagating and actualizing water ethics locally and regionally while Section 7 spells out the conclusions.

2 DEFINING ISSUES AND THEIR RELATIONSHIPS

2.1 *Ethics*[2]*, law, normative behavior and social responsibility*

Ethics is a branch of philosophy that is based on morality. Accordingly, "[ethics] looks at the meaning, therefore, of statements about the rightness or wrongness of actions; at motives; at blame; and fundamentally at the notion of good or bad" (Katz, 1991). Nevertheless, ethics is not only the result of existing human or cultural values. Much of environmental ethics, for example, stem from other types of knowledge, such as ecology, which has driven many of us to think morally about our uses and abuses of the environment, and the impact that societies and modern forms of development has had on natural resources.

So, *ethics* is considered the *science of morality*. It is one of the three major branches of philosophy, alongside metaphysics and epistemology[3]. But, is ethics the same as *law*? Do *ethics* and *law* overlap? Literature available from different scholars concludes that:

- Ethics is related to but is different from law and also above law. It is judged by what you do and not by what you know (knowledge).
- Ethics is the personalized way in which one makes value-laden decisions.

[1] In 1998, the *World Commission on the Ethics of Scientific Knowledge and Technology* (COMEST) was established. A resolution, to that effect, passed at the 29th session of *UNESCO's General Conference*.

[2] Ethics, by definition in dictionaries, refer to: a) a set of principles of right conduct; b) a theory or a system of moral values; c) the study of the general nature of morals and of the specific moral choices to be made by a person; moral philosophy; d) the rules or standards governing the conduct of a person or the members of a profession: e.g., *medical ethics*.

[3] http://encyclopedia.thefreedictionary.com/ethics

– Preston (2001) stated that "... the *law* floats on a sea of ethics", and one can find easily such overlap when we examine such issues and themes that lie at the heart of contemporary legal analysis, such as individual liberty, protection from harm, the promulgation of a just society.

Issues of *social justice* are determined by the *common good* and *public interest*; general principles of justice and fairness; the protection of human rights; exploration of matters of integrity, truthfulness and honesty; appropriate boundary setting for state intervention in a liberal democratic society; the recognition and management of conflicts of interest; and broader perspectives on acting in ways that are consistent with the duties entrusted to persons in professional roles.

Normative behavior implies the involvement of standards and values, which constitute the foundations of moral principles adopted or accepted by a particular society. By definition, values are "the moral principles and beliefs or accepted standards of a person or social group, so that they are likely to be culturally relative" (Katz, 1991). This means that values are likely to be culture-specific, and thus they tend to be relative.

However, moral principles are usually used to assess actions as morally *right* or *wrong* and hence subject them to an absolute standard rather than any culturally acceptable way of doing things. This idea is extended towards the values that humans may or may not hold regarding the environment, the use of its natural resources, and the impacts of human activity on it (Simmons, 1993).

This shows that *ethics has a relative meaning* and it differs from one culture to the other and one person to the other. For this reason, it is more reasonable to advocate using the term *social responsibility*. Using this term would allow for *accountability* as well as developing indicators and standards for measuring how much progress we have in actualizing water ethics.

2.2 *Water ethics*

In this context, *water ethics* as part and parcel of this specific and distinct philosophical field, is still emerging in academic arenas, professional discussions, and dialogues on water governance (Herromoës, 2002). *Major concerns* of water ethics are on conservation, as well as adequate access to basic needs of water and sanitation and the deprivation of poor and marginalized communities throughout the world of such a fundamental human right. These challenges, which are mostly due to the lack of empowerment and the inability to pay for the service, are posing difficult *ethical dilemma* that needs to be solved based on *societal ethical frameworks*.

These *ethical frameworks* are necessary to build, in order to address issues such as the allocation of limited water resources and its relationship to efficiency, productivity, valuation, as well as equity and social justice. This is especially significant for consideration of environmental conservation and sustainability for future generations within integrated water resources management contexts (UNESCO & RCWE, 2005). In specific terms, Mrs. Vigdis Finnbogadottir[4], Chairperson of COMEST, explained in the first conference of establishing COMEST in Oslo (Norway), April 1999, that "ethics can be simply defined as an attempt to evaluate choices from essentially human perspective". She has guided the work of the *Sub-Commission on Water* by putting several questions to investigate:

– How to balance the right to water as a prerequisite for life with the right of ownership?
– How to agree on preventing contamination or selfish exploitation of a shared basic resource?

[4] She is the ex-president of the Republic of Iceland. COMEST is composed of 18 prominent personalities, including Mrs. Suzan Mubarak, the first lady of Egypt. COMEST started its work in 1999 in the First Conference in Oslo, Norway.

3 WATER ETHICS IN THE CONTEXT OF INTEGRATED WATER RESOURCES MANAGEMENT

The concept of IWRM represents a paradigm shift in the management of water resources. It has been coined and advocated since the early 1990s, and it gained wide acceptance as an appropriate approach and management tool for rational governance of water resources and improved delivery of water and sanitation services. IWRM is an ecosystem-based approach that takes into consideration the inter-relationships between natural resources systems and socio-economic objectives, and attempts to integrate them in sustainable management of water resources. The IWRM approach broadens water resources management to take account of factors outside the water sector such as national development and poverty alleviation objectives.

The multiple objectives of balancing economic efficiency, socio-economic equity, and environmental sustainability are all reflected in the IWRM definition adopted by the Global Water Partnership (GWP): "IWRM is a process, which promotes the coordinated development and management of water, land, and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems".

The IWRM approach is composed of the following elements:

- An enabling environment.
- Appropriate institutional development.
- Practical management tools.

The *enabling environment* constitutes the legislation, policy and financing structures. It comprises regional, national, and local sustainable development policies and regulations that promote decentralization and bottom-up participation.

The appropriate *institutional development* and clear definition of roles are critical to the formulation and implementation of IWRM policies. Development of effective institutions entails clear demarcation of responsibilities between actors, separation of regulatory from service provision functions, adequate coordination mechanisms, filling various types of gaps, eliminating overlaps and matching responsibilities to authority and capacity.

The *management tools* of IWRM include *technical instruments* for water resources assessment, risk management, communication and knowledge networking; *economic instruments* such as prices, tariffs, subsidies and others; and *organizational instruments* such as community-based participatory management of local water resources, and public-private partnerships that tap into private sector resources and expertise to improve water resources management and service delivery to the poor.

3.1 *Water ethics is pivotal in implementing IWRM*

Finally, it should be noted that IWRM approaches can be implemented only within a society that has adopted *ethical framework* for water management. All management tools of IWRM should be based on *established ethical principles* for water resources management. This is a prerequisite to their adoption by the society. Otherwise, some of these tools, especially economic instruments, might reduce access to water among poor and marginalized groups of population. This needs new thinking and new priorities have to be set within in the framework of a strategy and *Plan of Action*.

In this context, a *Soft Path Approach for Water Management* is advocated to keep pace with the burgeoning demand for more water, and local, national and international initiatives are underway to overcome the water crises. Frequently, however, the benefits are small. The reasons are many, such as national institutions do not work together; plans and programs are often duplicative and sometimes contradictory; donor involvement is fragmented and unfocused; and water is generally heavily subsidized, providing no incentives for conservation.

Nowadays, there is a consensus that reliance on physical solutions, although still continuing to dominate the traditional planning approach, failed in satisfying basic water requirements for human

activities, and above all, it gave origin to several social, economic, and environmental problems (Abuzeid & Hamdy, 2004).

Given that water represents an essential and vital element in our own bodies and in all our activities, management of it should take into account not only physical aspects of the resources such as hydrogeology, topography, and climatic conditions, but also theoretical, practical and cultural considerations such as beliefs, local knowledge, myths, representations, rituals, customs and traditions (Berteaud, 2003).

Indeed, by now, there have been many changes in the way people think of water resources management. Many countries are redirecting their approaches towards the soft path approach through developing new methods to meet the demands of growing population without requiring major new constructions or new large scale water transfer. Figure 1 illustrates the main policy measures of one such soft path approach, viz. demand management.

Abuzeid & Hamdy (2004) noted that many countries, particularly those in the arid and semi-arid regions are changing their way of thinking vis-à-vis water resources management. They are beginning to shift their focus from supply augmentation and are now exploring the possibility for efficiency improvements, demand management, reallocating water among different users to reduce projected gaps and meet future needs. They however do note that such a change in attitude faces strong internal opposition and it is not yet universally agreed upon.

The author concurs with this policy approach of demand management as illustrated in Figure 1. Actualizing water ethics and following a cultural approach, is pivotal in strengthening the implementation of the IWRM. And this is the main assumption of the chapter.

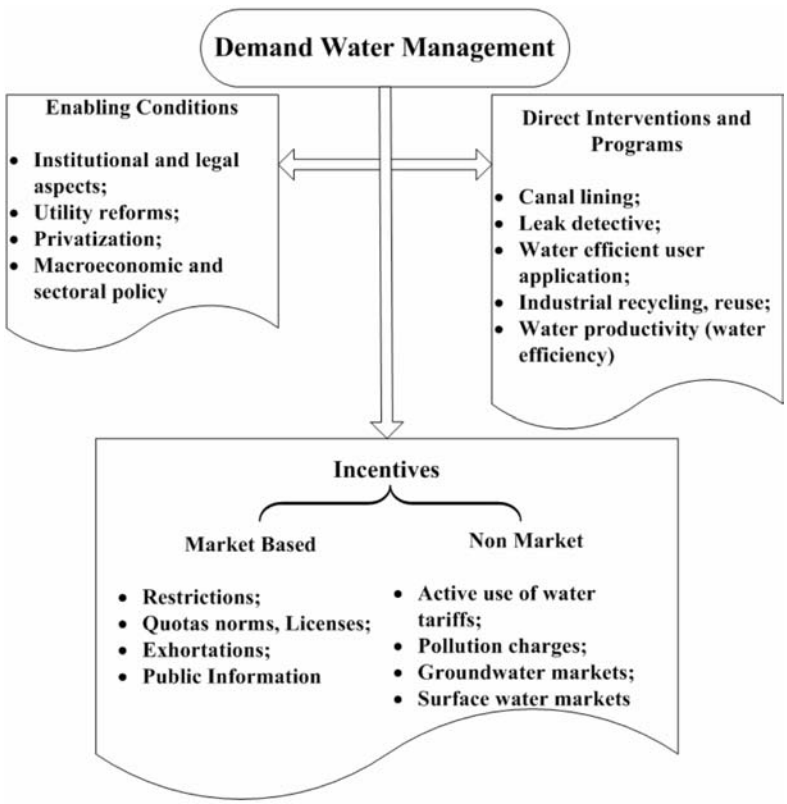

Figure 1. Demand water management approach: Main policy measures.
Source: Abuzeid & Hamdy, 2004.

4 UNESCO GENERAL FRAMEWORK OF WATER ETHICS

4.1 *Drawing on COMEST work on water ethics*

The creation of COMEST in 1998 is a landmark achievement towards global cooperation. A resolution, to that effect was passed at the 29th session of *UNESCO's General Conference*. Special attention has been given by COMEST to freshwater along other vital areas of energy and information technology, for which three working groups were established to investigate and research into their field, within specific mandate (UNESCO & RCWE, 2005).

The mission entrusted to COMEST is ambitious since the Commission must act as an intellectual risk-anticipating forum and also as a source of advice and as an intermediary between scientists, decision-makers and communities. Up till now, it has taken an interest in such varied domains as water, energy, outer space and the information society, thereby indicating the diversity of its action.

In my view, the work of the *World Commission on Ethics of Science & Technology* (COMEST) within UNESCO could be considered as one of the great renowned works of our time. It is to be added to the great world work of *Brundtland Committee* on Sustainable Development and its report *Our Common Future*; *Olaf Palme Committee* on *Disarmament*; and the report on *Our Global Neighborhood* by the *Commission on Global Governance* in 1995. Like all these movements, that of *sustainable development* began with ideas about relations between people and their environment. Such ideas are no less than the very substance of ethics, the moral principles embodying the conceptions, interest and ideals from which human behavior and the value systems on which they are based on springs (Selborne, 2003).

4.2 *Review of COMEST publications on water ethics*

The UNESCO's COMEST has enriched the relatively young topic of *water and ethics*, with a series of publications handling the various ethical issues of water use and management. These publications were written from the point of view of experts on different aspects of the occurrence and use of fresh water who are interested in the ethical aspects of this important subject. Here is the review of these pioneer writings to help draw an overall image of the importance of *Water Ethics* in the context of alleviating the ongoing world water crisis. The publications of the UNESCO can logically fall into four main categories (*see Annex*).

COMEST publications can have a most important contribution to the strengthening of the concept of adopting a soft path (ethical factors) for leveraging the problems incurred in water stressed areas.

4.3 *RENEW nodes*

As mentioned earlier, COMEST has established its own network, in partnership with the International Hydrological Programme/UNESCO, to promote best ethical practice in all aspects of freshwater use. The *Research and Ethical Network Embracing Water* (RENEW) has established *three nodes*. These are at the Australian National University, Canberra, serving Australia and the Asian Pacific; at the University of Bergen, Norway, serving the Nordic-Baltic region; and in Cairo serving Egypt and the Nile Basin.

RENEW's mission is "to promote engagement in the ethical issues involved in the sustainable use and equitable sharing of fresh water resources at all levels and in the handling of response to water-related emergencies and disasters".

The program of these nodes would embrace all aspects of water, and expected to work in tandem with the parallel UNESCO *International Hydrological Program* (IHP) proposal to create a *Global Organization of University for Teaching and Training on Ethics of Water* (GOUTTE).

4.4 *Ethical principles in water use and management outlined by COMEST*

Access to freshwater has increasingly been identified as a major threat to world peace in this century and ethical issues relating to freshwater use has been accorded high priority. The first meeting of

the *COMEST Sub-Commission on Water Ethics* was held in Aswan, Egypt, in November 1999. The ethical issues relating to water mirror broader debates on social ethics and relate to a number of ethical principles. The Sub-Commission therefore decided that rather than analyze the ethical issues of water management in detail all over again, it should concentrate on promoting best ethical practices. Some fundamental principles were identified as essential components (Brelet, 2004):

- *Human dignity*, for there is no life without water and those to whom it is denied are denied life.
- *Participation*, for all individuals, especially the poor in water planning and management with due recognition to cross cutting gender and poverty issues.
- *Solidarity*, for water continually confronts humans with their upstream and downstream interdependence, and initiatives for integrated water management may be seen as a direct response to this realization.
- *Human equality*, for all persons ought to be provided with what is needed on an equitable basis.
- *Common good*, because by almost everyone's definition water is a common good, and without proper water management human potential and dignity diminishes.
- *Stewardship*, which respects wise use of water.
- *Transparency and universal access to information*, for if data is not accessible in a form that can be understood, there will be an opportunity for one interested party to take advantage of others.
- *Inclusiveness*, for water management policies must address the interests of all who live in water catchment areas. Minority interests must be protected as well as those of the poor and other disadvantaged sectors. In the past few years the concept of *Integrated Water Resource Management* (IWRM) has been also used for propagating environmentally sustainable management of water resources.
- *Empowerment*, or the requirement to facilitate *participation in planning and management* means much more than to allow an opportunity for consultation. Best ethical practice will enable stakeholders to influence management. Water management is fundamentally a question of social and environmental justice based on three essential concepts: *equity, fairness and access between and across generations*.

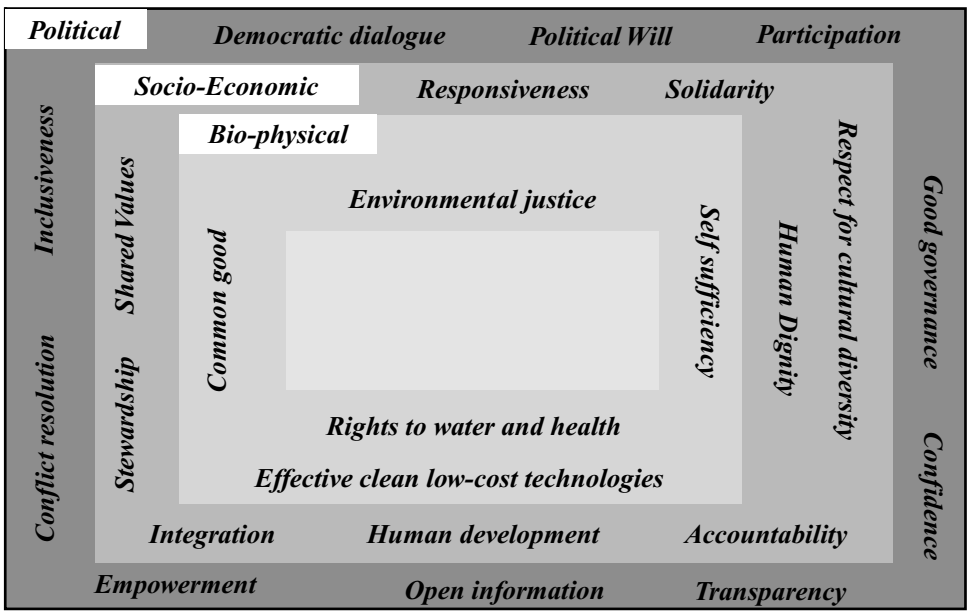

Figure 2. Clustering principles of ethical behavior in water use and management.

– *Partnerships*: Where partnerships are formed this will help different communities or interest groups to understand each others' requirements. For example, applied technology is only likely to be relevant and successful where there is a clear understanding of the user communities needs.
– *Focus at the local level*: By concentrating at the local level a focus is possible which enables practical solutions to real issues. If technology and investment programmes had been funded to assist the one billion people without adequate access to fresh water on a region basis, this massive failure to give all people the basic necessity of life would no longer persist.

In short, water management is fundamentally a question of social and environmental justice based on three essential concepts: *equity*, *fairness and access between and across generations*. Figure 2 shows that the previously mentioned principles can be clustered to ease the development of indicators monitoring progress in applying ethical principles.

5 A CULTURAL APPROACH TO ACTUALIZE WATER ETHICS, WITH SPECIAL REFERENCE TO ISLAMIC RELIGION

5.1 *Water and culture*

The concept of culture, or civilization, *encompasses* all social phenomena: customs, traditions and beliefs, ideas and mentalities, morals and behavior, institutions, arts, sciences and technology, etc. However, the judgments made are always based on a system of values belonging to a particular culture which claims itself as a reference point or even as a dominant culture.

In all places and at all times, the relationship between water and culture has been profound, complex and at the same time ambivalent. Culture has an important influence on how users of water perceive this vital natural resource, and determines their behavior in relation to it. If users are to participate meaningfully in the sustainable management of water, cultural behaviors will have to be taken into account (Berteaud, 2003). According to the French philosopher Gaston Bachelard: "water is the mirror of the past, present and the future".

The relationship between water and culture is intimately related to the sensibilities, representations and mentalities which create feelings and collective identity, and which can also be a source of potential conflict, or a powerful catalyst for creating solidarity and therefore social and territorial cohesion.

Both water and culture are fluids—the first one being concrete, and the second immaterial—which gives life and unifies all members of the human society. The etymological root of the word *culture* in fact comes from the Latin verb "*colare, cultus*", meaning to flow, thus clearly showing the moveable and evolutionary character of both concepts (Berteaud, 2003).

History has taught us that the rise and fall of civilizations is dependent on adherence and commitment to certain *ethical water values*. The rise of the *ancient Egyptian civilization* was due to systemic planning, management, and water engineering, as well as adherence to the values of cooperation, participation, equity in distribution, solidarity in times of floods, and *no pollution to the river* principle; to the extent that these values have been considered *sacred*.

5.2 *Water ethics in Islam*

As part and parcel of the natural environmental system, water is given a great special importance in Islam. It is a blessing from God that sustains life. Water is mentioned in Quran in 63 places (Jamil, 1999). They are classified under several categories. Here are some examples according to their corresponding verses of Quran:

– All organisms depend on water, Allah said: "We made from water every living thing" (Anbyya'30).
– Water is the source of all vegetation, Allah said: "It is He who sendeth down rain from the skies, with it we produce vegetation of all kind" (An'am 99).

- Water is a source of sustenance, God said: "He sends down rain, and brought forth therewith fruits for your sustenance" (Baqara 22).
- Water is the source of drinking, Allah said: "See ye the water which ye drink? Do ye bring it down (in rain) from the cloud or do we? Were it our will, we could make it salt (and unpalatable). Then why do ye not give thanks?" (Alwaqi'a 86-70).
- Water is a permanent source of water food and animal proteins. Allah said: "Lawful to you is the pursuit of water game and its use for food—for the benefit of yourselves" (Ma'ida 96).

In addition, ensuring social justice for Muslims is among the cornerstones of the Religion (Al Awar *et al*., 2005). Most of the Prophet's *hadith* is about the preservation of justice and equality including equality in water use and access to water resources. Consequently, true Muslim believers cannot grab water in excess of their needs since they are obliged to allow free access to any amounts of water to others beyond their basic needs (Faruqui, 2001; Naff & Dellapenna, 2002). In fact, the issue of considering water as a vital community resource is emphasized in a specific *hadith* quoting the Prophet giving all sectors of society the right to free access to their basic needs of water.

Islamic thought is understandably the chief cultural and ethical source of predominantly Muslim Arab societies. Consequently, any ethical framework for water management in the Arab Region has to be essentially based on Islamic beliefs and acknowledged by relevant Islamic rules. Therefore, looking into Islamic ethical bases for water management is a necessary prerequisite step for developing such a framework. Actually, extensive Islamic rulings cover a wide range of issues in environmental and water management from environmental stewardship and water conservation to sectoral allocation, water pricing, and privatization of water sectors. All these rulings are based on Islamic values that call for social justice and participation of all sectors of society in natural resources management.

5.2.1 *Stewardship and conservation*

According to Islam, humans are the most favored of God's creatures. However, they are responsible for ensuring that God's gifts to humanity, such as nature, are well conserved and taken care of so that they would be equitably available for all on planet Earth. Therefore, the environment is to be protected by humans with clear command against upsetting the natural order through pollution or over exploitation of natural resources. Accordingly, in the Quran, God commands the believers to "make not mischief on earth," i.e. they should not degrade or pollute natural resources. Water conservation in quantity and quality is specifically encouraged within Islamic laws. The Qur'an tells the believers that they may use God's gifts, such as water, for their survival, provided that they use it in moderation and not in excess (Faruqui, 2001).

Among mostly used water conservation tools is treated wastewater reuse for irrigation. Treating and reusing wastewater has great advantages in water management, since it conserves freshwater for the highest-value uses. Moreover, the reuse of nutrient rich wastewater helps control the environmental impacts of dumping raw sewage in streams and water bodies and enhances agricultural productivity. However, with the utmost importance given to personal cleanliness and public hygiene in Islamic tradition, most Arab societies have been sceptical in their initial response to the idea of wastewater reuse for irrigation. But, in Saudi Arabia for example, after consulting with scientists and engineers, the *Council of Leading Islamic Scholars* issued an authoritative opinion (*fatwa*) stating that treated wastewater can theoretically be used for all purposes as long as it does not pose any health risk to society (Abderrahman, 2000). As a result, the practice of reusing treated wastewater in Saudi Arabia began in 1978 and the kingdom now reuses about 15% of its wastewater for irrigation purposes.

5.2.2 *Water pricing*

In Muslim nations, water pricing is very complicated and disputable since, as mentioned above, the Islamic perception is that water is a common public good which should neither be bought nor sold (Faruqui, 2001). However, most contemporary Islamic scholars have concluded that, in spite of its original nature as a common good, individuals have the right to use, sell, and recover value-added

costs of developed water infrastructure for water supply distribution. Accordingly, water in Islam is categorized as follows:

- Public property, which is water in its original natural state with free access for all.
- Restricted private property, such as lakes and rivers, where owners may have certain rights, but also have obligations (e.g. should not hold back surplus water).
- Private property, which is developed through investment in infrastructure, work, and knowledge.

Based on the discussion above, in principle it is not against Islamic ethical beliefs to charge a price for water. As a matter of fact, historically, as the economy grew in the early Islamic state markets for water were established, and the first medium for exchange was crops, then water, and afterwards money (Faruqui, 2001). However, it is important to note that within Islam, such price should be a *fair price* that would lead to greater equity in water use which should be the first consideration in any economic instrument used for water management. Thus water tariffs based on price elasticity of demand are allowed in Islam as they are largely equitable. Moreover, cost recovery is also allowed in Islam due to its positive effect on enhancing water services for the poor (Faruqui, 2001). Therefore, governments are entitled to fully recover the cost of water services. Moreover, since Islam encourages the protection of the environment, the price can include the cost of wastewater collection and treatment.

5.2.3 *Privatization*

The goal of full cost recovery of water service delivery is best reached through the participation of the public sector and private sector. Islam supports privatization of water supply and sanitation provision in principle as long as it leads to a fair and free market, which results in equitable cost sharing. After all, Muhammad was a businessman prior to his Prophecy, and he set an example for ethical business dealings. Muslim scholars agree that privatization is allowed within Islam as long as users are served equitably and charged a fair water price.

5.2.4 *Sectoral allocation*

According to Islam, and during the days of the Islamic state, water use was prioritized in order to make the most of available water quantities for the whole population. As such, irrigation was given third priority, behind domestic use and *quenching of thirst* which was assigned the first priority. Consequently, contemporary Islamic scholars considered reallocation of water among sectors and giving priority to basic water needs for life as a necessity that is not in conflict with Islamic belief. Moreover, reallocating water from the agricultural to the domestic sector enhances social justice and equality in water use which are very important in the Muslim faith. These are very important considerations in some countries of the Arab Region in which sectoral reallocation of water has become a dire need.

5.2.5 *Participation*

Contrary to the centralized governance and decision-making systems that exist in most Arab countries, community participation in all public matters, including management of water resources, is mandatory in Islam. In the Qur'an, believers are defined as those who, among other things, manage "their affairs by mutual consultation". As such, according to Islam, this consultation is required of all those who are entitled to a voice including women.

Therefore, all members of society should be proactive in developing and implementing proper participatory water management schemes. Furthermore, the role of each and every individual in society is important when it comes to spreading awareness for water use and conservation. It should be mentioned here that Muslim clerics have an important role to play with respect to preaching and educating people according to the aforementioned principles of ethical water use (Faruqui, 2001).

To summarize the Islamic perspective of proper water management in one principle, one could say that in Islam management of water is considered ethical when it enhances equity among water users and justice for all God's creatures (UNESCO & RCWE, 2005). Therefore, it can be concluded that there is no contradiction between Islamic belief and worldwide accepted ethical standards of

integrated water management principles which balance equity, efficiency, and sustainability across society. Predominantly Muslim societies are capable of implementing integrated water resources management measures which adopt ethical principles of equity, solidarity, and stewardship and respect the societies' heritage and cultural background.

5.3 *Action research as a methodology of proper water management*

Implementation of water ethics needs a change in behavior. And in our view, in order to change behavior, we need to change structures (education curriculum) and the systemic structures in the society, e.g. laws, principles and rules. Using action research methodology would allow for making progress through societal participation, on a wider basis, for creating interests with solid reasons or convictions. In this regard we need:

- To change behavior for a favorable team learning among stakeholders.
- To enhance the very rich values inherited in the Moslem societies, using cultural approaches to embody them into our behavior.
- To monitor progress on the basis of developing a set of principles and rules of ethical water use conduct.
- A *proposed code of water ethics* could be developed to suit each community and regions.

In addition, we have *to ask the questions that matter* on each level or domain:

1. On a shared language level: What do we mean by the term water ethics? Water ethics could be expressed in terms of:
   - Set of principles of right conduct; a theory or system of moral values.
   - The study of the general nature of morals and the specific moral choices made by a person; moral philosophy.
   - The rules or standards governing the conduct of members of a group or profession. So, the progress made in this area could be measured against principles of right conduct and behavior of users, researchers, engineers and experts or consultants engaged in the water sector.
2. On how do these apply to users of public/private sectors, researchers and experts? What are the major ethical issues regarding conduct and behavior of each group?
3. On why is this concern for any community or nation, at this point of our time?
4. On what we want to do next?

The *Research Inquiry* here would be on *three levels*:

5.3.1 *Level one: The value system*

For Moslem communities, Islam is at the centre of every day life, however, there are:

- State laws and regulations, local law, customary law common heritage, history, to bring about commonalities, on a regional level.
- Cultural aspects: indigenous traditions particular for each society, e.g. elders play a role, informality, relaxed time (negotiation under the tree), strong family attachment etc.
- Ethical guidelines (written and not written), known from rituals and the popular sayings.
- Education, schools curriculum.

Islamic thought is the chief cultural and ethical source of predominantly Moslem societies. Consequently, any ethical framework for water management in the region should be mainly based on Islamic beliefs and acknowledged by relevant Islamic rules.

Extensive Islamic rulings cover a wide ranging of environmental and water management issues:

- Most of the Prophet's *hadith* is about the preservation of justice and equality including equality in water use and free access of all sectors of society to water resources.

– During the days of Islamic state, water use was prioritized in order to make the most of available water quantities for the whole population: irrigation was given third priority, behind domestic use and *quenching of thirst*, which was assigned the first priority.
– In summary, it can be concluded that there is no contradiction between Islamic belief and world wide accepted ethical standards of IWRM principles, which balance equity, efficiency, and sustainability across society.

5.3.2 *Level two: The question of reason why?*
This is the phase of *Theory Building*, on a general level:

– Water is a human right issue of priority.
– Access to water is legitimate for every individual community and country, and especially for the poor.
– Collaborative action among riparians is the only way to face the challenges and complexities of future water demand.
– Through negotiation of international agreement it is possible to get satisfactory win-win benefits.
– The water data availability principle should be respected by all riparian countries.
– There is no fresh water security without major shift in thinking.
– Creating a learning environment on river basins is essential.

5.3.3 *Level three: Five ideas for actualizing water ethics in Islamic communities*

1. Using experiential learning and innovative tools for skills and capacity building.
2. Bench-marking and bench-learning of best ethical practices. This would include learning from each others' experiences for knowledge transfer by formulating a code of conduct for Water Ethics.
3. Using dialogue and its tools.
4. Raising awareness of water stakeholders, with identified target groups: farmers, industrialist, decision makers and universities. This could be done through publishing and disseminating bulletins and newsletters that publicize the activities, as well as:
5. Special program for educating youth and students in schools and libraries, and in cooperation with NGO's and the governments.

However, we need networking. This could be done through the *Group of Eight* of the *Organization of Islamic Countries* (OIC) that could take an action. It is suggested that the *Network* could take an interacting triangular partnership (Figure 3).

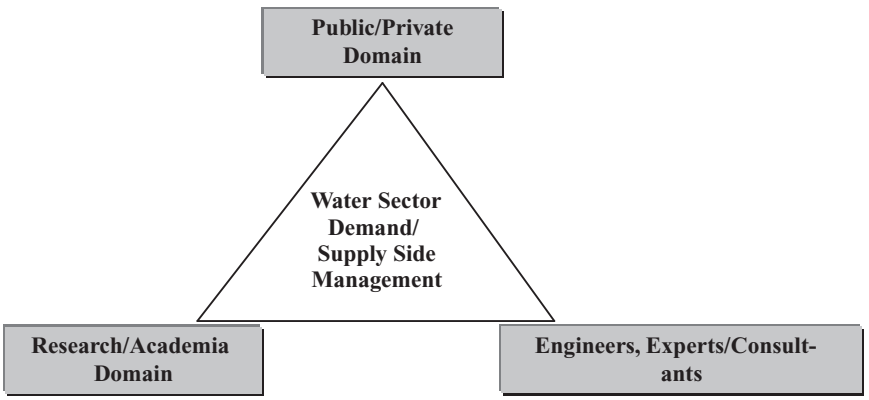

Figure 3. Interacting triangular partnership of the Network.

This would aim at creating knowledge based *ideas* that could be translated into *projects*. Hence, it is suggested to launch the establishment of an *Islamic Network* for exchange of experiences of water best ethical practices.

6 EGYPT'S EXPERIENCE IN ACTUALIZING WATER ETHICS[5]

6.1 *Using experiential learning and innovative tools*

Incorporating ethics in the education curricula, as well as introducing hands on tools for enhancing skills and capacity building, through: initiating a program for incorporating water ethical principles in schools curriculum; introducing a module on water ethics as a postgraduate study in universities; promoting research on water ethics among postgraduate students; initiating a research competition among young professionals and water engineers, through in depth research; and linking with international education programs on water ethics within RENEW nodes and others.

6.2 *Learning from each other experiences for knowledge transfer*

In this regard, we need to depict on the countries' detailed stories of experiences of scientists, engineers, researchers, household users, farmers and industrialists, who are, in this difficult circumstances, demonstrated wisdom that enabled them to save and rationalize their conduct in the water sector. Their actions and success stories are used as a tool for learning and could provide guidance for others who want to do the right thing in circumstances that are similarly difficult. Many of these experience stories of moral leadership and stewardship could be illustrated with presentation of their practices. It is proposed that a *Reward for Best Practices* to be recognized on the *Water Day* in March of every year, and to be documented and disseminated on a wider scale in the region.

6.3 *Formulating codes of conduct for water ethics*

This could be guided by a concept and definition brought about by H.E. Susan Mubarak in Alexandria, 2002. She explained that: "The ethical framework is fairly simple: to seek equity and fairness, to promote applications of knowledge that will promote well-being now and in the future, to include the excluded, reach the unreached and think of the unborn as we take actions today".

A code should include basic principles for enhancing social and economic responsibility on the use and management of water. It provides guidelines for the ethical behavior in water use and management, by expressing the social rights and responsibilities of stakeholders for the sake of maintaining water resources, and protecting it from pollution and depletion.

Furthermore, the code topics should be subject to researched work and then to a candid dialogue in seminars and workshops. This would be targeted to various groups, including children, women, youth, as well as various stakeholders of water use and management. These seminars will be based on a process of learning for more in depth study of the various aspects of each topic.

[5] In this (RENEW-Egypt, www.nwrc-egypt.org/rcwe), it is starting to build up a wide-ranging expertise in water ethics uses and management, through Egyptian and Arab water research and educational institutions, and in cooperation with a consortium of other research and educational centers, industry, water utilities, non-governmental organizations, and inter-governmental bodies. And it will serve as a much needed, and long overdue forum to generate water knowledge and experience as well as disseminate it through the *Arab Network of Water Ethics* (ANWE).

6.4 *Raising awareness of water stakeholders*

The identified target groups for promoting awareness in water use ethics include communities of scientific researchers, farmers, industrialists, decision makers, universities, students, women, and youth. Moreover, serious awareness activities should be targeted at children, as well as other stakeholders in the agricultural and energy fields, tourism, municipal and local government fields. A special program could be done for educating youth and students in schools and libraries, as well as colleges and universities in cooperation with NGOs and the government.

6.5 *Publishing and disseminating bulletins and newsletters that publicize activities of the network; and monitor its work*

6.6 *Establishment the* Arab Network for Water Ethics *(ANWE) as a tool for implementing IWRM*

ANWE is a civil society, not-for-profit; regional organization dedicated to water ethics issues in the Arab Region. It is an informal body acting as a *think tank*. It was formally inaugurated on March, 2006 in Cairo, Egypt, by H.E. Dr. Mahmoud Abu Zeid, the *Chairman of the Arab Water Council*. The launch came as a result of two years of planning, discussions, and consultations with several governmental and non-governmental organizations and experts in the field, as well as the UNESCO Cairo office. Following the launching of ANWE, and after the two days of extensive discussions, it was possible to outline suggestions and recommendations with regard to the strategy and plan of action to be implemented in the immediate future.

7 CONCLUSION

The above analysis suggests that soft factors of human nature and social learning need more attention for change and development of the water sector in all countries and regions. It is absolutely necessary to have a cultural approach to actualize water use and management ethics. This makes water ethics an important tool for sustainable water resources management in these communities. And, through networking, it is possible to organize and coordinate the efforts made to actualize water ethics as a noble objective.

In addition, it is now possible to capitalize on the work done by the newly established *Regional Center for Water Ethics* in Cairo (RCWE) using its knowledge based society for water ethics to organize and coordinate efforts for the sake of extending this experience to other Moslem countries and communities. The *Organization of Islamic Countries* (OIC) could play a pivotal role in taking this issue further and initiate the proper mechanisms for operationalisation of water ethics as a tool for sustainable water resources management to the benefit of these countries.

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ANNEX—REVIEW OF COMEST PUBLICATIONS ON WATER ETHICS

The first category: Ethical behavior in water resources

The ethics of freshwater use: A survey
It provides for an overview of the practical areas of concern relevant to ethical stances, the concept of water as an ethical issue, guiding principles on ethics with regard to water protection, consumption, and management. The survey came out as a result of intensive discussion among Sub Committee members (Selborne, 2003).

An overview of the topic as a whole
An essay highlighted the scope of water ethics by stressing the difficulty of defining a global ethic and presenting an argument on the context of environmental ethics; constructing a water ethic; role of the individual; and role of groups (Delli Priscoli *et al.*, 2004).

A historical perspective (Lessons learned from civilizations)
There is always an important lesson to be learned from history. Just as well, in the field of water management it is evident that civilization started and nourished by rivers and ample water resources. The ancient have recognized the importance of water protection and conservation; it is time for us to treat water the way they did. This essay reviews the ethics of freshwater use in a historical perspective as a background to our current problems. It covers in outline the interaction between water use and the development of civilization from the advent of agriculture through the development of state action and of cities, and from the rise of ancient civilizations to the emerging global society (Hassan, 2004).

On water and ecology
An essay explained linkages between ecology and water. It described the functioning of freshwater ecosystems and the resulting benefits of combining water management with ecological management. It argues that maintaining ecological systems is not simply an additional newly-identified need for water.

Ecological systems function as cycling systems between the earth and the atmosphere, and can perform what are often the most cost-effective solutions to water management. By the same token, water control can benefit ecological systems by regulating flows, sustaining fish and managing multiple uses. A new awareness of how humans are co-managing ecosystems with traditional methods is needed. Claiming to preserve a state of nature or to separate human interventions from a perceived state of nature can be as unrealistic as ignoring human impacts on the ecosystem (Acreman, 2004).

On human health and sanitation
The human being is the center of concern in the discussion of any issue. Water has some vital and close links to health. An essay discussed these links and the ethical problems arising from them. It explored the interaction of poverty, sanitation and health and the recent attempts at intergovernmental level to make real progress towards its solution (Porto, 2004).

The second category: Water use ethics

Water in agriculture
Producing food is a main role of agriculture and thus ethically highly significant, since food security for all people is a moral imperative for leaders. Yet, in the essay dealing with this topic, it is argued that agriculture can accommodate some degree of reallocation to other sectors, and that reallocations to higher value use are needed. Exclusive attention to meeting food needs can exert a very high, perhaps irreversible, toll on the environment and make it more difficult to meet food needs in the future.

It is also argued that food can be traded, and thus virtual water can be imported or exported if stable trade relations exist. When competition sharpens, farmers usually sell their land to the city developers rather than grow food. This raises the ethical question of taking land out of production for urbanization. The opportunity costs for irrigated crops must become more explicit in national water policy.

The essay then attempts to highlight some of the ethical measures to be taken into account when water is used for irrigation such as: attempts should be made to reduce water waste through water conservation practices, and to encourage a more equitable distribution of water in irrigation networks. Attention must also be paid to water quality, as use of water for irrigation can result in contamination of runoff with pesticides and fungicides, as well as increased water salinity resulting from leaching of minerals from irrigated land. Irrigation run-off can be a significant source of pollution, impacting both wildlife in water bodies and human users downstream (Appelgren, 2004).

On the use of groundwater

An essay discussed the dangers of a simplistic approach to the issue of the sustainability of groundwater use and the need to treat each case as site-specific. The issue of groundwater use is of great importance to arid areas such as that of the Arab world. The reason is that mainly the major water resource for these areas is from groundwater (whether renewable or fossil non-renewable). Currently in most countries of the Arab region groundwater depletion is the looming issue that calls for the securing the needed water for current and future generations. Criteria are presented for the evaluation of proposed schemes of groundwater use and the ethical implications involved (Llamas, 2004).

The third category: Ethics in water management

On women and water

An essay concentrated on the special role of women in water use and from related social and environmental problems. It highlights both the nature of some of the key problems and the efforts in recent decades by inter-government and non-governmental organizations to overcome these problems. The essay argues that, in fact, women are the key water managers in many small villages and communities. As such they become the key to maintenance and operations of facilities. Nonetheless, women are rarely involved in strategic decision-making processes regarding water resources management. The authors show that increased participation of women is both ethical and pragmatic approaches (Aureli & Brelet, 2004).

Ethics and water resources conflicts

This particular essay is of major importance for some Arab countries where most water resources come from outside the countries' borders. The importance stems also from the fact that water resources are as scarce as they can be, thus conflict over the distribution of these resources can escalate the problem of water availability and might lead to water crisis or even war. The essay summarizes recent developments in regard to the complicated decision-making processes required to harmonize the interests of those who are parties in a water-resources conflict. It discusses the nature of the *yardsticks* required to assess the ethical components of the objectives, the means and consequences involved in both domestic and international community (Trondalen & Munasinghe, 2004).

Financial perspective

This essay handles a rather debatable issue, that is water projects. It is known that water projects are among the most costly ones in the context of development projects, thus a continuous argument exists to find a way by which water can be financed without compromising the fulfillment of the human right to water. The document deals with the ethics of the financing of water resources development and management against the background of sustainable development. It decreases

practical ways of introducing ethics into water financing in order to promote poverty alleviation in a context of globalization (Tenière-Buchot, 2004).

Institutional issues
Recognizing the importance of a sound institutional structure to effectively manage water resources, this essay introduces some of announced institutional structures of a number of European Countries that can be considered as learning experiments. The essay deals with the institutional dimension of ethical issues in water management. Following a short historical introduction it contrasts the position in regard to water rights and the institutional structure. It stresses the dangers of applying simplistic solutions to the present complex situation (Barraqué, 2004).

Water in civil society
This essay describes an arid African upstream safari in the form of a transboundary expedition to seek and share new sources of water. Perhaps an expedition into the water resources of every region is needed to discover the facts that can raise awareness of the status of water resources (Asmal, 2004).

Ethics of water related disasters
This essay discusses the nature and impacts of water-related disasters and the scope for the mitigation of the vulnerability of communities to such disasters (Dooge, 2004).

The fourth category: Benchmarking of best ethical practice

Learning from others is a pronounced concept in regard to dissemination of best ethical practice. A publication sheds light on what criteria should be considered when wanting to promote ethical aspects of a water related action. At the outset the publication lists several criteria that can be considered as indicators of best ethical practice. This document is a useful tool for others to abide by the proposed ethical criteria in order to set its water related activities on the right track (Brelet, 2004).

II
Some ethical aspects of new water management

CHAPTER 4

Water rights and water governance: A cautionary tale and the case for interdisciplinary governance

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ABSTRACT: Although Australia is the world's driest continent without the complication of international borders and a generally good governance reputation, its record of water governance is very poor. This chapter considers some of the potentially general lessons that might be derived for water governance. These include: the difficulties of delineating water rights; the apparent preference for creating property rights in unsustainable uses of water while failing to deliver basic water rights; the inter-twining of carbon and water crises; the dangers of privatising networks that form natural monopolies; the dangers of disciplinary hubris where interdisciplinary understanding is critical. It concludes by starting to address some of the water governance issues raised by globalisation.

Keywords: Water Governance; Australia; Water Rights; Property Rights; Privatization; Interdisciplinary Governance; Globalisation

1 OUR CAUTIONARY TALE: WATER GOVERNANCE IN THE DRIEST CONTINENT

Australia has, for some time, been regarded as an example of good governance. My home state of Queensland holds a very special place in the annals of governance reform as the first to create what *Transparency International* later called a *National Integrity System*.

Despite the rhetoric and the emergence of the term *natural resource management* (NRM), in Australia, with regard to water, we have long traditions of lack of governance and, in the panic engendered by the current drought and global warming, we have come to provide a convenient catalogue of some new practices, which we consider best avoided by others.

This might seem surprising for the world's only continent in which there are no international borders to complicate decision making. The latter factor is less of a benefit than might be thought. The flow of water across the internal boundaries of our country, our *states*, (six states and two territories) seems to turn *State Premiers* into warriors for their own farmers, and negotiations seem to be as long, protracted and fruitless as those between sovereign states. Indeed, the absence of war as an alternative may make these differences more interminable as the threat of war is not open as a means of breaking the log jam.

1.1 *A rough water map*

Most Australians live around the coast, and as if doubtful of their chosen home are ready for a quick exit. While we avoid the driest parts of the coast, we also avoid the wettest—tropical North Queensland.

The three largest cities: Sydney, Melbourne and Brisbane, lie seaward of a low range of mountains that runs up the East Coast and are called the *Great Dividing Range*. Most rain falls on the seaward side and runs into the ocean through short rivers. The rest falls on the other side of the *Divide* and forms into two great river systems whose length and catchment areas match those of the world's great rivers. The Murray-Darling basin falls between the Volga and Mississipi in length and its

catchment area of 1.07 million km^2 is greater than the Indus. Further north and west lies an even greater catchment area of 1.2 million km^2 approaching that of the Missouri. There the similarities end. The rain that lands in Australia's inland tropics starts out by flooding the *channel country*, to flow into what are rightly called *rivers* whose waters so evaporate on their journey to the inland that when they join they form what are with due modesty called *creeks* (the Diamantina and Cooper's Creek). These creeks become nothing more than a series of drying waterholes and the rain that falls in the North virtually makes it to the ultimate destination—the great inland salt Lake Eyre—once every two decades. The Murray River usually flows to the sea but, in the past, was blocked by sand dunes one year in 20 and now one year in two.

1.2 *Brisbane in normal times*

Located in Southeast Queensland, with eight hours of sunshine a day, the tourist advertisements used to brag: "beautiful one day: perfect the next". However, in summer, it would have been more appropriate to say: "deluge in between". When I first came to Queensland's capital city, Brisbane, nearly twenty years ago, water was a very important issue. Most of Brisbane's 1400 mm of rain falls during the summer months in a series of downpours in which the heavens open and up to 100 mm of rain falls within an hour on the hard slopes of Brisbane hills. As I was building on the top of a hill with a block that ran away from the road, I asked how we would organize to drain the roof and the tennis court. The architect's response was that the water had been running down that hill since time immemorial and that no one can stop it. This view was just the local version of a city-wide problem: how the water that fell from the sky would make it into the sea without doing too much damage on the way. Locally, the solution was to avoid concentrating it so that it did not end up as a river through someone's lounge room. City-wide, it was an issue of coping with the periodic floods that had the power to destroy bridges and dump sailing ships on the front door of the port office. Locally, they told me that if I were eccentrically concerned for downstream neighbours, I could build a sump at the bottom of the garden and pump the water back up into the street—though it was pointed out that the gutters probably could not take the extra water.

One of the solutions had been to build a dam, the Wivenhoe Dam, which was never allowed to fill to more than 45% to even out the flow and avoid some of the flood surges and reduce flooding levels by an estimated 2–3 m downstream in Brisbane. The 45% of catchment provided a new source of water to Brisbane which had traditionally just drawn water from its eponymous river. Some of the cost of this dam was built into water rates but there was no charge for excess consumption and until the early 1990s, the cost of installing and reading water meters was thought to be a waste of money. Water taken from the river ended up in the river one way or another—whether routed via Brisbane's gardens or recently installed sewers.

Now water is also an issue—for the opposite reason. After six years of drought, water storages fell to 16% of capacity in Brisbane and quite a few other city dams in southern states. At a meeting of the *Brisbane Institute* in February 2006, one of the experts invited to speak (Peter Ravenscroft) suggested that if usage continued and no rain fell, Brisbane would have to be evacuated by Christmas.

1.3 *Traditional water management and regulation practices*

For Australia's large cities, state owned water authorities drew water from convenient rivers but increasingly built dams to catch the swift flowing coastal rivers—seeking water security and a source of power. There were droughts and there were water restrictions to keep dam levels above set targets of 40–50%. One particularly short and violent river (the Snowy) was diverted across the *Great Divide* to provide hydro-electric power and extra water to support irrigation in the Murray Darling basin.

By the early 1990s, there was opposition to the building of new dams by defenders of the environment and defenders of the public purse. There were several reasons for the latter. An aversion to public debt and a convenient refusal to track changes in public debt with changes in

public assets meant that it was easy to claim fiscal prudence by selling public assets and deferring the building and maintenance of other public assets[1].

While water was not privatised, the corporatisation and sale of electricity assets had the effect of reducing the attraction of dams. As power generation was increasingly corporatized or privatized, the demand for hydro-electric power fell away as power companies preferred to build coal fired power stations and reduced the amount of spare capacity in the system (for the very logical reason that building more hydro-electric power stations would increase the supply and decrease the price while building fewer power stations would decrease the supply, decrease their capital requirements and allow utility providers to charge higher prices). As a consequence Australia is less reliant on renewable energy resources in absolute as well as percentage terms than it was 30 years ago.

This water was delivered for free to farmers through above ground channels. Farmers would distribute that water to their crops through similar channels as they had no incentives for more efficient water use. Water has been allocated to farmers, generally for free and more water has been allocated than water was available. Three states shared the Murray-Darling catchment areas (Queensland, Victoria and New South Wales) and licenses to use water were issued by those three states and by South Australia through which the remaining water sought to make it to the sea. Much of the over allocation was by governments in coalition with the rural based *National Party* (known until the 1980s as the *Country Party*), a minor party enjoying the advantage of high voter concentrations. Outside of the irrigation areas, farmers have had the right to dam water flowing over their land and Australia is dotted with little dams that in a normal season seem as numerous as Los Angeles swimming pools.

If we were reckless with surface water, our treatment of artesian water was positively criminal. Australia is home to the largest and deepest artesian basin in the world, covering a quarter of the continent, up to 3,000 m deep and holding an estimated 64,900 km^3 of water. For the last century, any land holder has been able to put down a bore and take the water for free. This approach meant that many landowners have not even bothered to cap the bores which have been running for 100 years.

1.4 *The drought*

Last year, Australia experienced average rainfall—with above average rainfall in the tropics and droughts in the Southeast. This phenomenon is related to the El Niño. We appear to be having two El Niño occurrences in short succession with a short break in between. The current drought is worse than any in living memory. It is being referred to as a one in a hundred year drought and there is as little rain as the *Federation Drought*[2] of 100 years ago. However, three factors make it more severe:

- It is hotter.
- Irrigation farmers are dependent on water.
- A smaller percentage of the rain falling in catchments is making it to the public dams for reasons that are not clear but could be due to more being trapped in private unregulated and unquantified dams or because rainfall is replenishing underground water reserves which have been severely depleted.

There is open speculation that 1/100 year droughts may become 1/20 year droughts. As the El Niño effect is ultimately caused by the warming of the mid Pacific Ocean, some may wonder whether global warming might make El Niño more frequent and possibly even permanent—just as the Gulf Stream has been for the last 10,000 years. This alarming prospect was underlined when, after declining mid-ocean temperatures and some good rains in the middle of 2007 seemed to hail

[1] This is not to say that public ownership and public debt is to be automatically preferred either generally or in traditional areas (see discussion of privatisation in Section 5.2).

[2] It was so named because it spanned the Federation of Australia's formerly separate colonies on 1 January 1901.

the end of an El Niño and the start of a La Niña, ocean temperatures started to rise and rainfall predictions fell. This might spell disaster for many farmers who borrowed to plant widely on the expectation of a debt alleviating La Niña harvest. Given the much larger ocean masses and the fact that it is relative differences in temperature rather than absolute levels that are likely to be more relevant, a permanent El Niño may be unlikely. But the possibility of one does send a chill to those who have settled in the driest continent just as it is in danger of getting drier.

Australian Governments did what governments tend to do on such occasions. They stated that there was no reason to panic and then, to ensure that they were not seen to do nothing, tried to do everything.

1.5 *The response: Brisbane*

In Queensland, water restrictions were repeatedly toughened—though without any meaningful price increases. Watering of gardens was initially allowed with a hand held hose (meaning that those who had more time or could hire someone to hold it were unaffected). It was then limited to three days a week and for limited periods (though one of those periods, in the early morning, was the worst time to hose). Later a more stringent ban on watering gardens was introduced. Warnings were given that *Level 5 water restrictions* would be introduced but were not announced in advance[3]. These restrictions banned all watering of gardens from the reticulated (town) supply system except where the watering is performed three days per week between the hours of 16:00 and 19:00 with a bucket or watering can.

Per capita water use for drinking and sanitary purposes has been fixed at 140 l/day. Those who violate these norms are sent 'please explain' letters and are also threatened with fines. Most serious of all for the future of philosophy emerges from the curious fact that showers are set at a maximum of four minutes and four minute timers are being sent to every household in Southeast Queensland. Not only would a modern Archimedes be denied his bath but he would not have enough time in the shower to get his or her thoughts together. This means one form of Thales' *water wisdom* would be in short supply!

There are massive attempts to increase the supply and improve the distribution: a new dam, recycling of water, pipes to link all existing dams, a desalination plant etc. A rebate of up to US$ 1,750 for each householder was offered to install a tank of 5,000 L or more (just over a week's supply for an average household at the current limit) before 30 June 2007. The price of tanks increased sharply in response. Rather than trying to collect the run off from storm water pipes and recycle it, the government is massively subsidising the installation of tiny inefficient tanks—and doing so over such a short period. The greatest effect was to increase the price but not to increase the long term supply of water tanks because the market would be expected to boom before the 30 June and then *tank* (pun intended) after that date.

1.6 *The response: The Great Artesian Basin*

The Olympic Dam mine—a multi-mineral mine and Australia's largest, is seeking to treble its output and move from underground to open cut operations. It is over 1,600 km away from any significant aquifer and has been drawing its water from the Great Artesian Basin to the amount of 35,000 m^3/day. It was generally recognized that it could not rely on artesian water to increase its production. Accordingly, it has proposed building a desalination plant on the coast, using 30 MW of electricity and pumping 120,000 m^3/day of water from Spencer Gulf which is about 300 km away. While this is highly controversial because of the proposed location of the brine discharge, it is an indication of the feasibility of large scale desalination and pumping over long distances. Some alternative suggestions are highly creative—such as pumping of salt water to the mine, the use of *hot rocks* technology for energy and depositing the salt on to the bed of an existing salt lake.

[3] These restrictions were introduced on 30 April 2007.

1.7 *The response: Murray Darling*

On the other side of the Divide, things are much worse. The Murray Darling basin is Australia's food bowl with 40% of the agricultural produce and 72% of the irrigated area. There is widespread concern about the over allocation of water with reduced wetlands and increasing salinity. The restoration of environmental flows had been agreed to and afforestation is commencing. However, in January 2007, it was announced that allocations for environmental flows would cease until further notice and irrigation allocations would be zero.

Two radical plans were rejected. The *Premier of Queensland* suggested a series of *Snowy* schemes where the short rivers that run into the Pacific be diverted to the long rivers that flow into the Upper Murray Darling Basin. On the other hand a government backbencher with farming interests (Senator Bill Heffernan) suggested that it was time for Australian agriculture to recognize that its future lay in the neglected wet North rather than the dry South and that government subsidies should not be wasted on supporting agriculture in the Murray Darling but should be used to assist the transition to the north of the continent.

The *Prime Minister* had a major problem. For a decade, he had been a global warming sceptic. While the drought may well be part of a cyclical phenomenon, having the hottest year on record exacerbated the drought and made him appear unprepared.

His response was two fold—urging farmers to pray for rain and trying to take over all powers over water from the state governments. Unfortunately, the opinion polls suggested that the electorate was praying for an end to his reign. Accordingly, giving him more power was not as attractive solution to others as it was for him.

The plan to take over state powers *vis-à-vis* water was developed by one of the brightest of his junior ministers, Hon. Mr. Malcolm Turnbull. Turnbull was a flamboyant lawyer who had made his reputation defending free speech in the spy catcher trial and in establishing the *Australian Republican* movement. He made his money as a merchant banker. The plan to takeover state powers over water resembled a takeover in which US$ 10,000 million was put on the table for conservation measures and to buy up water allocations. The proposal was developed in the minister's office with only the most belated and cursory opportunity for the *Departments of Finance or Treasury* to look into the proposal.

Malcolm Turnbull was very keen to establish a market in water rights. Like many politicians influenced by simplified versions of neo-liberal economics, he was keen for the claimed efficiencies of markets to re-allocate water rights to those who could gain most value from them. This approach would be facilitated by *recognizing* property rights in water by farmers. The fact that these rights had been over allocated, generally at no cost, and would be made immensely more valuable by tradability was of secondary concern.

The plan was presented as *the* answer to managing water despite the fact that the Federal government had no experience in water regulation, and had not consulted the state and regional authorities (such as the *Murray Darling Basin Water Commission*) who did. The states were expected to buckle under the pressure from their farmers who were expected to be happy to take the money and by their own ability to fund significant conservation measures because the Federal government has a monopoly of growth taxes. The irony that the Federal government was using taxes raised from citizens to shift power from one level of government that they elected to another level seemed to have been lost on those who pressed the states to give in on the basis that the *Feds are paying*. The states recognized the need to end the system of state based allocations but wanted that power to be given to an independent commission appointed by state and federal governments rather than by a central government in which Australia's rural party (the *National Party*) was a member. In the end, all but one state (Victoria) agreed. As all the state governments were Labor[4] governments, there have been suspicions that these states left it to the then most recently elected and most secure government, Victoria, to take the flak from the *Federal Coalition Government* on this issue.

[4] This is the spelling for the *Australian Labor Party*.

Meanwhile the *National Party*, while happy to allow the crystallization of water allocations into firm property rights, were totally opposed to any compulsory purchase of water rights and suspicious of even voluntary trading. This was partly because of the strong attachment of farmers to their land.

I have spent quite a bit of time on this tale of water governance in a country with a generally good (and not infrequently deserved) reputation for governance in general because it provides a cautionary tale for those seeking *good governance* of water.

2 WATER GOVERNANCE

2.1 *A very recent development*

One reason why this tale provides little evidence of governance, good or otherwise, is that the use of the term *water governance* is a relatively recent development[5] in Australia and globally. Indeed, *governance* is a term that only received wide currency in the mid 1990s—though the phenomenon it described is old enough (Drori, 2006: 99).

Water was not seen as requiring what we would now call governance. Attitudes to water may go through a number of states. These are described as below:

1. Water as a free flowing resource—something freely available to all. In some cases, it was seen as much of a nuisance, danger and public bad as a public good[6].
2. Water as an incident to property in which the owners of the property have rights to take water from streams that pass over their property and aquifers that lie below their land and can be tapped.
3. Water as a good that can be taken provided *as much and as good* is left for others (Locke, 1689, Edition 1924: 131).
4. Water law as an adjudication of rights between those with access to water at least one of whose desired takings would not leave *as much and as good for others*. This may be left in the hands of courts or be the subject of water regulation.
5. Water as something that needs to be reticulated by engineers to provide water to those whose property is not adjacent to running water—in either irrigation schemes or for urban use. The supply of water is generally assumed and it is assumed that the costs of capturing and distribution of such water is affordable by governments, residents and/or farmers. Such water is delivered and cleaned through *water services*.
6. Water as something that needs to be managed—though generally in an apolitical way—as if the engineers and technocrats/bureaucrats were engaged in the *administration of things* that Marx and Engels so unpresciently imagined the work of government to become in a post-revolutionary *classless* society.

The term water governance has become more common as governments and citizens have come to appreciate: a) the limited supply of water; b) varying access to water; c) the multiple demands on water (water for personal, recreational and decorative, agricultural, industrial, environmental uses); d) the increasing involvement of business and NGOs as well as public authorities and individual users; and e) the different ways in which water may be conceptualized—as a human right, as an

[5] For example the term *water governance* appeared for the first time in Australian state legislation in 2006—*The Victoria Water* (*Governance*) *Act* of 2006. On the international level, as late as 1997, one of the most important international treaties relating to waterways and their non-navigational use, the *UN Convention on the Non Navigational use of International Waterways* does not mention the term governance at all. On the international level the concept (term) governance began to appear in the context of such concepts as sustainable development and environmental protection.

[6] We should not forget the *traditional* Brisbane attitude to water and the fact that, in many countries, levees are built for the opposite purpose to dams—to keep water out.

economic resource, as a part of the environment, as a necessity of a wide range of life forms whether they are of use to humans or not and, more broadly, the centrality of water to life and the way we live it. In Australia, the *Wentworth Group* of prominent scientists have for a number of years now stressed that Australia's climate and Australia's water situation is *changing Australia* (Cribb, 2006) and exposing potential difficulties generated by what some see as a complex federal system (Bellamy, 2006) which includes local and state water authorities.

This is not just a matter of management but of making value choices, allocating resources, avoiding inefficiencies and recognizing the dangers of market failure and the abuse of market power. Hence the talk of and need for water governance.

The impetus behind talk of *governance* is that water is too important to be left to engineers and technocrats. Water is relevant to every person and every aspect of our lives and the environment we live in. However, it is possible that taking everything into account in making decisions will mean that no decisions are made and that, even if made, they will seem inadequate, inappropriate and even misconceived from some points of view.

It is important to recognize that the introduction of the word *governance* provides no solutions on its own—even, or especially, when the semi-compulsory complimentary adjective *good* is placed in front in an apparently knowing way. The variety of approaches to governance may lead some to wonder if the many proponents of good governance or *governance reform* are really talking about the same thing.

Some definitions of governance are so broad as to seem to encompass the social, economic, cultural and political systems and processes within or even beyond a nation state. McKay (2007: 150) defines governance as "the process of decision making in the community involving both formal and informal actors at all levels". The United Nations Development Programme (UNDP, 1997: 2–3) defines governance as "the exercise of economic, political and administrative authority to manage a country's affairs at all levels. It comprises the mechanisms, processes and institutions through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences".

Veiga da Cunha (this volume) cites the Global Water Partnership (GWP, 2002) definition accepted by the United Nations (UNESCO, 2003): "the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society".

Later, he stipulates that "water governance includes not only the action of the government but also the underlying issues such as the different stakeholders' participation in the decision process, the sharing of investments in water issues and of benefits of water development, or even the exclusion of a part of the population due to their weak economic and social power" (Veiga da Cunha, this volume).

Veiga da Cunha (this volume) sees governance involving "government, private interests (agriculture, industry, energy, trade, etc.) and the civil society, including users and consumers . . . at local, national and even international levels". These are seen as forming a partnership through which decisions are made".

The problem with such broad definitions is that they end up encompassing most elements of the society in a partnership that is so broad as to defy any possibility of decision making.

In fact there are two models that seem to dominate:

1. A *political* model in which the government consults *widely* and then determines what is to happen.
2. An *economic* model in which water rights are fixed and made tradeable.

Sometimes the consultation is confined to those who agree with what the government wants to do (or with those who are proposing the change in the first place). Sometimes the government decision is to follow the market model. The Murray Darling example encompasses both faults.

These models reflect the fact that definitions of governance tend to be very broad but that policies and processes tend to be from a far narrower perspective. This reflects the tendency of academics

and practitioners to use the term *governance* but define it from the perspective of actual remedies followed and so reflect political and economic approaches to governance that are narrow.

Governance involves institutions that can make decisions. Governance reform is stimulated by the recognition that institutions which seek to make such decisions are either flawed or non-existent and the various disciplines have different diagnoses and remedies for such governance failure.

2.2 *Interdisciplinary water governance*

The importance of good institutional governance is recognised by many disciplines that have potential to contribute to institutional governance and reform. The problem is not that it is ignored: the problem is that each discipline has a strongly theorised notion of institutions, which colours and structures their view of the nature of institutional problems and the best means for addressing them. For example, lawyers look at institutions and see sets of formal norms, ethicists see informal norms and the values that the institution claims to further; economists see incentives and disincentives (UNDESA-UNDP-UNECE, 2003: 372); political scientists see power relations[7]; social psychologists see complex webs of interpersonal and group relationships; and, management theorists see structures and systems. Accordingly, the problems are seen in the deficiency of laws, ethical standards, incentives etc. and the solutions are seen as lying in remedying those deficiencies. All these partial insights into institutions and their problems are important and any solution that ignores them is likely to fail. However, as proffered solutions tend to be developed from only one disciplinary perspective, they are necessarily limited. In the areas of water governance, economics has tended to predominate with a clear role for law and less recognition for hydrology than might be imagined. Ethics and human rights issues have not been particularly predominant.

I have long argued that values debate is an essential component of good governance, not just for itself but for its ability to assist in co-ordination of the other components. Good governance involves ethical standard setting, legal regulation and institutional reform (including decision making processes and the setting of economic incentives and disincentives)[8].

All co-ordinated and especially organized or institutionalised human activity has to be justified for two reasons. First, such activity involves the commitment of time and resources by those involved and/or those who are paying. Second, and more fundamentally, any concentration of people, power and resources constitutes a potential threat to others.

This justification serves three important governance purposes. First, it provides a positive guide as to what the activity should aim for and achieve. Secondly, the justification provides the basis and purpose for the legislation and regulations that govern that institution's creation, existence and conduct. In so doing it provides a basis for the purposive interpretation of that regulation. Third, the justification provides values that serve as a positive guide that should be at the centre of the institutionalized ethics of the participants. It sets out the positive standards which its members should follow and by which they should judge themselves and be judged by their peers. Finally, these values set out a basis for evaluating the structures and processes of decision making and decision implementation in that they set standards for the criticism and reform of institutions.

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[7] Veiga da Cunha (this volume) includes a definition that reflects the political science paradigm of governance: "The water sector, as part of the socio-economic system, is conditioned by general politics and is, thus, influenced by decisions that lie outside of the water sector. Water governance determines who gets which water, when and how, and establishes who has the right to water and to water services. The representation of various interests in water decision-making and the role of politics are important in the definition of governance dynamics".

[8] It naturally has to be evidence based—a requirement that is becoming easier to meet with the growth of research and the greater ease of its communication.

2.3 *Governance virtues*

The values that should inform water governance will not be coherently articulated or unanimously adopted overnight. However, debate underlying the values being pursued by the water governance (or any other form of governance) tends to produce convergence and clarification of difference. I have long argued that ethics involves asking hard questions about our values, giving honest and public answers and living by them. This is as true of the collective actions in which we engage as our personal actions.

The values debate in water governance has thrown up a number of procedural and substantive values. Common lists of procedural values include: participation, transparency, accountability, coherence, responsiveness and respect for the practices of existing communities, especially traditional owners and integration and development on that basis of the necessary instruments, rules and institutions that allow for the implementation of the governance concept (UNDESA-UNDP-UNECE, 2003: 373). Substantive values include respect for rights, the precautionary principle and, on many definitions, equity and efficiency.

Some, like UNESCO, might refer to these as basic *attributes* of effective water governance. I would tend to characterize them as *virtues* in the same sense as Joseph Raz sees the *Rule of Law*, democratic decision making, respect for human rights, etc. as virtues of law—virtues which are mutually supporting and desirable in themselves and collectively but which can be present to a greater or lesser degree in real legal systems. The same is true of the above virtues of governance systems.

3 WATER RIGHTS

3.1 *Water rights—A slippery concept*

Creating property rights and efficient markets in their transfer is the ideological *one-size-fits-all* approach. Markets can be an enormously powerful tool in harnessing the desires of individuals to trade what they have for what they would prefer. However, complications may emerge depending on the nature of the material over which property rights are to be created. Water is a prime example. As Getzler (2004: 329) put it "water as an ephemeral and changeable element incapable of exclusive possession was hard to fit into any available legal or philosophical categories".

Agricultural production requires land, water, sun and labour. Where the water fell on the land or ran through or past it, the water was taken as an incident of land tenure. The surface and ground water was appropriated by land holders largely on an individual basis in what would generally seem like a Lockean world in which land owners could take what they wanted and leave *as much and as good for others*. Water was taken for granted because it is seen as a renewable and sufficient resource. Where that did not hold, conflicts arose between upstream and downstream users—originally over the quantity upstream users took from streams and rivers and later about what upstream users put into the system.

Where water was brought to the land by extensive hydrological work, it was generally through significant bureaucratic and political systems which organized the creation and maintenance of those works. In ancient societies dependent on extensive irrigation, water was central to politics and politics was central to water. In the irrigated areas of even modern states such as Australia, the latter remains the case. This has generally led to administrative and taxing regimes that controlled and allocated water rather than regimes of property rights (Getzler, 2004: 10–11).

Separating water rights from land rights or politics can be extremely difficult. On its way from the sky to the sea, water runs over land. That which soaks in *naturally* would seem to go with the land. However, if changing the land and/or damming that water affect the ability of other users to take as much and as good for their own purposes, then the assertion of a right by uphill land users diminishes the rights of those downhill. At this point, there needs to be a set of rules and institutions to interpret and apply them—a *governance system*. Whether or not that system

involves rights—human rights, user rights and property rights—or other forms of rules involving markets, taxes or less formal arrangements is neither philosophically nor jurisprudentially pre-ordained.

Before considering some of the alternatives in water governance, there are some basic technical issues that have to be appreciated.

1. Water is not something that is produced to any significant degree. While it goes a little far to say that "water is neither created nor destroyed", for all practical purposes this is so. Even where hydrogen is separated from oxygen this is only part of a fuel system the point of which is to recombine these elements.
2. Although we may formally buy, sell and own water from bottles to tankers to the content of private dams, our relationship to water is less like ownership than renting. We generally take water that is of high quality and at altitude and/or pressure and downgrade it. This assertion is true whether using water for consumption, agriculture or production.
3. Water is not a static product but part of a cycle in which it is drawn from the sea (and, to a lesser extent the land) rises as rain and returns to it.
4. The *same* water can be used several times in each cycle and more intensive use might be seen as increasing the *velocity* of circulation.
5. However, its re-use may depend on improving the water and/or pumping it to a different location. This process involves providing water *services*—through pumping or gravity, streams or pipes, water sanitation plants or through sand, soil and/or wetlands.
6. The costs of moving water from one catchment to another is very expensive—water is both heavy and bulky for its price so transport costs are generally prohibitive for agricultural use.
7. The above points indicate that the rights that are sought are not to *water* as such but to the access and use of water of a particular quality at a particular place. Getzler points out that water has more often been regulated by *reasonable use rights* rather than title. The alienation of water rights from the ownership of land has not often been attempted and was largely abandoned by British courts in the mid 19th century after toying with Lockean theories for much of the previous 50 years (Getzler, 2004: 335). Getzler points to the significant obstacles to efficient transactions taking place.

Finally, most water is in the form of sea water. Most water ends up in the sea. Conversion of it into fresh water and pumping it to where it can be used at a pressure that is useful is the most important service of all. This activity requires energy—traditionally solar energy has been used, and for the foreseeable future this will remain the predominant energy source for this purpose (see next Section).

3.1.1 *Water and energy*

The natural water cycle involves the sun's energy for evaporating water and thereby both purifying water and, in raising it up, giving it the potential energy to run down from the highest mountains. Gravity allows the water to be distributed through streams and rivers and it also allows the subsequent improvement of that water by pulling it through wetlands, sand, soil and other natural purifiers.

We can now perform both functions artificially with desalination plants getting rid of salt, sanitation plants getting rid of waste, and pumps to move water to where we want. The amount of water purified by these means is infinitesimal on a global scale. However, the movement of water to where the people are, rather than the people to the water, is fundamental to civilization. It was the basis of ancient irrigation and it is necessary basis of city life. Much of this movement is powered by gravity, most spectacularly in the case of Roman aqueducts. Early irrigation systems relied on simple devices driven by people or animals, and modern systems require the extensive use of pumps to move water to its users rather than its users to the water.

The supply of water is effectively finite. However, the supply of fresh water is variable and, with sufficient supplies of energy, virtually infinite. In an age of global warming the latter provides

very real constraints and inextricably links our massive carbon and water problems. Most water on the planet is purified by our biggest renewable source of energy—solar power. Desalination plants have traditionally used *cheap* fossil fuels to separate the salt and raise the water to where the users are. Such plants may be driven by renewable energy resources—including wind power near the sea, *hot rocks* or solar power[9]. The use of solar power would be particularly apt. If fusion ever proved to be feasible, massive desalination plants might be a suitable use—as well as one that ironically goes directly to the sun's fuel source.

Such futuristic optimism/fantasy might solve the world's greenhouse, energy and water problems at the same time. Until then, the use of greenhouse and water issues will be interlinked (see Section 4).

3.2 *Human rights and property rights in water*

The human right to water in sufficient quantity and quality to allow for drinking, food preparation, washing and sanitation is widely recognized. Water is necessary for life. We cannot live without water—only deprivation of air will kill us more quickly. Indeed, we are largely water. Without clean water we contract diseases that make the retention of water difficult or impossible.

In many cases, human rights may be economic goods. This contention is hardly surprising. If the right is recognized and valued by individuals, it will generally be valued by a market if it is available on a market. This may lead to a demand for property rights.

For some of the interests, which are recognized as human rights that belong to human beings, markets are deemed totally inappropriate—such as, the right to a fair trial and the right to vote. Many rights can be enhanced or extended by the expenditure of money—for example, the right to free speech through the purchase of advertising space or, more generally, the purchase of the media outlets. However, the legitimate extent of that extension of rights varies. Many socio-economic rights are the subjects of property rights and markets—including the right to food, clothing, shelter, health care and education. Indeed, attempts to run modern societies without markets in food and housing are not generally seen as successful.

In some cases, the granting of property rights is seen as more effective than central provision (e.g. the central ownership of clothing at *kibbutzs* was abandoned). Jeremy Waldron (1990) points out that the right to property, if taken seriously, through giving minimum property rights to all, links property and equality.

Luis Veiga da Cunha (this volume) rightly chides those governments who think that giving a right to water means that the government must provide water free to those who possess that right. This is a common mistake for those who think that the correlative of a right must be a duty and that that duty must fall on the government. McCloskey (1986) has argued rights should be seen as attributes of persons and centered on right holders rather than duty bearers. Rights are logically prior to duties and cannot be re-described in terms of duties without loss of meaning. However, I have also argued that there *is* a correlative—though not a correlative duty cast upon individuals or institutions. A human right involves a right to a "scheme of social arrangements that will provide the various dimensions of rights for those who are a part of and subject to those arrangements" (Sampford, 1997). The arrangements may differ from society to society. In some, the resources for socio-economic rights may be provided by the market, in others by a minimum wage or by some specific institution which provides the resources needed for particular rights. In that essay, I concluded:

> "Of course, some schemes of social arrangement can secure more ... rights than others and some schemes are not possible until a society has reached a certain level of

[9] This is convenient as many places most in need of desalination are in areas that have limited water, limited agricultural productivity and probably limited cloud.

development[10]. But this merely means that the moral ideal of human rights entitles men and women to a better scheme of social arrangements for securing rights and to constant improvements in that scheme[11]. In this sense, human rights contain within them a very important *right to development*".

However, in addition to the fact that human rights are perfectly compatible with systems that respect and protect property rights and open markets, it is also vital to recognize that the distribution of goods via the market is on the principle of one dollar—one vote and not one person—one vote, and that markets do not automatically deliver human rights. From a human rights point of view (and John Rawls' [1971] theory of justice), the worth of the system is judged on the basis of what rights are effectively available for all. The fewer and more basic the rights, which the scheme of social arrangements delivers to its citizens the less just it is.

Australian governments may argue that they provide water at rates that citizens can afford in cities and that housing standards require the provision of water and sanitation by other means in remote locations. However, there is a concern that water regimes like that proposed for Australia quickly tend to create property rights over unpaid allocations of farm water, while there is no move to recognize rights for individual citizens. If property rights are the way to protect farmers with a limited moral claim, why should we not provide property rights in the limited amounts that individuals require? If it is unnecessary for the latter, is it necessary for the former?

Perhaps it would be better to recognize the relevant needs in some other way. It makes little difference whether the system delivers water at a low price or delivers the funds to pay at the market price. The human right to water could be met by:

1. A guaranteed low price.
2. Market price, but with the market price provided as a payment to all citizens and/or residents.
3. An increase in a relevant social security provision or tax rebate.
4. A set of water credits that citizens could claim from water authorities (whether they be government, corporate or a *statutory authority*/QUANGO—Quasi Non-Governmental Organisation).

If fundamental human rights do not require the protection of property rights, it is not clear why lesser interests have to be secured by property rights. This is where a market might seem to be particularly appropriate with water being rationed among various uses. The importance of water to generate food and the human right to food to sustain life might suggest favourable treatment of water for farming.

However, the same arguments might be made about other factors of production—land, farm equipment and, possibly, fertilizer (for which there was a long history of subsidy in Australia). It is better to have market prices charged for all factors of production to ensure the most effective economic use. If the price of food rises too high, this can be dealt with by a direct subsidy based on food value, which, in times of water scarcity would give an incentive to produce food rather than other commodities but would favour the most water efficient ways of producing the essential food groups. If the price mechanism left too little water for producing food because too much water was diverted for industrial and *luxury* uses (e.g. private gardens), the answer would be to tax water used for other purposes. This approach will encourage the development of other sources of water or the more intensive use of water.

The use of the price mechanism not only directs water to efficient uses and discourages uses that are not valued but also provides resources to ensure that individuals receive their basic rights to water

[10] Although human rights are possessed by all human beings and amount to a right to social arrangements that will allow for the enjoyment of those rights, the setting up of social arrangements at anything less than a global level immediately sets up distinctions between those subject to the different sets of social arrangements.

[11] For this reason, human rights are neither static nor pre social. They are not natural rights but rights to the kind of organisation that will make it possible to enjoy them.

and food. Over the medium term, if industrial and luxury uses of water are priced at the marginal ecologically sustainable economic cost of supply, then this will ensure that new water is brought into the system to ensure that industrial and luxury uses of water are not a *drain* on other uses.

If water is to be of variable supply and the supply (including more intensive use) is flexible, then the pricing mechanism would seem a suitable way of both rationing and increasing water supply.

But what is it to be priced? A right to quantities of water in perpetuity, the price of an annual allocation, or water as it is delivered? The idea of auctioning allocations—whether annually or permanently—is very popular. I am deeply skeptical.

There could be long term prices and spot prices subject to fluctuation based on the variability of rain. However, there is a strong argument that extra rain should go into storage (levelling out annual prices) and ecological uses (such as periodic flooding of wetlands) with adjustments made the following year.

To provide a long term right to water is likely to be inefficient and based on guesses about the future that are likely to be inaccurate. Building bad guesses into the division of scarce and increasingly valuable resources seems clearly inadvisable. Nevertheless, there are three arguments that are likely to arise for property rights.

3.2.1 *Locke and property rights*

Where the importance of preserving property rights might once have seen to be a predilection of the landed classes, neo-liberals are more likely to cite Locke. Like other neo-liberal icons, Locke was much more enlightened and egalitarian than his more simplistic followers would have us believe. In his *Second Treatise of Government*, Locke sets out two main principles—the right of an individual to have access to the resources needed to sustain life; and the right of an individual to enjoyment of the fruits of their own labour where he mixes his labour with a natural resource. Locke's example of this was filling a pitcher of water from a fountain (Getzler, 2004: 1). These are based on an *assumption of abundance* in the availability of those resources: "Without that assumption [of abundance], a theory of rights and justice, even of a broadly Lockean stamp, would have to reverse the priority and make the proviso the major principle, and entitlement subordinate to it" (Hayward, 1995: 130).

This is evidenced from Locke's proviso that an individual can only fix his property by labour in that which he can profitably use, and "whatever is beyond this is more than his share, and belongs to others" (Locke, 1689, Edition 1924: 131); an idea while vital to private property remains ultimately subject to a broader commons.

Although Locke was strong on liberty and property and allowed individuals to appropriate elements of the environment by mixing his labour with it in a state of nature, this principle was centered on the proviso that you left *as much and as good* for others (Locke, 1689, Edition 1924). The *others* would naturally include future generations. Accordingly, taking water from a stream so that the water eventually went back to the sea and rose again as rain to replenish the stream was perfectly acceptable. However, taking water in conditions involving the competition for resources was another matter.

3.2.2 *Incorporation of unrealistically priced water into the value of land*

Where water is a critical factor of production and is under-priced, under-pricing is likely to be built into the value of the land. Under that scenario, when water is appropriately priced, then a transfer of wealth takes place from the community as a whole to individual land owners. Where the original recipient of the underpriced water still owns the land, there is no injustice[12]. Where a later purchaser has bought land that is inflated by the availability of water, there is a problem. To some extent, farmers in a dry country might see the unsustainability of providing underpriced water. On the other hand, the government had effectively encouraged such thoughts through the

[12] Failing to gain the benefit of an unjustified windfall is not an injustice.

profligate allocation of water licences. Some compensation might be appropriate for a period but the compensation should go to those who can prove disadvantage to themselves rather than to all. The fully priced water provides a fund from which such compensation can be paid.

3.2.3 *Property rights and certainty*

One reason for preferring property rights is to provide the *certainty* for investors that markets are seen to require. In an analogous carbon trading argument, there is a demand for *investor certainty* (though not necessarily for producers, consumers and governments).

The problem is that certainty cannot be provided under a scenario of climate change. The key point is that the government needs to send consistent and long term messages. Often those messages have to be that change is inevitable and certainty is a fool's paradise. Governments need to send cautionary messages about environmental damage. They need to provide incentives to those who find ways of doing more with the same resources or doing the same with less. By providing incentives to such innovators and disincentives to those engaging in harmful activity, the overall welfare is increased.

Finally, I would argue that, if anyone deserves certainty it is the holders of fundamental human rights rather than investors in water allocations.

If a product is in variable or diminishing supply, the price ought to change. Providing certainty to any player will almost always be to the disadvantage of another. If the price is set low, others will either have to lose out or pay a higher price. If certainty is provided by the conferring of a property right, then the holder is given the opportunity to gain windfall profits (or rather *non-rainfall* profits).

To provide certainty to one involves the transfer of risk to another. If the water distribution system is to guarantee supply of a variable resource, then a much higher price must be charged. This outcome is rarely what is intended by the desire to create certainty.

If the government charges a price higher than the current cost of production, then it is in a position to do one of two very important things:

1. Invest in infrastructure that increases the effective supply of water and the abatement costs of the energy used in building and operating that infrastructure.
2. Use the extra funds to reduce the VAT (*Value Added Tax*) or sales tax on goods to ensure that there is no inflationary effect generally (this could be targeted at food and other products that rise because of the increased cost of water to produce though this may be more complicated and make little difference in practice)[13].

However, if a right to water is created, a valuable asset is created, a transfer of wealth effectuated and the resources that could go towards either improving the supply or reducing the increased cost of goods produced is lost.

3.2.4 *Land grabs and water grabs*

As water is important, there are many people who seek secure property rights over it. There is a real danger that *mistaken*[14] allocation of property rights might prove as unjust as some of the great land grabs of the past—and just as hard and painful to undo[15]. While some may be enamoured of creating property rights and markets in them, such schemes can result in serious market failures where a whole industry becomes more expensive and less efficient because of the creation of a property right where it bears no useful purpose—for example, taxi licenses[16].

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[13] The poor generally spend more of their income on consumption than their richer fellow citizens, so across the board cuts are generally as advantageous as targeted price cuts—which have their own problems.

[14] Allocations of water property rights that benefit some groups against others might occur for reasons of coercion and bribery as well as ignorance.

[15] When property rights were put in the wrong hands, we have often had to have a revolution to overturn it!

[16] In many jurisdictions, taxi licenses are generally issued for regulatory and or qualifications purposes for a nominal amount. However, if new licenses are not issued in line with increased demand and existing licenses

I have no doubt that price signals are required. The question is whether the price is captured by governments, farmers or merchant bankers and others engaged in arbitrage. In other words, if the price is to be increased, who is to gain the windfall?

For Coase purists, initial allocations do not matter (Coase, 1960). This is easy for the rich to say. It is easy for those who will derive commissions from the marketing and transfer of water rights to say this. It is not so easy for those who are not allocated water rights in the first place and do not have the wherewithal to buy it.

4 CARBON AND WATER

There are many intersections and parallels between the water crises striking some countries and the carbon crisis affecting us all.

I will briefly list the intersections:

1. Increasing the supply and availability of water generally involves energy—the production of which generally involves the generation of carbon dioxide emissions. While some forms of power generation are carbon neutral, the diversion of carbon neutral energy to water merely shifts the problem.
2. Global warming threatens to change rainfall patterns and increase water supply problems in some areas.
3. Global warming increases evaporation that is not matched by greater rainfall, as warmer air can contain more moisture.
4. Global warming will melt Arctic and Antarctic ice sheets removing a theoretical source of supply of water (global warming also reduces glaciers, temporarily increasing supply while reducing an important long term storage of fresh water at high altitudes).

These intersections provide us with good reasons to deal with each problem. The analogies may be more important for ethical and policy debate.

The first analogy is a tentative one. One of the biggest problems facing climate changes is that the western image of the 'good life' involves unsustainably high outputs of carbon—a *high carbon lifestyle*. A good life is unsustainable while developed nations follow this lifestyle. It is even more catastrophic if developing nations follow us. As I wrote in 2000:

> "The economic success of the developed North and the attraction of its values for other countries creates a huge problem for its continuation. The values on which we built our wealth and the attractiveness of the lifestyles that the emissions make possible are so attractive to less developed countries that most wish to follow. However, if other nations follow, it will lead to the ruination of those northern economies. The greatest obstacle to solving the North's environmental concerns and problems lies in the fact that the South wants to emulate us. In one sense, this might be seen as a great irony. However, it is really a simple matter of consistency.
>
> There are only two ways that the North can persuade the South to act in ways that will not destroy the environment in this and other ways. One is by coercion (military or financial) to ensure that the South remains poor and does not make great calls on global

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are transferable, scarcity increases their value. While this provides windfall gains for the earlier license holders, later license holders have to charge to service their capital and consumers have to pay more. Once the taxi licenses have reached a significant capital value, license holders who have paid significant sums for their licenses would suffer losses if new licenses are issued and lobby against issuing new licenses. All this feeds expectations, originally illegitimate, that new licenses would be issued sparingly if at all to preserve the capital value of existing license holders. If new licenses are issued, they are limited in number and auctioned off. While this may add slightly to revenue, the overall cost of hiring a taxi in that city remains higher and, to the extent that the market is efficient, by the cost of servicing the capital of the taxi licenses.

> resources and the *Global Commons*. The other is to address the South's aspirations and treat the rights of the citizens of the South as deserving equal concern and respect. In the long term, the former will not work even if it were morally acceptable. Not only is this a spaceship earth, there is only one class. Indeed, we are not passengers of any class but the crew. If the solution to the problem involves meeting the South's aspirations, this creates the possibility of an even greater problem. The more the aspirations of the citizens of the South are met, the greater the economic growth required and the greater the emissions and other pollutants generated.
>
> However, I would argue that this only underlines the extent of the problem we are dealing with and the extent to which current development paradigms are unsustainable" (Sampford & Brown, 2000).

I am not sure that Australians are quite as addicted to a *high water* version of the good life. In some cultures, water is a great luxury and the conspicuous display of it is part of the culturally acceptable forms of ostentatious display. There is an element of this in western culture—including the green lawns of suburbia and of golf courses. This display is sometimes found in those who dislike the predominantly consumerist culture—and loving your lawn is more generally socially acceptable than loving your V8 four wheel drive, at least in the social circles of which the author is aware.

It would be ironic if we did have to change our vision of the good life not only from high carbon to low carbon but also from high water to low water. One of the more ironic consequences could well be in nomenclature. Would the *Greens* have to become the *Browns*?

The second analogy is a more important one. Those who are seeking to halt climate change divide into those who want carbon taxes and those who want carbon trading systems. There is a similar division among those who are suggesting solutions to water scarcity.

5 WATER GOVERNANCE APPROACHES

5.1 *Beware granting rights to unsustainable activity*

Where water is being overused, creating rights to continue at least part of that use is reminiscent of the approach taken to a number of other environmentally harmful activities. Of all the means for reducing the pollution/overuse, this approach is always the one favoured by the polluters/overusers because it instantly creates a valuable asset which they receive and for which others must pay. They will find it much more palatable than auctioning permits.

It is argued that businesses have been built, valued and often sold to *bona fide* purchasers without notice on the basis that the harmful activity, hitherto permitted should continue. There are several problems with this:

- Those engaging in the harmful activity have been doing so by externalising their costs on others who have suffered and continue to suffer from the harm done. In emissions cases, it is essentially a *right to pollute*—a new right that appears in no declarations and in no texts—but which is proclaimed by some western economists[17].
- The idea of a right to harm others is offensive. It is similar to those who have been beating their spouses being given a property right in beating their spouses in order to be able to sell that right to someone else; or those who have *not* been beating their spouses being given property rights in not beating them, which they can trade with those who want to start. This is, in formal terms, crazy. On one level, the only reason why we would tolerate this kind of craziness is that

[17] E.g. "A free-standing legal right exists in Article 17 of the Kyoto Protocol for developed countries . . . to use emissions trading as a policy instrument to assist them to meet their greenhouse target commitments" (Fisher & Beil, 1998). Note: the authors seem unconcerned to make clear what they mean by a *free-standing legal right*.

those who are beating their wives are very powerful and want to reduce the total amount of wife beating while still continuing to do it most of the time.

– If the idea is supported, then it will encourage investors to seek out industries that are engaging in harmful activity and maximize the harmful activity to maximize the property rights they will be given when the next harm is recognized. This approach rewards polluters, exacerbates pollution and creates perverse incentives for those who know about pollution to use that knowledge to the detriment of society.

I would summarize by saying that pricing is important to provide the right incentives and to avoid perverse incentives. There should be price incentives to use less water, to degrade it less, to return it to the relevant catchment, to improve the quality, and generally to re-use water during each cycle from sea, to rain, to sea. It is important that prices for carbon should also be set lest the demand for water does not end up favouring carbon intensive power.

It is clear that water has been underpriced and oversold (or generally *over given*). The answer is not to crystallize this mistake into a long standing property right. That would be a bit like finding that you have rented more office buildings than you own at a very low price and deciding that the answer was to give away the office buildings. Those who were given the rental in the first place may be very keen on this arrangement. The financiers who will make money by arbitrage may be very keen on the arrangement as well. Their enthusiasm is not an enthusiasm that a responsible government should share.

If a resource is underpriced and the price is increased, this provides a *windfall*. The question is who should gain the benefit of the windfall—those who have already benefited from the underpricing or the general community? If the windfall comes to the government through increased taxes or charges, the extra income can be used to either invest in increased supply or to reduce other inflationary pressures on the economy.

5.2 *Water privatisation*

There are many meanings of privatisation—based on the various functions that are performed by government departments and agencies that may be transferred into corporate hands. I will not argue that privatisation is either always wrong or never wrong. I would instead argue the following:

1. Careful consideration should be given to what should and should not be held publicly. To consider whether public ownership is more effective than non-government ownership, it is necessary to start by setting out the goals to be achieved and consider not only the best institutional means for achieving it but also the risks inherent in each alternative. These points are discussed more generally and fully in Sampford (1998).
2. Simplistic neo-liberal ideology is no better a basis for privatisation as simplistic *scientific* Marxism is a basis for nationalisation.

   The supposed elegance of markets should not cloud the difficulties of its application to water. One must avoid comparing an idealised version of the system you like with real versions of the systems you dislike. This is as foolish as contrasting the failings of contemporary capitalism and the communist ideal. We must look at *real* markets, *real* public companies, *real* government organisations and consider the ways in which they can be improved. There is no surer way of turning the debate into an ideological fight (and also lose the plot) than to compare the idealised version of the market-place with the reality of government or vice versa. In water we sometimes hear of an idealized market in water with the liquid flowing to wherever it is cheapest and of government waste and inefficiency. On the other side there are those who imagine civil servants unerringly identifying the public interest arrayed against a host of greedy vested interests and financial carpetbaggers. Perfect markets and perfect bureaucrats should be left to fiction and not public policy.
3. Natural monopolies are better held in government hands. There are particular problems in privatising infrastructure networks. These include water, gas, power, roads and telecommunications. The traditional approach has been to treat such networks as *natural monopolies*, in

that duplication is enormously expensive and thus makes competition inherently inefficient. Those who hail the value of private organisations and their goal of profit maximisation should recognize the simple point that profit maximisation may be achieved in three ways: increase in market share, cost minimisation and price maximisation. Of these, the one that involves the least work is price maximisation. Even if raising the price of water is part of the strategy, it is more desirable that the increased price should come to government so that it can either devote those resources to increase supply or to reduce other costs.

4. The existence of a natural monopoly in a network (of roads, pipes, transmission lines) is no reason to retain monopolies in areas that use that network (e.g. installation of telephones, bus companies). Accordingly, rivers, streams, major dams and the water distribution network should be publicly owned but other means of collections (including tanks), recycling (especially waster water plants) and production systems (such as desalination plants) can be privately owned.
5. There are costs involved in any change in ownership. Although those who benefit from fees may be keen to promote those changes, the cost of the change reduces the value that the government can gain from privatisation. Accordingly, the burden should not be placed on governments to justify why an asset should be kept in public ownership but the burden should always be on those who argue for change—and those who argue for change should always declare any personal or corporate interests that would be furthered by the change they propose.
6. There will always be risks in any change—including the risks that are not anticipated[18]. There may be knowledge asymmetry between governments and the private firms who negotiate deals on water privatisation and on the operation of water markets. This asymmetry is even greater when it deals with individual farmers—who also have less access to capital, less appreciation of risk and less capacity to handle such risks. A common problem is the tendency to under-price assets to ensure that the privatisation is a *success*. Politicians pushing privatisation are less concerned that the price be maximised than that the sale go through. In this they will be often aided and abetted by the underwriters who want to minimise their own risk.
7. There are greater opportunities for corruption in privatisation and its variants like BOOTs (*Build Own Operate Transfer*) and PPPs (*Public Private Partnerships*). The opportunities for corruption are usually confined to the annual revenue of the state. But there are much greater opportunities for corruption with the assets of the government that can be sold off during privatisation and higher still with the natural resources of the territory over which the state wields power. In Australia, Tony Harris, the former *Auditor General* of New South Wales opined that corruption was probably greater in Victoria in the 1990s (when there was massive privatization at the same time as a limited number of gambling licenses were issued) rather than Queensland in the 1980s (the *cause celebre* of Australian corruption in which corruption was found to go right to the Chief Commissioner of Police and the Cabinet. The greatest corruption scandal of the 20th century involved the Russian privatisations of the early 1990s—especially in the resources sector.
8. Privatisation may be an impediment to good policy choices, especially in a changing environment. The classic case is where a government contracts with a BOOT company to build a toll road. Any such contract will require the government to give undertakings not to build a competing road for free. However, it may well be that future traffic demand would suggest that the best policy was to build or upgrade another road. If the toll road is owned by the government, then it may decide to build the second road and accept the *loss* in asset value for the public benefit. If governments have to negotiate with the private owner, the latter may derive monopoly profits. If they do not have to negotiate with the private owner then the market is not operating (note that I have separate reasons for believing that tolls are not the best means of paying for new roads, see the next point). It could well be argued that property rights held by governments may

[18] Or as Rumsfeld put it: "there are things we know we don't know and there are things we don't know that we don't know". It stands as a reminder to avoid similar recklessness with lives, money and reputation.

be squandered. However, a government that cannot be trusted to use its assets effectively and efficiently probably cannot be trusted to dispose of them at an adequate price!

9. In some cases, it will cost consumers/taxpayers less if the government were to borrow to build a road, dam, etc. than to pay tolls. This will especially be the case in major infrastructure projects that require significant public participation in their governance.
10. Where significant human rights have to be protected, privatisation is less likely to be satisfactory. The classic example is corporately owned or managed prisons. The organisations that deliver the basic human rights to water are likely to be another.
11. One should not have higher hopes for the success of regulation in recently privatised areas than for regulation generally. One of the reasons why privatisation is so strongly supported is the imagined simplicity of purpose. Public sector organisations are seen as having to pursue a range of social and economic goals (creating employment, maintaining a national presence in key industries, sustaining local businesses, developing domestic technology, providing vocational training in high technology industries, decentralising industry etc.). This is certainly true of water policy which needs to take into account the human right to water, the supply of water to farms and industry, the importance of water to the survival of communities, environmental flows, and providing reserves against future droughts. Planning for such a range of goals is complicated; some goals contradict others and it is difficult to maintain accountability when the partial achievement of one goal may be used by managers to offset significant failures to achieve others (most notably, profitability). By contrast, corporations are seen as single-minded profit maximisers, simplifying both management and accountability.

However, if corporations are assumed to pursue a single goal of maximising profits (and it is unwise to assume that they will not), the means of pursuing other goals needs to be spelt out. This is usually done via a regulator tasked to preserve the public interest and prevent monopolistic practices. I have long been deeply skeptical about a privatisation process that involves disaggregating the multiple goals of public organisations and establishing separate organisations to pursue them, e.g. a privatised body seeking profits and a regulatory body to ensure that this new body pursues other goals. This may appear organisationally simple, with separate organisations determinedly pursuing different goals. Yet to me it appears to be a recipe for either collusion or conflict. At some point, the various goals have to be reconciled. The public sector model seeks to do this at the beginning rather than at an indeterminate end. Indeed, I find it remarkable that those who are keen on deregulation in other areas because of doubts about the effectiveness of regulation and the problems of regulatory capture are so happy to argue that regulation can be introduced to ensure that private monopolies operate in the public interest.

Overall, I would summarize by saying that the more the state has to be involved in the detailed governance of the activity, the less likely that there will be market efficiencies. The less involved the government has to be in the detailed governance of the activity, the more likely that privatisation can work. This involvement may be via regulation or via making commitments as to what it is going to do or not to do. If the activity has to be subject to extensive regulation and the government remains heavily involved, it will be difficult for the market to operate—at least in Australia.

6 GLOBALISATION AND WATER GOVERNANCE

Where states may be justifiably cautious about locking up water rights in private hands, they have generally been very keen to claim rights against their fellow sovereign states. States may claim rights over water that falls on sovereign territory or flows through sovereign territory. This occurrence provides the source of possible tension with the potential for war—though such potential is rarely realized with well watered agricultural territory being a more tempting target. The problem is that one state usually uses too much of the water for well watered agriculture and not enough is being given to the riparian state.

Geography and gravity regionalize most water governance issues—with issues arising where catchment areas cross state boundaries. The two most popular borders are mountain ranges and large

rivers—the one preventing and the other exacerbating potential conflict over water. However, the biggest issues tend to involve up-river and down-river states. One might say that, where sovereignty and gravity clash, gravity wins—unless there is a dam in the way (which is the main bone of contention—when the upstream state builds a dam or system of dams).

Between states, the arguments of *long user*[19] are likely to be most steadily promoted and least easily defeated. To national governments, the human rights of the citizens of other states are of much less interest than the rights of their own citizens. While they are increasingly critical of states who abuse the rights of their own citizens, they are slow to recognize the damage they do to the rights of citizens of other states. The Australian experience with non-sovereign states would suggest that agreement is difficult and imposed solutions are often unrealistic.

Large scale global regimes are unlikely to be the answer because water management has an essential local dimension to it. Global water governance in theory is moving toward an integrated approach. This has been formulated as a principle[20] and although not yet considered as established international law (ILA, 2004), it may be considered as soft law.

> "The New Delhi Declaration affirms the duty of states to ensure the sustainable development of natural resources, including the principle of equity, the goal of the eradication of poverty, the importance of the precautionary approach to human health, natural resources, and ecosystems, the principle of public participation and access to information and justice, the obligation of good governance, and the reality that the management of resources must take place in an integrated fashion. The *World Summit on Sustainable Development* in September 2002 adopted a similar declaration: the *Johannesburg Declaration on Sustainable Development*, A/CONF.199/20" (ILA, 2004).

But global water governance in practice, at least in the past, has been developing very slowly and in a few selected areas only. Left out of its sight is such elements of water systems as "waters not connected to a *common terminus*" (Hildering, 2004: 59). A serious exclusion, from the *Watercourses Convention*, is so-called confined groundwater. This "can result in the exclusion of important waters such as involved in disputes in the Middle East" (Hildering, 2004: 60).

It may be that global water governance issues might move beyond catchment areas if large scale desalination and pumping become financially and environmentally viable. However, it is hard to see this being effective for agriculture. Industry is more likely to move to where there is water rather than the other way around—and the same is likely to be true of agriculture, but while this may be possible for Australia and has been suggested[21] many states in the world have no such choice because of their geography. Desalination is likely to supplement water available in particular catchments and is likely to be second to recycling and efficient water use. However, water governance will often face interesting choices between capturing water before it drains into the sea and desalinating sea water. Again, it is critical that there be no perverse incentives through under-pricing of carbon in delivering water.

For many in the developing world, this discussion would seem to be quite arcane. The basic issue is not seen as water governance but securing basic access to sufficient safe water for domestic purposes. As Calaguas (1999) (*WaterAid*) put it starkly:

> "1,100 million people lack access to an adequate supply of water.
> 2,600 million people lack access to adequate sanitation.

[19] The Common law term for long term use that creates a right to continued use.

[20] See for example the ILA New Delhi Declaration, in which the principle of integration and interrelationship, in particular in relation to human rights and social, economic and environmental objectives are included (Principle 7) (ILA, 2004: 15).

[21] Australian Broadcasting Corporation TV Program Transcript Location. [http://www.abc.net.au/7.30/content/2007/s1851685.htm]; Broadcast: 19/2/2007.

> 1.8 million children die every year as a result of diseases caused by unclean water and poor sanitation.
> Close to half of all ill-health suffered by people in developing (sic) is caused by a lack of access to clean water and sanitation.
> Illness caused by unclean water or poor sanitation causes 443 million school days to be missed each year globally.
> African woman may walk over 6 km/day to collect water, spending as much as 8 hours"[22].

The *United Nations Water Conference* (1977), Mar del Plata, Argentina, emphasised a very basic water need, *access* to drinking water in sufficient quantities and quality for satisfying basic needs[23]. And to this very date although the language and terminology has moved to "ensuring sustainable access" or "actions in the field of governance agreed include securing equitable access to water for all people" access to water has still not been secured for a substantial part of the world's population.

This is in stark contrast to the conditions in which water law, water management and water governance emerged in the West. For example, water law started by adjudicating disputes between those with access to a river. *WaterAid* are talking about the rest of the world who do not have ready access to a river flowing by—conflicting interests that were not even contemplated by water law. One of the reasons is that the technical means for delivering the water to non-riparian users required public authority (even if wielded by non-state organisations from the local landlord to the international water corporation).

Yet the issues of access and governance are not really in opposition. I doubt that there are any countries which do not have enough water to meet the identified right to water for all its citizens. It is a question of deploying economic and political resources to deliver that water. Indeed, in many countries, the wealthy pay less for their water than the poor as the former receive reticulated water and the latter must fetch it or buy it from high priced water tankers. Meeting human rights is not so much a matter of capacity as willingness. Or to put it another way—the issue is not of scarcity but lack of governance. In the case of the poorest countries, some of the capacity will be in the hands of other wealthier countries—all they need is the will and the (good governance) way. Only good governance will deliver the human right to water. Bad governance will not.

Perhaps the biggest question in globalisation and water governance will be whether the developed nations will see developing nations as an opportunity for their less scrupulous companies to seize resources or as the home of human beings entitled to equal concern and respect and the possessors of rights to water.

To put it another way: are water rights something to be sought from corruptible governments at the expense of their people, or are water rights something that should be recognized as possessed by those people against their own governments? Certainly *International Human Rights Law* in the area of the *Right to Water* is decisively moving toward the latter. The *Right to Water* "received unprecedented attention at the 2006 *World Water Forum* in Mexico City", but it was "not mentioned in the *World Water Forum's Ministerial Declaration*"; rather "water was recognised to be of critical importance for sustainable development"[24]. But the *Right to Water* is still some way from being firmly established as a part of global water governance. The expense of moving water means that the exploitation will not be through the extraction of a valuable resource but through the ownership of those resources and the use of these without benefiting the people of the developing country and often at their expense.

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[22] Water Aid & Rights and Humanity (2003–2007).
Available at: [http://www.righttowater.org.uk/code/Policy_1.asp] (Accessed 25 September 2007).

[23] Water Aid & Rights and Humanity (2003–2007).
Available at: [http://www.righttowater.org.uk/code/Policy_2.asp] (Accessed 25 September 2007).

[24] Water Aid & Rights and Humanity (2003–2007).
Available at: [http://www.righttowater.org.uk/code/Policy_2.3.asp] (Accessed 25 September 2007).

The 2006 *World Water Forum* in Mexico City had "four sessions specifically devoted to discussing the right to water"[22]. The fourth session was on: *Securing the Right to Water: From the Local to the Global, Civil Society Perspectives*, and it focused on privatisation in the water sector. Maude Barlow (*The Council of Canadians*) stated that there was a *mighty contest* between civil society and development banks, transnational corporations and some governments, over access to water[25].

Such a *mighty contest* could be averted in a range of ways:

- Through the continued promotion of the right to water until it is firmly established as a right in *International Human Rights Law*. In fact "delegates at the Mexico City conference argued that the international community should adopt a binding international treaty that guaranteed that all members of humanity had a right to receive adequate, accessible, affordable and clean water".
- Through corporate codes of conduct.
- Through vigilance in enforcing the anti-bribery convention and the domestic laws that implement them.
- Through the principles of responsible investment.

This merely underlines the fact that, if water rights are to be secured for the 2,600 million poor, we will require all the techniques of good corporate governance as well as good public governance.

7 CONCLUSIONS

Despite being the driest continent, water and the governance of its distribution and use has only recently become a major issue in Australia. This is happening during a high point for market solutions in western countries with strong arguments being made for privatisation and for the creation of alienable and tradeable water rights. However, the particular nature of water should make us doubly cautious in adopting such an approach.

Water has been over allocated and underpriced—partly for political reasons. Those who had the benefit of this process are now reluctant to give it up and are arguing for property right in the benefits they have enjoyed for so long and want to treat it as vested rights. It is an argument for vested rights based on 'long user' principle that Australia did not accord its original inhabitants whose use had been for so much longer. It is an argument which sets, and partially follows, a bad precedent in creating property rights in unsustainable activities.

Traditional concepts of water rights owe more to John Locke's *labour* or *appropriation* theory of property. However, these were based on the assumption of abundance and the ability of the appropriator to leave *as much and as good for others*. This might be fine for an 18th century settler on Hudson River during John Locke's time. Taking water in Australia today will almost certainly *not* leave as much and as good. In the absence of abundance, there are choices and conflicting preferences. If it is taken for environmental purposes, it may make the water left better, but it will not leave as much. For most other uses, the use of water will diminish the quality and quantity of a water supply already severely compromised on both criteria.

Those choices will involve values. The market is not designed to make value choices but to reflect the value choices of market participants and the resources they command to secure those values. The starting point of market schemes may involve very large transfers of wealth from some groups to others and large windfalls to those who had previously engaged in unsustainable activities and to those who will gain from fees in setting up the market and brokering the transfers—and/or using greater knowledge, greater capital reserves, a better appreciation of risk or a better ability to handle that risk.

[25] Water Aid & Rights and Humanity (2003–2007).
Available at: [http://www.righttowater.org.uk/code/Policy_5.asp] (Accessed 25 September 2007).

The one-size-fits-all economic solutions are an inadequate response, based on a view of governance that is centered on the discipline of economics. What is needed is an interdisciplinary approach to governance which accepts and absorbs the insights of economics but also reflects the insights of ethics, law, environmental science and political science. We will then have a greater chance of realizing that governance is not just about markets, rights are not just about property, and globalisation is not just about the globalisation of property and markets.

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CHAPTER 5

Ethics and uncertainty in Integrated Water Resources Management with special reference to transboundary issues

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ABSTRACT: The chapter examines selected ethical questions related to uncertainty, which affects most of our decisions and actions in the area of water resources management. After a brief discussion of environmental ethics categories, it discusses the essence of *Integrated Water Resources Management* (IWRM) approach. IWRM is embedded in the context of sustainable development and thereby implies long-term management of water resources. The long-term aspects of IWRM are related to the issue of intergenerational equity. Difficulties in projecting uncertain future and possible needs of future generations are briefly discussed. The applicability of cost-benefit analysis and the related discounting are brought under review. Last part of the chapter is concerned with some ethical issues and uncertainty in transboundary water management. The fundamental ethical problem is how to induce countries to adopt a cooperative approach. The chapter makes the point that we will always have a degree of uncertainty no matter how much we increase our knowledge and we must learn to live with different categories of uncertainty in water resources management and make our decisions in view of these uncertainties.

Keywords: Ethics; Uncertainty; Water Management; Intergenerational Equity; Discounting

1 INTRODUCTION

At the end of the 19th century, Professor Wladyslaw Bortkiewicz, a well known economist and statistician, defined the probability of an accidental death by being kicked by a horse in the Prussian cavalry. He gained fame and the university chair, and many of his followers took it is a proof that we can foresee future events, at least in probability terms (Kozminski, 2005). But the horses in the Prussian cavalry were not so skittish, while the world is much more! It is enough to glance through the history of the last 100 years, which brought about a number of events completely unforeseen, and what's even worse, quite often came as a total surprise.

We have to recognize that we will always have a degree of uncertainty no matter how much we increase our knowledge, and we need different strategies for dealing with different types of uncertainty. There are many ways to deal with uncertainty. We have to learn to live with uncertain events, which are observed frequently but cannot be fully predicted. We have to live with the uncertain states of nature, which are stochastic in nature and cannot be resolved by too short and too few observations. Finally we have to prepare for unanticipated events, which may strike in a surprising way.

The purpose of this chapter is to examine some ethical questions related to uncertainty, which affect most of our decisions and actions in the area of water resources management, with special reference to some transboundary issues. We shall be especially concerned with integrated water resources management (IWRM), understanding that this well known acronym covers planning, developing, managing and operating water resources systems. As pointed out by Loucks & van Beek (2005):

> "... The success and performance of each component of a system often depends on future meteorological, demographic, economic, social, technical and political conditions, all of

> which may influence future benefits, costs, environmental impacts and social acceptability. Uncertainty also arises due to the stochastic nature of meteorological processes such as evaporation, rainfall and temperature. Similarly, future populations of towns and cities, per capita water-usage rates, irrigation patterns and priorities for water uses, all of which affect water demand, are never known with certainty."

In the years 1998–1999, the UNESCO's *Working Group on the Ethics of Freshwater Use* under the Chairmanship of Professor R. Llamas, looked at a wide range of topics related to the ethical management of water resources such as natural and man-made disasters, food security, industrial water uses, human health and sanitation, ecology, water institutions and financing, markets and pricing, the special role of women, challenges of technology, water resources conflicts and several others. In 1999, the *World Commission on the Ethics of Scientific Knowledge and Technology* (COMEST) established a *Sub-Commission on the Ethics of Fresh Water Use* under the Chairmanship of Lord Selborne. The Sub-Commission resolved that rather than analyze once more the ethical issues of water management, it should promote best ethical practice. Most of the papers produced so far by the members of the above mentioned Working Group and Sub-Commission are already published under the *International Hydrological Programme* of UNESCO in a *Series on Water and Ethics*. These publications make it clear that ethical issues are imbedded in all aspects of water management decisions. But ethical values take different forms under different ethnic and religious viewpoints – cultural diversity is an important factor, which always must be recognized in judging what is ethical and what is not (Delli Priscoli *et al*., 2004).

Before going to the essence of this chapter, probably it is justified to glance through different categories of ethical approaches (Warren, 2004). The normative ethics is divided into three groups: utilitarianism, in brief the *greatest good to the greatest number over the longest period of time*, deontological (duty) ethics, which is based on the notion of duty rather than on outcomes or consequences, and virtue ethics, focusing on the attitude of individuals rather than general notions of right and wrong or desired outcomes.

The environmental ethics categories which all can be justified against one or more of the normative ethics outlined above are: *anthropocentrism* which places humans at the center of any concept of morals or ethics, *non-anthropocentric* individualism which attach moral considerations to animals, plants and, in extreme cases, the non-living environment, and *ecocentrism*, which depend on the notion that all life is interdependent. Since the Earth is divided into four spheres: hydrosphere, atmosphere, lithosphere and biosphere that includes all three former environmental ethics categories in which life exist, to the author of this chapter, most appropriate is combination of anthropocentric and ecocentric perspectives in which humans are seen as a part of the environment.

The chapter has four parts. First, the IWRM concept, as a way to ensure equitable, economically sound and environmentally sustainable management of water resources, is discussed with a special focus on the sustainability aspects of IWRM. The second part of the chapter is concerned with the question of how uncertainty affects our ethical responsibilities towards the future generations. To what extent we can be held responsible for activities that inflict risks on our descendants? In the third part, ethical aspects of transboundary issues in water management are discussed. Transboundary water issues assume importance since most of the world's population lives in areas that cross national boundaries. Finally, the chapter concludes with few observations on the role of ethical appeals in the current, unfortunately not so ethical, world.

2 INTEGRATED AND SUSTAINABLE WATER RESOURCES MANAGEMENT

According to *Webster's Dictionary*, the need for integration arises when we deal with a situation of a "regularly interacting or interdependent group of items forming a unified whole". Integration, then, is the *art and science* of blending these items into a whole. But how much integration is needed in a given problem situation is an open question. The scope of integration must always

be carefully thought through. Those who are involved in water resources management know that integration by itself cannot guarantee development of optimal strategies, plans, or management schemes.

Integrated Water Resources Management (IWRM) is not an entirely new concept. In 1958, almost 50 years ago, the UN *Department of Economic and Social Affairs* published report on *Integrated River Basin Development*. In 1970s, there was a series of UN-sponsored studies of integrated water management, such as *Comprehensive Development of the Vistula River System* in Poland and *Integrated Development of the Vardar/Axios River Basin* in former Yugoslavia and Greece. These studies were landmarks in the development of integrated water resources planning methodology.

The IWRM, as it is known today, is based on the *Dublin Principles* drafted in 1992 at the Dublin Conference on *Water and Environment* (a preparatory meeting for UNCED focusing on water in the context of sustainable development). Few months later, IWRM was proposed as a specific program area for the freshwater sector in *Chapter 18 of Agenda 21* (UNCED, 1992). In this document, IWRM is based on the perception that water is a natural resource, and is both a social and economic good. Therefore, it is asserted that "in developing and using water resources, priority has to be given to the satisfaction of basic needs and the safeguarding of ecosystems". Four specific objectives to be pursued by IWRM have been formulated as:

- Identification and protection of potential sources of freshwater supply that integrates technological, socio-economic, environmental, and human health considerations.
- Sustainable and rational utilization, protection, conservation, and management of water resources based on community needs and priorities within the framework of national economic development policy.
- Design, evaluation and implementation of projects and programs that are economically efficient and socially appropriate within clearly defined strategies, based on full public participation.
- Strengthening, in particular in developing countries, of the appropriate institutional, legal, and financial mechanisms.

Although there are many definitions of IWRM, the one proposed by the *Global Water Partnership* is best known (GWP, 2000):

> "IWRM is a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems".

Although IWRM is the current buzzword of water management, several comments have been made that indicate that the concept should not be treated in a dogmatic way. Already in the late 1980s, it was noticed that the "progress in adopting an integrated approach has been hesitant and unsystematic, in part because of the absence of suitable models for implementation" (Mitchell, 1987). Similar doubts were expressed few years later by Kuijpers (1993) who observed that in the Netherlands, the strategy of IWRM is mainly a policy at a strategic level. The gap between integration at a strategic level and the operational level is still large. According to Kuijpers, the IWRM approach cannot be achieved and implemented in a fragmented institutional setup, which includes several largely autonomous and poorly coordinated administrative bodies. In fact, this comment agrees fully with the current opinions on the importance of institutional arrangements (governance) for practical implementation of IWRM concepts.

But fragmented and shared responsibilities are a reality and likely to persist at the global, regional, national and even local levels. Thus, "rather than stress the degree of fragmentation which exists between the large list of agencies" it is more productive to concentrate on "an assessment of the adequacy of the coordinating mechanisms" because this is "the crucial test of institutional adequacy" (Kellow, 1985). Indeed, there are many examples of agencies that have been merged but nothing has really changed; similarly, there are several examples of problems transcending

boundaries of specific water agencies, but they are well handled because of the effective coordinating mechanisms. The country-specific character of integrating and coordinating mechanisms should always be taken into account. Each nation should be developing its own version of IWRM that is best suited to its climatic, social and economic characteristics – to its tradition and culture. Like the notion of *sustainable development*, IWRM should be interpreted differently in different countries, according to the stage of development.

There are many critical challenges that an effective IWRM program must seek to meet. To mention just a few, they include water supply to the poor, the maintenance of human health and sanitation, preservation of healthy ecosystems, water quality improvements, reuse, recycling and use of low quality water, a shift from supply-oriented to demand-oriented water management and the use of water resources in relation to social and economic activities and functions. They are discussed elsewhere, among others by Kindler (2000), and their ethical implications are illuminated in the Report of the UNESCO *Working Group on the Ethics of Freshwater Use* (Llamas & Delli Priscoli, 2000) and in the reports published by UNESCO in the *Series on Water and Ethics*.

In the context of this chapter, special attention is given to the relationships between IWRM and the sustainable development, which implies managing for the long term (Loucks *et al*., 2000). The *Brundtland Report* of 1987 defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". To avoid impeding the "ability of future generations to meet their own needs" requires prediction of their future needs. Is that possible? Considering accuracy of historical predictions of our today's needs, predicting the needs of generations yet unborn, and to provide for them, is to large extent *mission impossible*. What we can do, however, is to manage water more equitably and do it in the ways which ensure that water resources and related ecosystems on which humanity depend will continue to thrive. But when the design life of a project is several decades if not centuries, future generations are the clients who really benefit of our efforts, and who ultimately pay the cost. To what extent water managers have ethical obligations to design our projects for the benefit of our descendants? If so, how do we balance our responsibility towards today's taxpayers with our obligation to consider the long-term well being of tomorrow's customers?

In water resources management usually cost-benefit and risk-benefit analyses are used to determine if action will be taken. Normally action is taken if benefits outweigh costs or risks. But should always benefits outweigh costs? As stressed by Kelman (1982) "in areas of environmental safety and health regulation, there may be many instances when a certain decision might be right even though the benefits of that decision do not outweigh the costs". In addition, in both cases of cost-benefit and risk-benefit analyses, it is needed to compare, using a common metric, the near-term costs with sometimes quite distant benefits. This creates a problem of placing the monetary value on things not normally bought and sold on markets and to which no monetary price is attached. Referring again to Kelman (1982), "there are a number of reasons to oppose efforts to put dollar values on non-marketed benefits and costs, beyond the technical difficulties of doing so". The ethical dimensions of such issues are obvious and we must remember that the multi-criteria decision making, involving trade-off analysis, does not provide a complete answer to similar doubts as well.

In other words the question remains, how much we are willing to sacrifice today for benefits that will accrue later in our lives and in the lives of succeeding generations. In the case of such long-term ramifications, analysts employ discount rates to compare present and future costs and benefits and/or risks. But for any reasonable discount rate (i.e. above 2% or so per year), what happens a century from now hardly counts at all. The reason is the power of compound interest, which does discount a distant-future worth of goods and services into almost nothing as measured by today's money (Arrow, 1999).

Thus, although *sustainable management* is rational and morally well justified, we have to recognize in IWRM that even our best intentions to preserve and enhance the current state of natural environmental resources for future generations are always clouded by uncertainty. In fact, we need more than *preservation* and we should rather try to balance traditional human values with the new technological advances remembering that water is not only a means to other goals but it is also

important as an end in itself (Llamas & Delli Priscoli, 2000). The next part of the chapter puts some light on the issue of intergenerational equity, in the context of sustainable development and management of water resources.

3 THE ETHICAL ASPECTS OF INTERGENERATIONAL EQUITY

Intergenerational equity is often defined as the balance between present and future generations based on justice and fairness. In other words, referring to the original *Brundtland* formulation, each generation holds the natural environment on trust for future generations. Still, in the literature there are competing views on what it means, and what exactly it is that needs to be sustained for the future generations. In this context, the Nobel laureate Thomas Schelling makes an interesting point, arguing that intergenerational equity needs to account for the likelihood that future generations (particularly in the developing world) are likely to be significantly wealthier than current generations. But does being *wealthier* also mean that they will inherit a wealthier natural environment?

There is a general agreement that intergenerational equity is an ethical and not a legal principle. But still the principle alone does not help much if there is no guidance on how to implement it. Thus, how should we measure fairness? How do we know what will be the needs or wants of the future generations? How far into the future should we look (Warren, 2004)?

The well-known international lawyer Brown Weiss (1992) suggested that there are three fundamental principles of intergenerational equity:

a. The principle of conservation of options, which requires each generation to conserve the diversity of the natural and cultural resource base so as not to restrict the options available for future generations.
b. Conservation of quality, which means that each generation should pass on the planet in no worse condition than it found it.
c. Conservation of access, which provides that each generation should provide its members with equitable rights of access to the legacy of its predecessors and should conserve this access for the future.

Just to show a bit of the ongoing debate, Alder & Wilkinson (1999) challenge the above principles stating that intergenerational equity should be seen as an example of virtue ethics—that we feel a gratitude towards our predecessors and so we should feel a paternalistic responsibility for future generations. They identify four main problems with intergenerational equity, which make it difficult to achieve sustainable development. The first problem is identifying whose future we are talking about and how we are to apportion benefits and costs. The second and third problems relate to the form of sustainable development that is sought. Should each generation pass on the same suite of environmental goods to the future, or just the resources equivalent to the stock used by the specific generation? Finally they note the fourth problem, which sounds a bit like a joke, that the present generation is always likely to be worth more than any future generation.

It's interesting, however, that the last problem mentioned by Alder & Wilkinson echoes in other works. For example, Arrow (1999) quotes several authors who claim both empirical evidence and theoretical arguments that individuals recognize moral arguments for the far future but treat themselves and the near future better. To quote Arrow: "this approach leads to a non- cooperative game, in which each generation is somewhat selfish (compared with perfect morality) and recognizes that future generations will be similarly selfish". So are all generations equally selfish?

Going back to the first one of three questions mentioned above—how should we measure fairness? A major problem is that what constitutes fairness is difficult to define, and a matter of ethical and moral judgment. We know, however, that this is a central motivating force in our private and public lives. It is deeply enmeshed with questions who pays, who gets, and how the outcome is distributed (Campbell & Marshall, 1999). In the case of water resources management, it is concerned with the ways in which water and access to water and water-related services are

divided. Equality, justice and social change all have their roots in our perceptions of fairness. It arises early in childhood, "when it is echoed in the familiar cry of—that's not fair" (Mack, 2006).

The next question is: do we know what will be the needs or wants of future generations? We know that even our best intentions to provide for the future are constrained by the difficulty of predicting long-term needs and this affects of our current decisions. In this regard an important medical standard is usually adopted that says: *first, do not harm*. All major interventions in the nature, like long-distance inter-basin water transfers, must be treated with great care. We must also be careful proposing certain cost-saving measures that sometimes result in increased risks. But by recognizing that the world of water is changing and complex, the best hope for new insights and strategies lies in pooling our individual perspectives and experience. There are several examples of scenario building, among others the *World Water Vision* presented at the 2nd *World Water Forum* in 2000 and WBCSD scenarios (2006) that do not only acknowledge uncertainties but also try to clarify and enhance our understanding of the future. One thing is certain, that future cannot be ignored.

Finally, how far into the future should we look? In 1999, some of the world's foremost economists (Portney & Weyant, 1999), agreed on a standard cost-benefit procedure for the evaluation of projects with timeframes of forty years or less. They have agreed that for such time horizons, it is appropriate to discount costs and benefits to make present value comparisons and the discount rate should correspond to the current opportunity cost of the capital. Beyond these time horizons, however, the views were not so unanimous. One of the propositions was the possibility of a discount rate that was not constant over time, based on the observation that people do attach lower weights to the distant benefits and that they do not use a constant exponential discount rates. The longer the time period before the effects are felt, the lower are the implicit discount rates proposed. But using such discount rates is not without problems. It may lead to time-inconsistent plans, which will not be followed because future generations may decide to reconsider their actions. Finally in the presence of significant intergenerational effects (for example climate change), *mock referenda* were suggested through which willingness-to-pay of the present generation to reduce the risk of future generations would be elicited. However, those who participated in that discussion came to the conclusion that there will always be differing views on the appropriateness of discounting in the context of sustainable development analyses.

One of the most interesting examples of real-world water studies with intergenerational equity issues explicitly taken into account is *Water for the Future* carried out in the second half of the 1990s by the *Committee on Sustainable Water Supplies for the Middle East* formed under the Chairmanship of late Professor Gilbert White by the *U.S. National Research Council*, *U.S. National Academy of Sciences*, *U.S. Academy of Engineering*, *U.S. Institute of Medicine*, the *Royal Scientific Society of Jordan*, the *Palestine Health Council*, and the *Israel Academy of Sciences and Humanities* (Committee on Sustainable Water Supplies for the Middle East, 1999).

Sustaining the freshwater resources of the Middle East is one of the most difficult water management problems in the world. Adequate water supplies to meet basic human needs are essential to maintain and enhance the welfare of all the inhabitants of the region. For the present generation, water-related concerns primarily focus on the distribution of the resource within the society and the preservation and protection of water quality. For future generation, additional concerns will be to ensure adequate water supplies and preserve the quality of the environment, in addition to achieving greater equity in the distribution of water throughout the area.

The study was guided by five fundamental criteria: 1) The view taken should be regional; 2) the demands and needs of both present and future generations must be taken into account; 3) all options should be considered for balancing water supplies and demand; 4) the maintenance of ecosystem services should be viewed as essential for achieving sustainability of water resources; and 5) the close relationship of water quality and quantity should be clearly recognized. To quote the study report:

> "There is an important concept embodied in the terms sustainability and intergenerational equity—the idea that the present generation's children and grandchildren should have at

least as much ability to use a resource as does the present generation. Intergenerational equity includes the sustainable use of water resources".

The study area includes West Bank and Gaza Strip, Israel and Jordan. Most of the study area receives less than 250 mm/year of rainfall. It has approximately 12 million inhabitants, which already live under significant water stress. The population is likely to grow, economic development is badly needed in some parts of the area, and the water stress may significantly increase in the near future. The environmental considerations (including ecosystem preservation and enhancement) in the study were not an adjunct to planning for sustainable water supplies, but a major and essential component of the planning effort.

Achieving intergenerational fairness implied the need for a variety of management measures including monitoring the quality of water resources, scientific and technological research and development (R&D) efforts to make more efficient use of available resources; protection of water resources against their contamination and degradation; intergenerational assessments of the effects of particular projects and uses; effective maintenance of capital investments, such as municipal sewage treatment plants, water delivery systems and environmentally friendly barrages; protection of watersheds and aquifer recharge areas by appropriate land use planning and systems for sharing the resources equitably among communities. Although new technologies hold some promise for increasing water supplies, none currently appears to be cost-effective and ready for large-scale application.

Among several key questions considered when choosing among various water resources planning options were such as *what are the implications for present and future generations?* and *will the current generation's access to resources be conserved for future generations?* It is interesting that these questions correspond well to the above listed principles of Brown Weiss (1992).

Given the rate of population growth, special attention was given to water conservation measures in all three major sectors of water use—urban, agricultural and industrial. Pricing policies that encourage conservation were carefully considered.

The study briefly outlined above provides a good illustration what it means by taking care of intergenerational equity in the real-world water management planning efforts. It should be noted that the word *ethics* has not been used even once in the study report, but the ethical aspects of the problems being studied are obvious and of great significance.

4 THE ETHICAL ISSUES IN TRANSBOUNDARY WATER MANAGEMENT

The past few decades have seen a period of rapid water resources development in many parts of the world. As demand for water grows, there is an increasing need to develop water resources shared by two or more countries, which so far could not be developed in an integrated fashion because of inherent political and legal complexities. In such cases, appropriate linkages must be developed between laws of nature and laws of humans, ensuring that these laws are compatible and mutually reinforce each other.

Moreover, in many transboundary river basins specific water uses such as hydroelectric power generation, navigation, or discharge of wastewater have induced the decline of other valuable functions, such as fishery, maintenance of aquatic ecosystems, etc. The ethical aspects of such problems are of particular importance since customary international law is of limited use. This is because planning of shared water resources development and protection cannot be regarded as a generally accepted obligation of sovereign states. Moreover, the *political feasibility* of plan implementation is usually of overriding importance in transboundary river basins. Depending on the political circumstances, some alternatives may be simply impossible to implement, in spite of the fact that international cooperation between riparian states is needed for ethical reasons. Such needs become fully apparent when the decreasing water quantity and/or quality are threatening human existence and health.

The IWRM is not an easy task in the transboundary basins. The shortcomings of conventional concepts and management approaches have been identified by the international community as (Falkenmark & Lundqvist, 1999):

- Prevailing approach to water management puts more stress on allocation between different sectors rather than on upstream/downstream transboundary interdependencies and interaction.
- The predominant water management approach tends to be piecemeal, which lacks proper co-ordination and integration—the lack of understanding of interactions between land and water is especially acute in the transboundary context.
- The focus often is on water supply with much less concern for what happens to water after it has been used.
- The technologies being used are often inappropriate for the conditions of a given basin—there is a lack of access to simple and low-cost clean water use technologies.

All these shortcomings are especially difficult to deal with in the transboundary river basins where solidarity for water continually confronts humans with their upstream and downstream interdependence. But the nationally fragmented water resources management without considering the river basin *in toto* is a short-sighted policy which eventually can result in nothing but a worse situation than before. In this context, tradeoffs between short-term gains and long-term losses should always be considered.

As the demand for water increases, unilateral exploitation of shared water by one country often becomes an area of major conflict between the countries concerned. For example, the Ataturk Dam on the Euphrates has a potential to transform part of the Mesopotamia's plains, and Turkey's downstream—the downstream neighbours are worried. Jordan and Israel chronically overuse the Jordan River flows, and consequently the level of the Dead Sea is dropping. Another example is the well-known dispute between India and Pakistan over the use of the Indus River and its tributaries. In principle, all international water resources ought to be shared and used in a reasonable and equitable manner by the countries sharing those resources. But what is *reasonable and equitable sharing?* It is an ethical question similar to the one discussed earlier: *what constitutes fairness?*

Sharing water resources in transboundary basins is difficult for several reasons. First, water projects are capital intensive and allocation of their costs and benefits to individual states is as a rule subject to difficult negotiations extending often far beyond the realm of water management. There is no reliable and generally acceptable methodology for the solution of transboundary allocation problems. Second, the national water laws differ from one country to another. Third, the international water laws are still far from being fully developed and universally accepted. The 1997 UN *Convention on the Law of the Non-Navigational Uses of International Watercourses* undoubtedly constitute a major advance in international water law, but it still does not resolve some of the most fundamental problems (among others, water quality aspects are not treated adequately).

There are two basic options, which can be pursued in the transboundary river basins: autarkic water development or development of water resources in cooperation with co-riparian states. From the economic, social and ethical points of view, the first option is highly undesirable. Moreover, problems like flood risk management cannot be effectively solved by the efforts of the lower riparian only. But in spite of the fact that autarky in water resources management is not desirable, it may be inevitable because relations between sovereign states are not always governed by rational (not to mention ethical) considerations.

Basic problem facing all countries is to allocate limited water resources to a variety of different water uses in such a way that the net benefit to society is as large as possible. But remembering the earlier comments about the cost-benefit analysis, we have to recognize that the international river basins present a remarkably wide spectrum of different situations. They may include some of the richest and poorest nations in the World and transboundary diversity of social and economic conditions must be fully recognized. The three major goals of most countries are economic development, equitable distribution of income per capita, and social stability. There is much debate as to which of these three goals are most important and how they are best pursued once a reasonable consensus is reached on the best mix of them.

The problems related to development of transboundary river basins should always be taking into account that in most cases there are some effects of water projects (or non-water projects affecting water resources) that do not impose a cost or confer a benefit within the boundaries of a single nation. For example, a project in a rural area may draw labor from a neighbouring country, thus increasing earnings across the border and giving rise to a reverse flow of workers' remittances. Externalities affecting aquatic environment arise also when connection between sovereign nations is made through a natural system. Transboundary water pollution is a familiar example. All such external benefits and damages accruing to, or costs imposed on, other countries, should be taken into account.

In practice, international agreements arrived at through negotiations are the usual devices for dealing with water resources problems involving more than one country. The earliest use of such agreements occurred to deal with boundary problems and navigation and fishing rights in the boundary waters. Other agreements may be grouped into four general categories: a) water allocation; b) water quality management (pollution control); c) flood management; and d) integrated water resources management.

To conclude, water resources planning and management should extend beyond political and administrative boundaries, but political realities cannot be ignored. The fundamental ethical problem is how to induce countries to adopt a cooperative approach. One of the possibilities is that countries which receive positive net benefits if the agreement is concluded, may provide incentives in form of side-payments to those whose net benefits would otherwise be negative (Maler, 1989). But international relations occur at many levels and in many functional areas, water being just one of them. As an alternative to side payments, linking international water problems to *non-water* international problems in which the net benefits are reversed may also induce cooperation.

5 CONCLUDING REMARKS

The need for more integrated approach to water resources management is evident. This arises from the "widespread scarcity, gradual destruction and aggravated pollution of freshwater resources in many world regions" as pointed out already 15 years ago in the *Agenda 21* document of the United Nations which calls for "integrated water resources planning and management". The fragmentation of responsibilities for water resources management is still a reality in many countries of the World. This chapter is especially concerned with ethics and uncertainty in integrated water resources management, with a special focus on transboundary issues. The aim of this chapter was to consider more closely how uncertainty in water resources management affects our ethical responsibility towards current and future generations.

Practically all our decisions and actions in water management are surrounded by uncertainty and the problem extends over all spatial and temporal scales. This is evident in the current discussions on human and environmental risks related to extreme hydrological events (floods and droughts) and global climate change. But uncertainty is also high on the demand side of the water equation. This is especially evident considering that the notion of IWRM is strongly embedded in the concept of sustainable development, which implies managing for the long term. Considering accuracy of historical predictions of our today's needs, predicting accurately the needs of the future generations is to large extent *an impossible* task. But there are some principles to which we should try to adhere. For example, we adopt the medical standard: *first, do not harm*. All major interventions in the nature, like long-distance inter-basin water transfers, must be treated with great care. We must also be careful in proposing some cost-saving measures that sometimes result in an increased risk.

The issue given special attention in the chapter is that of using the present value criterion for project choices involving distant time horizons. The question is whether this criterion can be used at all and what should be the discount rate used in the analysis. There is a general agreement that a standard cost-benefit procedure can be used for the evaluation of projects with timeframes of forty years or less and that the discount rate should correspond to the current opportunity cost of the

capital. Beyond these time horizons, however, the views are much less clear and more conceptual work is needed.

The uncertainty aspects are especially difficult to deal with in the international river basins where solidarity for water continually confronts humans with their upstream and downstream interdependence. The fundamental ethical problem is how to induce countries to adopt a cooperative approach. But international relations occur at many levels and in many functional areas, water being just one of them. Linking transboundary water problems to *non-water* international problems in which the net benefits are reversed may also induce cooperation.

Practical application of the IWRM approach in the national and international scales raises several questions related to the ethical issues. How should we balance different and often conflicting demands for water and water-related services? How should we deal with uncertainties related to inter-annual and seasonal resource variability (floods and droughts)? How should we enhance resource conservation? How should we deal with upstream/downstream water allocation issues, including those concerning allocation of transboundary resources? How should we sustain precious ecosystems whose integrity is often threatened by the unwise exploitation of water resources? How should we strengthen institutional capacities at different resource management levels and provide for wider public participation in decision-making?

The list of ethical challenges that confront water resources management today is much longer than that discussed in this chapter, and many of them will certainly be dealt with in this volume.

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CHAPTER 6

Water and ethics in food production and provision—How to ensure water and food security and equity into the 21st century?

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ABSTRACT: Water and ethics, especially its relation to food production and food security, is a relatively new topic that deserves more attention than hitherto given. For over a generation now, mankind has been struggling to feed the world's population. Though overall we have managed to keep apace with the rising demand, production increases are still needed and distribution distortions persist. This chapter contributes to the ethical debate on how to address the on-going quest for safe and adequate food production and provision, especially in the developing and emerging economies of the South, from a critical perspective of the North. The key message is that responsibility for ensuring food security in these countries, while not undermining the natural and environmental basis for it, has to be shared among multiple stakeholders and partners. Developed countries continue to have a huge influence on the conditions for water allocation, agricultural development, and food production and trade, through development assistance, international agro- and food business corporations, international food trade agreements, food consumption patterns, etc. All these areas should be governed by very high professional and ethical standards, so that developed countries become role models for less developed countries and thus pave the way for a just and sustainable world.

Keywords: Ethics; Water; Food production; Poverty; North-South cooperation

1 WATER AND ETHICS: WHAT IS IT? WHY IS IT IMPORTANT?

As the pressure on natural resources in general and water in particular becomes greater, it is clear that water will not be naturally and evenly available and accessible to a large section of the world's populations in the future. Moral codes, appropriate institutions and technologies which are established and implemented in a coherent and integrated fashion, are increasingly needed to ensure sufficient, adequate and equitable access to water. Ultimately all these would contribute to alleviation of poverty, hunger, malnutrition, and disease conditions afflicting billions of people today.

Water and ethics in this overall context deals with the moral obligations related to sharing the world's limited, but renewable, water resources. Such obligations can be expressed at various scales from global to local, and involves a multitude of stakeholders (including humans and their bio-physical environment). Attaining fairness or equity in access to water for various human activities while also preserving the natural environment is a challenging goal. The vastness of scales and *integratedness* also implies a great deal of complexity in achieving this goal.

Water and ethics is a topic receiving increased attention (Kindler, this volume) as it is being recognized that the deficiency in attaining the *Millennium Development Goals* (MDGs) with targets

[1] The views expressed are those of the author and do not necessarily represent the views or policies of GEUS or any affiliated organizations.

set for 2015 (UN Millennium Project, 2005), to a large extent hinges on the difficulties of breaking established power structures and privileges that ultimately defines rights and access to water and other resources. Bringing these aspects to the forefront of discussions may be controversial and difficult to deal with. However, being open about the realities and confronting the actual workings of the various systems at various levels and their political character and implications may prove to be more fruitful in the longer term than to work on idealized and theoretical assumptions of inherently *fair and logical* systems. This is, and should be, the premise of the present and on-going discourse on *water and ethics*.

2 WATER ENTITLEMENT AS A HUMAN RIGHT

Attention is increasingly being drawn towards defining access to a certain minimum daily volume of water, e.g. 20 L, as an established human right, along with other often constitutional rights, like health, education, etc. This move emphasizes the fundamental, but under-valued, role that water plays in human survival and development (Veiga da Cunha, this volume).

3 WATER ENTITLEMENTS FOR FOOD PRODUCTION

However, and in this particular chapter, it should be highlighted that water serves another very fundamental role and prerequisite for sustaining livelihoods and fighting hunger and poverty in many parts of the world, namely that of input to agricultural activities. A major fraction of the global population is engaged in small-scale subsistence farming enterprises which are totally dependent on water for economic benefit, and often for their mere survival. The amounts of water required in agricultural production systems (cropping, livestock, fishing) are, however, many times higher than the 20 L entitlement suggested as a minimum for drinking and hygiene purposes. Because of increasing overall demands, increasing water infrastructure and diversion of water from natural sources, often benefiting the more wealthy segments of the society in developing countries, ensuring appropriate access and entitlements to water for these activities for marginalized people becomes just as important as a mere minimum drinking water right.

It is estimated that 70–90% of developed freshwater supplies in developing countries are withdrawn to grow food. Incidentally, 75% of the 1,200 million poor people in the world depend on agriculture as the primary source of income. Finally, over 850 million people suffered from malnourishment in 2005 (Centre for World Solidarity, 2006).

Securing food supplies, maintaining food security and avoiding endemic hunger or hunger caused by natural disasters or recurring floods and droughts, are still high on the agenda among many developing countries where population increases still tend to outrun gains in food production and productivity. However, relying on farmers fending for themselves by virtue of simple and direct access to natural resources, as have been part of the strategy in the past, is no longer possible as the natural resource base is shrinking gradually and surely, and the poor farmers can no longer be *parked* in or translocated to *excess* natural areas in outskirts or borders of civilization. There is a clear and pending requirement for keeping stock and sharing equally and consistently the amount of limited natural resources available, including water. Small-scale farming in most cases, however, not only serves the purpose of sustaining the direct beneficiaries, the farmers and their families themselves, but also supports more or less thriving local economies and food supply chains that help communities persist. Hence, ensuring that poor farmers across the globe get a fair share of production water, along with suitable land resources, for their farming activities is vital for their sustenance and mere survival and should be a moral obligation along with drinking water entitlements proclaimed today in various fora.

In this chapter, focus is mostly on the ethics of water for food production and how it plays out on accessibility of water for agriculture for various population groups. There is a parallel and associated issue of how access to the food itself, i.e. the products coming out of food production in

agriculture (grains, other staple foods, meat, and fish) is available to poor people, through regular markets, food programs, emergency relief, etc. However, this topic is treated only in the passing.

4 WHOSE RESPONSIBILITY OR BUSINESS IS WATER AND ETHICS?

With the advent of the concept of integrated water resources management (IWRM) (Global Water Partnership, 2000), more focus was given to *the three E's* namely, *efficient*, *equitable* and *environmentally* sustainable water resource management. It is constantly being highlighted and advocated that water development and management should target the poorest and marginalized people (especially poor women) and preferentially ensure the coverage of their (fundamental) needs, in terms of access and entitlement to secure and adequate water. Despite increased attention and debate, there was relatively little documentation of case studies dedicated to analyzing the processes and factors that gave access to water to rural farming communities as a result of various development projects (Llamas, 2004; Renger & Wolff, 2000; Gupta, 1995; Repetto, 1986; Wade, 1982). The complexity and variability in socio-economic and political settings makes it difficult to compare across studies and extract general lessons on key factors for success. However, recently, dedicated research and documentation has taken place on the topic of equitable water access and specifically corruption in the water sector (Plummer, 2007; Plummer & Cross, 2007; Stålgren, 2006; Huppert, 2005). In 2006, the *Water Integrity Network* was established as an open network of interested partners working for the eradication of corruption in the water sector and is hosted by the *Transparency International* (O'Leary, this volume).

Relatively more attention has been paid to defining ways of making water development and management more efficient and environmentally sustainable (e.g. Comprehensive Assessment of Water Management in Agriculture, 2007; World Bank, 2005, 2006) while only marginally addressing the human justice aspect. This bias in approach may hinge on the fact that dealing with appropriation of resources and especially reallocation/redistribution among groups of beneficiaries may be very difficult and contested. However, attaining efficiency in water use and cost recovery in water services, though feasible in principle is often difficult to achieve due to inefficient governance structures present in many developing countries. It needs to be emphasized, that the *three E's* are highly interrelated and interdependent. For example, attaining environmental sustainability requires simultaneous achievement of social justice in the sharing of resources through the consent between various users. If this is not the case, natural resources are more prone to encroachment and degradation to fulfill unmet requirements of the poor or to consolidate power and increase profits for the rich.

Water and ethics in agriculture is, or should be, the business of the multitude of stakeholders and partners involved in developing and managing water resources for agricultural productive uses. Stakeholders include farmers and farmer groups at the local level, national policy makers, international developments banks and donors responsible for support to large scale water infrastructure and irrigation projects in developing countries. A point stressed in this chapter is that generally there is too little systematic attention to these aspects in international development projects where the focus still is biased towards structural interventions and economic and short-term efficiency criteria.

Another critical but partly overlooked factor involved in distribution of water and food resources on a larger scale is the international trade mechanisms and organizations, like *World Trade Organization* (WTO). Such organizations have a huge, albeit more obscure, influence on how food products and with them virtual water (Allan, 2001; 1998) are distributed and transferred between distant parts of the world. It is a key argument of this chapter that developed countries, through their strong influence on trade policies and on policies and strategies for development assistance, have a heavy responsibility for the security of water and food provisions to poor people in the developing countries. This point is largely disregarded in much of contemporary discussions on water and ethics in food production as well as in the discussions of the trade organizations themselves.

5 HISTORIC VIEW—SETTING THE STAGE

Within the 20th century, it became obvious and generally accepted that the world's resources are limited, in the context of satisfying a constantly growing global population. The short version of the story is that through massive attention and interventions from the 1960s and onward, especially through the development of intensive irrigated agriculture in the Asian countries, food production and productivity rates increased significantly to ensure sufficient food supplies to a growing population. As an example, India changed from being not food self-sufficient to being surplus producer of food in just a decade's time (World Bank, 2006). This epoch is popularly called the *green revolution* and was made possible through the introduction of high-yielding seed varieties, use of agro-chemicals (fertilizers and pesticides), and expansion in irrigation facilities.

Today, at the beginning of the 21st century, the world's population continues to grow, but at a slower pace and with the prospect of leveling off during the present century at between 9,000 and 11,000 million (University Corporation for Atmospheric Research, 2007). Against this backdrop, the challenge of this era changes from one of feeding a growing population to one of ensuring nutrition for all, securing equitable share of safe water and food supplies, catering to demands of more affluent populations with a varied diet comprising of meat, milk, fruits and processed foods, and balancing the dual menace of obesity in one part of the world and continued under and mal-nutrition in other parts. It is also a question of addressing the threats of climate change and greater (potential) impacts of natural disasters and political unrest and how they play out on water resources availability, land and water access and socio-economic and political options for agriculture. Urbanization is yet another strong present-day factor that will continue to influence the distribution of people and human resources into the 21st century (World Bank, 2007; Dooge *et al*., 2004). All these factors make continued intensification of agriculture a necessity and the challenge is to achieve this while maintaining environmental sustainability and ensuring appropriate and ethical access to water and food for all. While sustaining and upgrading subsistence farming for marginalized groups, it is also necessary to invest in more profitable and intensive cultivation, especially close to cities. Diversification and specialization in crops and products are also required in combination with modernization and expansion of market chains. Such strategies may cause a polarization of farmers, into first and second class farmers. However, diversified and adapted context-specific strategies and reassessments are needed as external conditions change.

Another contemporary trend with ramifications on food production on a global scale is the apparent protectionism of wealthier states, which in turn generates a polarization of states, or parts of the world, between a wealthier (developed) part and a poorer (developing) part. This may be a simplification of the vastness of characteristics between, and even within, states, but serves to illustrate the fact that wealthy states to a large degree manage to control global resource access and economic progress in less developed states, through the setting of international trade prices for commodities, including basic food prices (e.g. of rice and wheat) and setting rules for immigration. The latter results in supporting a *brain drain* from developing countries to developed countries, and thereby causes skewness in access to specialized human capacity—a fundamental driver in development.

6 THE *ALTERNATIVE FOOD PYRAMID*

Food, food production and food consumption have many connotations to various people, depending on their role and association in a social context. This can be illustrated in the alternative food pyramid (Figure 1), showing that the perception of food may range from a sheer source of survival for people, e.g. those afflicted by natural disaster conditions or civil unrest or involved in food-for-work programs, to that of being a source of pleasure and a part of social norms and status in affluent societies. This pyramid, which resembles the more well-known food pyramid of recommended intake of various foods (illustrating that stable foods at the bottom should be eaten in largest quantities while higher protein-containing food items, like meat and fish at the top should be eaten

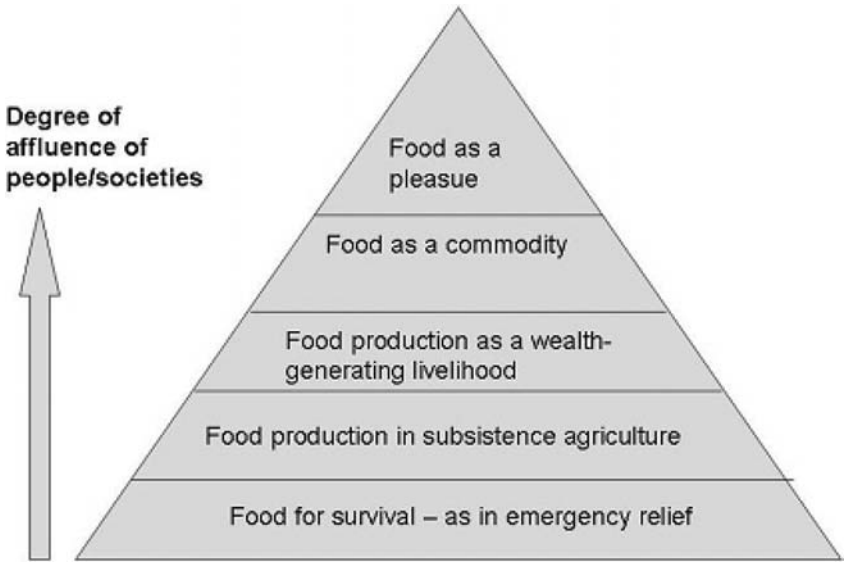

Figure 1. The alternative food pyramid.

in the smallest relative quantities), rather focuses on the social aspects associated with access to or choice of food. That the people at the bottom of the pyramid tend to eat more stable foods while people at the top consume more meat enhances the resemblance of the two pyramids. Furthermore, the fact that still a majority of the world's population belong to the lower levels of the pyramid and only a minority, people in developed countries or the wealthy minorities of the developing countries, belong to the top is emphasized by the triangular shape and the decreasing sizes of the stacked boxes.

The alternative food pyramid is brought forward here to emphasize that *food* is linked with a wealth of meanings and especially the disparity between the rich and the poor part of the world is striking. It is argued in this chapter that these incongruent perceptions may be important in explaining why the topic of ethics in water and food receives relatively little attention among the general public in the Western (affluent) part of the world. Firstly, food is not associated with social access and distribution issues in the West, and secondly, and because of this, people feel little relation with and responsibility for the inequity of access in other parts of the world, and in essence on a global level, of which they themselves are a part.

7 THE SCALE ISSUES AND EXAMPLES OF MECHANISMS HAMPERING EQUITY IN WATER AND FOOD

7.1 *Global scale*

Globalization is an accepted concept now. However, it means different things in different contexts. With respect to ethics in water and food, it means that equity issues expand and range from the local to the global level, and the challenge is to solve the present inequity issues at all scales (Dooge *et al*., 2004).

7.1.1 *Virtual water*

Virtual water has been part of the theoretical and academic discourse when it comes to finding solutions to the problems of geographical water distribution not matching water demands in many

parts of the world (Allan, 2001; 1998). The concept is simple and appealing: water-scarce countries alleviate the stress on their water resources by importing foods (from more water-abundant countries) that require large water quantities for their production rather than producing them internally, thereby saving the equivalent water volume, the so-called virtual water. With growing focus on water, the concept is gaining wide acceptance and uptake in political debate in countries of extreme water deficit, such as Israel, Egypt and Jordan, and signs of actual implementation of policies in this direction are emerging (Roth & Warner, 2007). However, broader analysis of motivations for policies and decisions on trade, food production and internal water use and allocation seem to suggest that other concerns and factors than water govern the choices (De Fraiture *et al.*, 2004; Wichelns, 2005). An overriding issue for many states is the reluctance of becoming dependant on external nations for significant food supplies and giving up their policy on food self-sufficiency. Similarly, admitting water scarcity and adoption of such counter-measures internally may not be popular and e.g. in Egypt such policies are not covered openly in popular debates (Roth & Warner, 2007).

7.1.2 *Climate change*

Climate change is widely discussed today. There is a general awareness of the threats and possible implications of climate change but still no understanding of exact impacts and even less of what actions potentially best address the challenges. There is no doubt; however, that climate change will affect disproportionately the least developed countries and the poorest and most vulnerable people living here (Moench & Stapleton, 2007). When talking about food production, this is firstly related to the physical realities because the anticipated gradual global warming will hurt most in already warm countries where crop production systems are already working at the margin of temperatures where further warming will reduce yields (Cline, 2007), whereas in more developed countries, temperature increases may have an, at least temporary, beneficial effect. Secondly, these countries, and particularly many African countries, are faced with already stark contrasts in coping capabilities and socio-economic resilience when it comes to mitigating and adapting to the impacts. The poor people will be further impoverished if no specific efforts are put in place due to climate change. Agricultural production will suffer significantly with estimated declines in total global agricultural productivity of between 3% and 16% (Cline, 2007). Due to the relatively high dependence on agriculture in developing countries such changes may be critical to not only poor people's food security, but the general global food supply situation. The compounding effect of climate change will not, however, manifest itself in a gradual change of scenario but could be manifested through a series of smaller or larger natural extreme events, like flooding and droughts and other more abrupt disasters or events triggered by the surpassing of critical biological or climatic-dependent thresholds that we do not even understand today. This calls for a much higher degree of attention related to emergency relief, food aid, and general disaster preparedness and prevention.

7.1.3 *Wider policies and trade*

International trading policies governing minimum prices on significant food commodities inarguably influence global food trade and consequently, and mostly indirectly, virtual water flows. Generally speaking, agriculture in developing countries is not profitable. High level of agricultural dependence may be associated with lower levels of economic and social welfare. Developing countries often get very little return for the use of any of their natural resources, including water (Sullivan, 2006), partly because of the export of primary products and resources with little processing and refining. Addressing ethical questions in water and food hence also is a matter of achieving more integrated production and manufacturing systems for these countries and favourable trading agreements for countries engaged heavily in primary crop production and associated export. These aspects need more integrated economic analysis as simply increasing global market prices, and resultant increased export may result in further drain on already water-short nations' virtual water resources and further processing results in increased use of process water and environmental degradation.

Biofuel production is another contested issue. Today 1% of the world's total arable land is cropped with biofuel crops, and this is projected to increase to 2.5–3.8% in 2030 (Swiss Agency for Development and Cooperation, 2007). Biofuels may lessen the strain on fossil fuels, reduce the net release of green house gases causing global warming, and provide job opportunities and income sources for the rural poor. Biofuel production in the North may however reduce production of cheap staple foods subsidized on the global markets thereby giving the poor countries a chance to enter the market with their food commodities. However, the concerns related to biofuels relate to increases in food prices especially for urban poor and further degradation of the environment. The parallel increasingly challenging demands for energy and food security are here closely linked, and overall policies and monitoring on these topics are required to ensure benefits for the poor rather than increased vulnerability (World Bank, 2007).

A similar concern can be raised when pristine rain forest in the South America are cleared for raising grazing cattle for meat production used in the hamburger industry in the North. This may be a marginal example of how food production is unethical with respect to access to water, but indirectly such transformations of natural environments will affect non-beneficiary local and indigenous people's access to natural resources, including water, and their associated options for food production.

7.1.4 *Development support*

International development support has become an established and significant part of the world economy. Though, in principle, a remedy for imbalances in wealth across the globe and despite *exit policies* to phase out such alleviating facilities, there is no clear sign that such structures will cease, simply because of the persistence of the problem, which is a cause for its existence, namely widespread poverty and inequality in the distribution of world wealth.

For more than a century, mankind has struggled to clarify reasons for relative poverty and find mechanisms and structures to eradicate it. With world population increasing and stress on resources intensifying, the challenges only grow and despite some learnings and possibly some success stories, the overall results remain insignificant. It is popularly argued that the sums dedicated to achieving the MDGs and general development support is not sufficient thereby indirectly saying that increasing the fractions of national incomes allocated to such support will increase the likelihood of success. However, this conclusion is optimistic and deceiving, especially assuming a business-as-usual approach. Increasing support may be required but it is not a sufficient condition. What is needed is a refocus of the support towards the wider contexts in which this support enters, and the inter-linkages with various levels of governance systems. The globalization today makes everything inter-related: water security, food security, energy security, and one problem cannot be assessed and solved independently. However, the complexity, at the same time, is immense, and nobody encompasses the knowledge, nor the sufficient political clout, across the problem areas to devise exact solutions, neither for the short term, nor the long. At the same time, the world is changing ever more rapidly, signifying constant changing conditions under which the problems have to be faced. Such scenario calls for much greater understanding and collaboration across the interests, disciplines, languages, and cultures in order to find agreement and collaboration for joint and just development.

Seeing the larger aspects of ethics, the rich countries providing financial support for development bears a large moral obligation to optimize the use of such funds and to think of real alternatives for the future workings of global economy. Though such financial development support may benefit poorer countries it may also have an effect of sustaining a status quo in the distribution of wealth and power. Through conditionalities on obtaining financial support, e.g. related to certain policies, development principles, and priorities in funding and expenditures, the donor countries have a quite strong influence on development paths followed in developing countries.

There is an increasing focus on corruption in the water sector. Development collaboration, in the form of donor assistance, is itself prone to corruption (Stålgren, 2006; Renger & Wolff, 2000). However, as more knowledge is generated, different types of corruptions are being classified and

networks are evolving to highlight and confront it in a rational manner. All these contribute to a more open dialogue on the topic and various practical tools and documented experiences to combat it. It is of critical importance that such focus is further supported and expanded into all aspects of development support, as corruption is at the core of the governance problem.

7.1.5 *Corporate conduct of multi-national companies*

International food businesses are increasingly acknowledging and expressing their social and environmental responsibility with respect to the water-food nexus. This is partly based on the recognition that their business is dependent on the natural environment and the ecosystem services it provides in agricultural production (water provision, pollination, soil fertility maintenance, etc.) as well as on the workers, often local farmers in poor countries, producing the raw materials for their products. Other dimensions, such as ensuring and improving the local as well as international image of the company are involved in such policies for corporate social responsibility. This trend is exemplified by *Nestlé* and *Coca Cola*, both giving rather clear descriptions on their policies (Coca Cola, 2007; Nestlé, 2007; 2006).

These companies, along with others, e.g. *Unilever*, have joined efforts to create a broader network of international businesses with a commitment to action. For example, The *CEO Water Mandate* [http://www.unglobalcompact.org/Issues/Environment/Water_sustainability/index.html] was established in July 2007, under the *Global Compact*, which is a framework for businesses that are committed to aligning their operations and strategies with ten universally accepted principles in the areas of human rights, labour, the environment, and anti-corruption.

7.1.6 *Awareness in the developed countries*

There is a wealth of analysis and assessment of development trajectories and outcomes for the developing part of the world (e.g. UNDP, 2007). But it is clear that a genuine global dialogue on development goals with equal and fair participation from the developing countries themselves is still lacking. The analysis and the associated agendas for development and development support are predominantly set from the rich part of the world. This is a result of history and entrenched power relations, facts that are not brought forward in the analysis, but yet may be at the core of the inequalities on a wider scale and continued pervasive poverty in many parts of the world. It is implicitly argued that how water is managed within a country has direct impact on the economic welfare of that country. However, it is not mentioned that this is not totally controlled from within each country. International trade policies, for example, impact the economic returns from water use (Sullivan, 2006). By giving development support to individual countries and focusing on and prescribing best policy and management options in a national context, shifts the responsibility to perform and achieve agreed goals to the individual countries. As a result, focus on the wider geopolitics, the broader context in which the development policies are played out is lost despite the fact that success of development initiatives may closely hinge on how we as a wider international community manage to address the overall rules of the game.

Similar to the traditional and widely advocated focus on awareness raising at the local level, there is a need for awareness raising at the opposite extreme of the population scale, namely for the educated well-off members of the North. There is a congruent and associated need for raising the awareness of the general public among the wealthy countries, related to development strategies, international development cooperation and principles and priorities for donor support. Through increased understanding and attention among the broader populations of these countries, and a more critical view on present day international collaboration, development support, trade policies, etc., it is hypothesized that influence and pressure for more just and equitable approaches will be raised.

Food and water access and equity in their distribution are not relevant political issues in the developed countries where the concern is more the food quality, the taste, food as a means of pleasure and well-being. More specifically, these questions in a development context and as part of international policies are not of great interest to the individual average citizen of the North. These points may be related to the alternative food pyramid. There is very little understanding of the

problems of food and water insecurity in distant countries and its link to the conditions and politics of the rich countries.

Also, the link between what we consume in the Western world and what is consumed/produced in third world countries may not be obvious. The influence on the production patterns in the third world is partly influenced by the consumption patterns of the West/North, e.g. hamburgers produced from meat grown in previous rainforests, bottled water from public areas in poor countries appropriated by international companies where local poor farmers previously cropped the land, cheap foods produced by farmers under heavy subsidies in European countries, practically preventing poorer countries the entry of their products on the EU market, etc. Raising such awareness, pointing out the links and the influence possible from conscious consumers, and generally raising a more open debate on these topics and fostering a demand for new ways of thinking may be a critical and important means of addressing some of the overall inequity issues on an international scale.

7.2 *National scale*

7.2.1 *Laws and policies*

Despite a recognition that participatory processes are critical in development projects related to water and agriculture and in overall development and governance at various levels, the drafting of policies are not perceived as being participatory and the policies themselves do not encourage participatory processes (Centre for World Solidarity, 2006). Attention to rights and democratic processes receive relatively less attention in the development processes, and projects still focus on infrastructure and technical solutions more so than the softer aspects of grievance, conflict resolution, and fulfillment of political promises.

Capital and recurrent subsidies for irrigation have been almost universal policy in many developing countries dependent on irrigated agriculture. It is estimated that farmers receiving water from government-built irrigation projects seldom pay more than 20% of the water's real cost (World Bank, 2006). An estimate for India shows that canal irrigation is subsidized nationwide to the extent of 95% if all capital and recurrent costs are taken into account. Well irrigators also receive subsidies on agricultural water, albeit indirectly through low prices for diesel fuel, electricity or equipment. Irrigators also receive subsidies on factors of production other than water, and also often receive output price subsidies via protection policies (World Bank, 2006). Despite arguments for serving the poor, the subsidies often tend to accrue more to the better-off farmers. Often, subsidies are used as an argument for poverty eradication, supporting the access to resources of the poor, while in reality the poor and the environment suffer (Repetto, 1986). Very close analysis of the outcomes, side effects, and the targeting of the subsidies is required to gain the intended benefits.

7.2.2 *Land tenure*

In many countries, land administration is governed by principles not securing rights to land for the poorest poor (Appelgren, 2004). This, in turns, heavily influences the options and possibilities for marginalized farmers to get access to water, to optimize its use and to sustain acceptable crop productivity. Irregularities and outright fraud are frequent in allocating and managing public lands. The rents can be large. In India, bribes paid annually by users of land administration services are estimated at US$ 700 million which is three-quarters of the public spending on science, technology, and environment. In Kenya, land grabbing by public officials, systemic during 1980–2005, was "one of the most pronounced manifestations of corruption and moral decadence in our society" (World Bank, 2007).

7.2.3 *Water and other infrastructure*

Big water infrastructure projects, like surface water irrigation schemes and major dams are prone to rent seeking and corruption (Stålgren, 2006; Renger & Wolff, 2000). This is because huge sums are involved in the construction, public bureaucratic entities are important partners in the transfer of funds and procurement and much of the funding is from external sources, such as international

donors. In addition, upon completion, such structures continue to be significant sources for rent seeking (Stålgren, 2006) basically through the possibilities for undemocratic ways of administering the rights and access to the water and associated benefits deriving from them (Centre for World Solidarity, 2006). Groundwater is generally regarded as a more democratic resource as individual farmers, with access to electrical or other energy source and the drilling technology, can enter into the irrigation business without having to get in line for and bribe themselves access to water (Llamas & Martínez Cortina, this volume).

However, securing access to water and land is not sufficient and has to be accompanied by other factors facilitating food production and marketing, like provision of electricity, extension services, infrastructure, like roads and market chains and the access to communication and information technology.

Water constraints have spurred strategic thinking and practical attempts to increase and optimize use of water and land resources, in both irrigated and rainfed farming. Possibilities for increasing arable and irrigated land areas are limited, especially in the traditionally large-scale irrigated countries like India, Pakistan and China (World Bank, 2007). Whether there is scope for water savings and increase in *crop-per-drop*, that is increasing the so-called water productivity is debated heavily (Comprehensive Assessment of Water Management in Agriculture, 2007; FAO, 2000). However, it is clear that this approach requires substantial inputs, in terms of improved irrigation technology, extension services, and other structural changes ensuring the incentives of farmers to save on irrigation water.

7.2.4 *Food security and poverty eradication*

Traditionally, developing countries have been characterized by a high degree of reliance on agriculture for livelihoods. Quest for food self-sufficiency and poverty eradication, has remained crucial policies in many countries for decades. However, both the subsistence farming and even the supplanted efficiency-advocated large-scale irrigated agriculture in developing countries are not profitable in a larger sense. There is a need to increase efficiency in existing irrigation schemes to unlock the potential and to justify the huge investments. Similarly, small scale farmers, often engaged in rain fed farming, have very low productivities.

World Bank (World Bank, 2006; FAO, 2000) and others increasingly advocate the re-assessment of these countries' food self sufficiency strategies, to accept partial food imports, mostly of staple foods, in order to increase overall efficiency in terms of natural resources use, economic returns from agriculture and global redistribution of wealth. The benefits include less strain on land and water resources, development of alternatives for more profitable sectors, like industry and cash crop production, while the risk involved are the fluctuations in international staple food prices, more pollution from industry and intensive agriculture and lack of purchasing power of the poorest of the poor.

Countries facing food insecurity and water stress are increasingly depending on global food markets. However, they need to be assured that they can have fair and secure trade with water-abundant nations. Secure basic food trade conditions for water-poor countries should become a priority for the *World Trade Organization* (World Bank, 2006).

7.2.5 *Urbanization*

Urbanization is a prominent feature of current development in many developing countries. It is driven by complementary factors pulling people to the city as well as factors pushing people out of rural areas. The implications for water allocation, food production and security have many dimensions. Increasingly, water is being allocated to urban areas, for domestic purposes and for growing industries in urban areas, a factor very pronounced in China. In general, economic returns from water use in urban areas and industry are considered to be higher, presenting a justification for such transfer. However, a potential conflict arises between water for the cities and the satisfaction of water demands for small scale farmers in the rural areas, and in essence the food self sufficiency of these populations (Centre for World Solidarity, 2006; Dooge *et al*., 2004).

Some new developments, potentially and partly countering these problems, are the increasing production of higher valued crops in the semi-urban areas by the newly urbanized farmers, and the concomitant use of waste water in their irrigation practices, thereby benefiting from an increasing and relatively secure water source and incidentally supporting the advocated re-use of water (Scott *et al.*, 2004).

7.3 *Local scale*

Access to water and food at the local village or suburb scale is critical for the individual families, whether farmers or urban poor. The realities reveal often very unjust and peculiar systems that these populations face when assuring access to basic necessities, the same essentials often taken for granted by the affluent groups in society.

Examples illustrating this are [partly from Stålgren (2006) and Huppert (2005)]: the need for poor families to purchase food aid which in principle should be provided for free, the need to pay for clandestine connections to public main lines of water or sewage, request for continuous payment for favours not to disconnect the same, request for *side payments* from farmers to irrigation engineers for timely delivery of water provision services, acceptance of bribery or threats of punishment for the revelation of local contamination events, acceptance of new public wells installed close to the local officer in charge and far from the domicile of the poor. Examples are numerous but serves to illustrate the realities faced on the ground.

Other examples include the illegal leasing of water bodies or public land to commercial enterprises, with significant implications on the access of the poor to land and water resources and pollution of the same (Centre for World Solidarity, 2006). Even worse, raising concern and protest by civil society groups may be followed by threats and intimidation.

Such problems need to be addressed as integral part of the development projects, with concurrent actions at the local level, involving stakeholders and NGO's, as well as higher levels to ensure that benefits also accrue to the poorest.

As water scarcity increases, irrigation projects will have to reduce water use and increase productivity per hectare and invest in water use efficiency. Where water is scarce, farmers in theory have an incentive to use water efficiently. However, if water is cheap, as is often the case when systems are subsidized, or water rights are insecure, farmers will not invest to save water or they may use saved water to expand their farms. In principle, water charges on a large-scale irrigation system can incorporate efficiency incentives. However, few governments are willing to raise water charges to the level required (World Bank, 2006) due to influence of farmers lobbies and with the justification of reducing poverty.

Furthermore, many irrigation systems are locked into an inefficiency trap due to the fact that inefficient water delivery and maintenance may provide sources for additional income or at least offer non-material advantages to the providing managers or technicians. Such system inefficiencies may be highly efficient in terms of personal gain. Therefore, the common practice of searching for technical and/or economic/financial solutions to the efficiency problem in irrigation is bound to fail in many cases (Huppert, 2005).

8 CONCLUDING REMARKS

Agriculture is the world's dominant user of water and land, and provides essential food, subsistence, livelihoods, and sources of income to billions of poor families around the world. Hence, ensuring the access of water and land to these populations is of paramount importance to global food security, poverty eradication and political stability on a larger scale. By 2050, the food demand of the world is estimated to double relative to today (Comprehensive Assessment of Water Management in Agriculture, 2007). Natural resource depletion and degradation, population increases, change in food preferences all make achieving this target increasingly difficult. Alternatives such as increasing water use efficiency, reallocating water for more profitable use combined with a more global

redistribution and reorganization of food production, commercialization, and trade are sought. However, the solutions are not straight forward; the gains are insecure and untested on a wider scale. We need to look at water and food in a broader perspective: as a cross-cutting issue of agriculture, food security, and human rights. Hence, there is a continuous scope for the assessment of the options and the progress happening, both as a result of inherent market mechanisms and of controlling policies and combinations of the two, at the local, national and global level. However, technology seems not to provide the right or sole answer, like in the days of the *green revolution*. We have moved beyond the era of technological fixes and need more sophisticated and integrated solutions.

Some key points brought forward in this chapter deserve more attention as they seem to be less prevalent in contemporary discussions of possible solutions and options for interventions. They relate to the role and responsibilities of the rich countries in supporting the progress towards global water and food security and equity in access across nations and population groups. One dimension relates to the consciousness in the West/North regarding these issues and the potential impact of more advocacy and awareness raising among the affluent countries. By raising a wider concern in the general public of the inter-linkage of our consumption patterns and the food production patterns and access to water and food in the third world countries, demand for more holistic solutions may be expressed. Voicing the case of the poor in our part of the world and ensuring the incorporation in wider food production patterns, trade policies and development assistance is a likely way of impacting the living conditions of these poor people without adequate personal voice in the global arena. Another dimension is our own consumption habits and consumer demands. Limiting our demands and avoiding waste and optimizing use may also make overall global resources go a longer way. Water and food ethics is very much about the rich countries taking a fairer share of the responsibility of the uneven distribution of resources, including water and food, on a global scale.

In general, it can be stated that water will and is playing an increasing role in the international agenda, but it is not (yet) overruling concerns on other aspects and most often is seen as a cross-cutting topic in relation to food production, energy production, and environmental concerns.

What can be done at various levels to change this would be:

- Developed part of the world: Support international and cross-disciplinary networks, initiatives, and processes to advocate transparent and accountable procedures in manufacturing and development support; increase public awareness, to request more transparent and equitable trade policies; consumer information on food products and production circumstances.
- Developing part of the world: Support democratic processes; support capacity building, avoiding brain drain; multi-disciplinary research; support and optimize local coping strategies; support multiple and reuse use of water; improve market access; work with local organizations to ensure multiplier effect.

Ethics is about morality and as such is a soft issue. Awareness and understanding is a prerequisite for acting in an ethically correct manner. When it comes to water and food on a global level this is not a matter of formulating simple principles as the world is very complex and governed by interests of opposing nature and with sometimes conflicting and unknown effects in the short or long term. Progress may be difficult and slow. There is always inertia against changing habits and established privileges. Take the example of fast food and snacks which contribute to obesity problems, especially in the developed part of the world. Though the link and the problem are identified, it is still not easy to solve, even in the developed world. The market mechanisms, the life style and commercialism are driving the development, and only by creating an informed and reflective and reactive producer and consumer can we optimize the products and the consumption. In lower income countries, where primary food production is often a matter of survival, the process of creating awareness may be secondary to the market mechanisms and this limits the progress significantly. The alternative production forms must be profitable, equitable and sustainable, because expensive and economically unsustainable systems, supported by external donor money, will not suffice though optimizing existing systems is critical.

The issue of water and ethics is relatively new, and surprisingly so, as it probably is at the core of the problem of solving today's problem of equal access to water and food. "The symptoms of inadequate provision of water services and dwindling water resources are being addressed, but root causes are rarely addressed, such as unequal power balances, unfair trade patterns between and within countries, as well as deficits of democratization" (UNESCO, 2006). Assuming that all partners involved would automatically strive for most efficient and equitable solutions is naive. If we do not understand the integrated and complex mechanisms driving food production, trade, water access, etc., we miss the opportunity, and fail, to solve the problem. It is a matter of change of attitude and approach, with a wider shift in focus to more value and fairness based thinking.

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III
Water as a human right and as an economic resource

CHAPTER 7

Water: A human right or an economic resource?

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ABSTRACT: The consideration of water as an economic resource or as a social good is a complex and controversial issue. In this chapter, the arguments in favour of both perspectives are discussed. The growing visibility, in international and national laws and practices, of a human rights approach to water, is also analysed, particularly in the context of the *Millennium Development Goals*. The impacts of economic globalization on water and the consideration of water as an economic resource are also discussed, in the context of recent perspectives on water privatization. Finally, the complexities of the relationship between water scarcity and poverty are reviewed by underlining the need of water governance at all the relevant levels, in order to ensure a balanced consideration of water as an economic resource, but also by respecting the human right to water, particularly for the most deprived populations both in urban and rural areas.

Keywords: Water; Human Right; Economic Resource; Value and Cost; Globalization; Poverty; Privatization; Governance

1 INTRODUCTION

A social good is defined as one whose benefits and costs for one individual or a limited group of individuals also tend to affect a larger social community in a positive way. This is the case, for example, of health, education or culture, as they not only benefit the target groups to whom they are provided but also all the individuals of the same social system. Accordingly, water may be considered as a social good, because more or better water for an individual or group may benefit a larger social group who are connected to the same water distribution system.

If water is considered as an economic good the situation is different. For instance, the implementation of measures favouring efficient water use will benefit society as a whole, but not the water suppliers, as a more efficient use will reduce the demand for water and consequently decrease the suppliers' revenue. That is one of the reasons justifying the need for regulation, in the case of water being considered as an economic good.

The idea that water is an economic good has been questioned by some, who argue that water is a vital social good, which governments ought to provide for free or, at least, at highly subsidised rates for the poor. They see an inconsistency between water as a human right and a social good and the fact that water could be allocated according to the purchasing power of communities or individuals, like any other commodity.

The issue of knowing whether water must be considered as an economic resource or a social resource has been a source of controversy. The consideration of water as an economic resource means that water must be allocated to its various uses in a way which maximizes its value for a social group or region. The consideration of water as a social resource implies that its availability should favour social well being, at both individual and collective levels. For instance, the supply of good quality water is essential for protection from diseases and, in many cases, to ensure human survival. Also, in recent times, there is a growing tendency to consider access to water as a human right.

The consideration of water as an economic good or as social resource good also affects the forms of sharing the water available within a certain community. If water is considered as an economic resource, more water for one individual may mean less water for others sharing the same water system. On the contrary, if water is considered as a social good, the improvement of its quality for the benefit of one individual may also mean better quality for others.

In January 1992, the *UN Conference on Water and the Environment* held in Dublin, as a preparatory meeting of the *Rio Conference on Environment and Development* later that year, adopted the so-called *Dublin Statement*, based upon four principles. This Statement clearly recognizes water as an economic resource, when it says in the fourth principle, that "water has an economic value in all its competing uses and should be recognized as an economic good" (UN, 1992). However, many have since contested this perspective, claiming that water, being essential to life, cannot be considered as a market good, as this would imply that those who do not have the capacity to acquire water of good quality must necessarily suffer. However, others claim that making water available at subsidised prices will generate non-efficient water use, leading to water scarcity.

As a follow-up of the Dublin doctrine, the *Rio Conference* has clearly recognized that water must be managed both as an economic and a social resource, stating in *Chapter 18 of Agenda 21* that "integrated water resources management is based on the perception of water as an integral part of the ecosystem, a natural resource and a social and economic good" (UNCED, 1992).

Those in favour of a water management strictly based on an economic perspective tend to claim that there is incompatibility in considering water both as an economic resource and as a social good. They propose the consideration of a benefit-cost analysis where a value is assigned to social and environmental costs. This perspective assumes a comprehensive evaluation of costs and benefits, complemented by a stakeholder participation process, with the aim of allocating water to the more valuable uses according to procedures accepted as fair and reasonable by the various stakeholders.

The fact that water is essential for life and health and crucial for some economic activities, such as irrigation, has led, in many cases, to making water available at subsidized costs or even free of charge. These practices may be popular among the water users, but they are certainly a source of expense to be covered by the taxpayer and they tend, in general, to engender inefficient use. They may also generate inconvenient side effects, as the poorest users may have only limited access to water, while the more wealthy, having access to water at low subsidized costs, may overspend and waste water.

2 WATER AS A HUMAN RIGHT

In present days, the access to safe water for facing basic individual needs tends to be increasingly considered a fundamental human right recognized in international law, although in many cases not explicitly, unlike other human rights, such as the rights to life, food and shelter, health and well-being, and protection against disease and malnutrition.

As a matter of fact, only two international conventions explicitly recognize the right to water: the *UN Convention on the Rights of the Child* of 1989 (article 24) and the *UN Convention on the Elimination of All Forms of Discrimination Against Women* of 1979 (article 14). Before this, astonishingly, only the *Geneva Convention* of 1949 (article 26) recognizes a right to water (to prisoners of war!). This is, indeed, somewhat surprising, as the access to safe water seems to be a pre-condition to warrant many other rights, such as those mentioned above. Nevertheless, it seems this incongruence is progressively being corrected. It will not be surprising to see the right to water being increasingly referred to in international declarations and national constitutions. A clear turning point concerning this issue was the approval in 2002 by 153 States of *General Comment No. 15* to the *International Covenant on Economic, Social and Cultural Rights*, one of the major human rights treaties which is being monitored within the framework of the United Nations human rights system (CESCR, 2002). *General Comment 15* clearly considers the right to water as an indispensable pre-requisite to the enjoyment of other human rights, stating that "the human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water

for personal and domestic uses. An adequate amount of safe water is necessary to prevent death from dehydration, reduce the risk of water related disease and provide for consumption, cooking, personal and domestic hygienic requirements".

The enumeration of the characteristics of water which are included in the human right to water, as mentioned above, is interesting. Adopting the definition provided by the United Nations these characteristics are the following: *sufficient*, i.e. in an adequate quantity, in accordance with international guidelines (this normally meaning 40 to 50 L/day per person, with an absolute minimum of 20 L); *safe and acceptable*, i.e. safe for each use (meeting very high standards when used for drinking), and of an acceptable colour, odour and taste; *physically accessible*, i.e. within safe physical reach, either within the house or near the household; and *affordable*, i.e. so as not to affect a person's ability to buy other essential goods.

The human right to water also explicitly includes the right to sanitation. Concerning this point, *General Comment 15* indicates: "States have an obligation to progressively extend safe sanitation services, particularly to rural and deprived urban areas, taking into account the needs of women and children". In fact, the human rights to water and to sanitation are closely linked. The right to water, in particular as it relates to water quality, cannot be ensured without adequate sanitation. And the right to sanitation cannot be achieved without access, on a regular basis, to a minimum amount of water. Water and sanitation are, actually, two faces of the same coin. Further, they are very much linked to the rights to hygiene and education, since transmission of disease may still occur even when water and sanitation facilities are installed.

At present, the human right to water is generally recognized at the international level and is viewed as an indispensable element of human dignity. Clearly, however, in many countries, much is still to be done for its acceptance at the national level. The reluctance of some governments to fully accept the principle of a human right to water is often related to the financial difficulties associated with its implementation.

The leaders of many countries are still afraid that accepting the right to water means that water must be delivered for free. This is no more true of right water than it is of the right to food. Water does not have to be free, but it should be accessible, sufficient, safe and affordable. The acceptance of the principle of a human right to water means only that water should be considered as a social good, as well as an economic good.

In developed countries the payment of water supply and sanitation expenses by the users tends to be increasingly accepted. Even in these countries, however, some groups, such as those living in certain rural areas or urban poor, may find it difficult to bear the full cost of the expenses associated to their water consumption for domestic and sanitary purposes. There must thus be solidarity or redistribution mechanisms by which the more wealthy communities in a country or region will contribute to ensure minimum levels of safe water supply to the more disadvantaged members of the society. Payments for water services should be based on equity criteria, ensuring that they are affordable to all, including the more disadvantaged groups. Clearly, if financing of water supply and sanitation is expected to come only from national funds there are only two alternatives for raising funds: water users or tax payers.

In the case of developing countries, the financing of water supply and sanitation to all, for example to comply with the requirements of the *Millennium Development Goals*, may prove to be unfeasible if resorting only to national funds. In this case, the use of funds from external sources, such as *Official Development Assistance* funds, may prove necessary.

Historically, the use of such international aid funds has been somewhat inefficient, because the funds invested were misused, spent in building water supply systems which were not properly maintained once in operation, and often largely lost due to corruption. The water users benefiting from these funds should normally be constrained by a system of incentives directed towards the efficient use of water, avoiding its waste and contamination.

Funding policies should be more ambitious but also need to be better controlled. In particular, a part of any investment in water infrastructures should always be earmarked for their maintenance and for capacity building, namely for training the men and the women who will be in charge of their operation and maintenance.

The quantification of a human right to water has been the object of some discussion. The fact that water is a limited resource should impose a limit to the right to water. As a result, the definition of human right to water normally refers to *basic needs* or *vital human needs*, usually understood as those relating to drinking water and to water for cooking and other fundamental domestic water uses.

There have been several attempts to associate a minimum amount of water to the satisfaction of these basic or vital water needs. An amount of 3 to 5 L/day of good quality water per person is usually taken as an absolute minimum in order to allow human survival. But some studies show that sanitary conditions improve significantly when these values increase to around 20 L/day per person. Several international organizations, in particular of the UN system, have put forward values of 20 to 40 L.

Gleick (1996) recommends the adoption of a value of 50 L/day per person, in order to satisfy four basic water needs: drinking (5), sanitation services (20), bathing (15), and food preparation (10). Obviously, such volumes correspond only to direct water consumption by humans. Volumes of indirect consumption, i.e. those of water used to produce goods, and particularly food, consumed or simply used by man are several orders of magnitude higher than those corresponding to direct consumption of water.

3 WATER AS AN ECONOMIC GOOD

An economic good is a good that contributes to the satisfaction of human wants and which can be sold or bought in a market. These goods are associated to a notion of scarcity, as is normally the case of water, as opposed to, for instance, air, considered as a free good. To manage water as an economic good means that water will be allocated to different water users or water use sectors in such a way as to maximize the benefit provided by water to the society as a whole.

Water cannot be considered as an economic good like any other and it escapes, clearly, any attempt to ignore its complexity. The first thing to clarify is whether it is water, as a resource, or the services provided by water that should be the object of an economic analysis.

Water is an economic good but not as many others. The law of supply and demand does not play freely. In most cases, the consumer has no choice. The setting of prices does not derive only from economic rationality but also from political choices that may involve subsidies and, thus, condition the tariffs. The consideration of water both as an economic and a social good corresponds to adopting an economic cost-benefit analysis, but accepting that some environmental and cultural costs and benefits cannot, in practice, be truly quantified.

The fourth principle of the *Dublin Declaration* (UN, 1992), recognizing water as an economic good, has been the source of some confusion regarding the interpretation of this principle and of a certain misunderstanding over what the concept of water as an economic good implies.

Savenije & Van der Zaag (2001) and Van der Zaag & Savenije (2006) have distinguished two schools of thought for the interpretation of the concept of water as an economic good. The first school, which is supported by neoclassical economists, states that water should be priced at its economic value, the market ensuring then the allocation of water to the best uses. The second school, which is supported by water decision-makers, assumes the existence of a process of integrated decision for the allocation of water resources, which does not involve, necessarily, financial transactions.

The first school considers that water is an economic good like any other and, thus, must have an economic price. This has been a source of concern to some water professionals, who fear that economic pricing of water could have negative undesirable consequences, for example damaging the interests of the rural populations and the urban poor or limiting the economic feasibility of irrigated agriculture, particularly in developing countries.

The second school supports the idea that the recognition of water as an economic good, put forward in the fourth *Dublin principle*, should obviously be also understood in the context of the

three other principles and, in particular of the first, which states that "water is a finite, vulnerable and essential resource, which should be managed in an integrated manner".

Water can, thus, be considered as an economic good, but is a special economic good and this is due to six different characteristics of water (Van der Zaag & Savenije, 2006):

- *Water is essential*. There is no life without water, no economic production, no environment.
- *Water is non substitutable*. There is no alternative for water.
- *Water is finite*. It is limited by the amount of the water that circulates through the hydrological cycle.
- *Water is fugitive*. Water flows under gravity and if we don't capture, it's gone.
- *Water is a system*. Several processes are interconnected in the circulation and flow of water as part of a complex system.
- *Water is bulky*. This creates difficulties to its long distance transport.

In other words, it can be said that water should be the object of *Integrated Water Resources Management*, a concept that became popular only a few years after the *Dublin Conference* and was subsequently disseminated, largely through the action of the *Global Water Partnership* (see, for instance: GWP, 2000).

Savenije & Van der Zaag (2000) have made an analysis of the concept of water as an economic good in the context of integrated water resources management, which they consider sufficiently described by the following four aspects:

a. The consideration of all the physical aspects of the water resources at different temporal and spatial scales (the integrity of the hydrological cycle and the related quality aspects).
b. The application of an inter-sectoral approach, recognizing all the interests of different water users (including social, cultural and environmental aspects).
c. The consideration of the sustainability of water, including trans-generational sustainability.
d. The participation of stakeholders in the water management process, at all levels.

Taking these four aspects in consideration makes it very difficult to accept water just as any other economic good which must have an economic price. In fact, the above mentioned aspects imply that: any use of water affects the entire water cycle (aspect a); social, cultural and environment requirements may have high societal relevance but very limited ability to pay (aspect b); the valuation of issues such as health, beauty, safety and particularly long-time sustainability are often more important than money (aspect c); and decision-making processes which consider the stakeholders interests are extremely difficult (aspect d).

Thus, decisions on water allocation appear to be seldom taken on pure economic grounds, and governments, generally, make decisions on the basis of political considerations (including, of course, economic and financial considerations, but often not with a predominant influence).

As Svenije & Van der Zaag (2000) state, in the second school of thought "water economics is understood to make the right choices of the most advantageous and sustainable water uses in a broad societal context." Considering water as an economic good implies making integrated uses of water, and not simply determining its price.

A full understanding of the role of economic valuation in water management begins with the clarification of three concepts:

- The *value of water*, which is determined by the various direct and indirect benefits which water provides to its users (including the social, cultural and environmental benefits).
- The *cost of water*, which is related to the expenses of providing water to the users.
- The *price of water*, which corresponds to the amount the water users are charged.

When dealing with cost and value of water, different concepts may be considered. According to Rogers *et al*. (1998) one may consider:

- The *full cost*, the *full economic cost* and the *full supply cost*.
- The *full value*, the *economic value* and the *value to water users*.

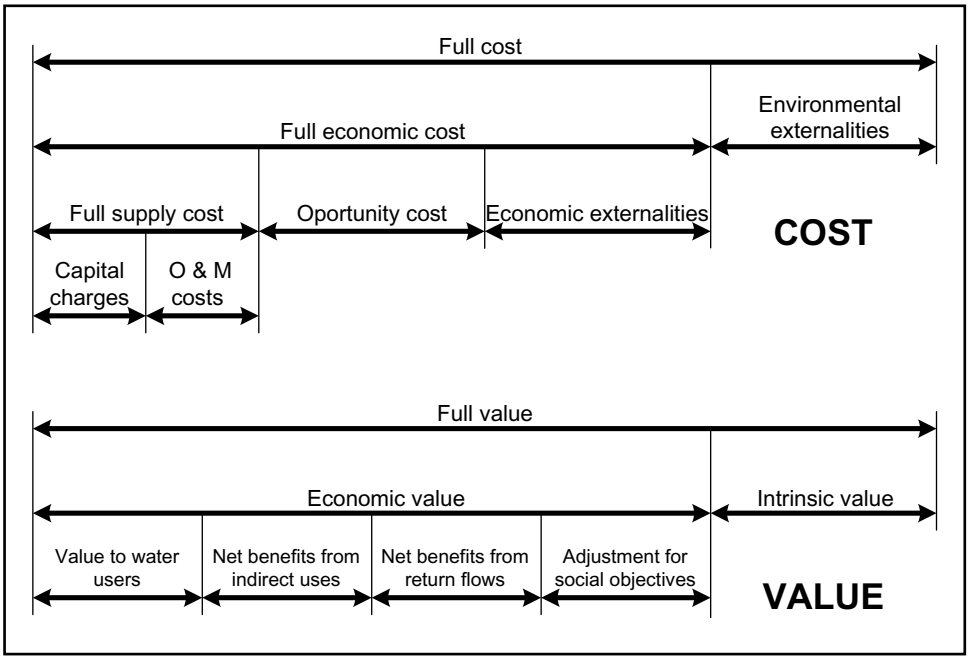

Figure 1. Value and Cost of Water (adapted from Rogers *et al*., 1998).

Figure 1, adapted by the author from Rogers *et al*. (1998), shows schematically the various components that add up to make the *full cost* (full economic cost and environmental externalities) and the *full value* (economic value and intrinsic value). The relevant definitions are provided below.

As for costs, the definitions are the following:

- The *full economic cost*, which is the sum of the full supply cost, the opportunity cost and the economic externalities.
- The *full supply cost*, which is the sum of the capital charges and the operation and maintenance costs; corresponding, thus, to the costs associated to the supply of water to a user without considering either the externalities imposed upon others or the alternate uses of water.
- The *opportunity cost*, which is the cost of not being able to use the resource for another social or economic activity.
- The *economic externalities*, which are normally associated with the impact of an upstream diversion of water, or with the release of pollution on downstream users.
- The *capital charges*, which include capital consumption and interest costs associated with the construction of water infrastructures.
- The *operation and maintenance costs*, which are associated with the daily use and maintenance of the water infrastructures.
- The *environmental externalities*, which are related to the ecosystem's health and maintenance.

As for the values, the following definitions apply:

- The *economic value*, which is obtained by adding up the value to users, the net benefits from indirect uses, the net benefits from return flows and the adjustment for societal objectives.
- The *value to water users*, which is at least equal to the marginal value of water use by industry and agriculture, or to the domestic users' willingness to pay.
- The *net benefits from indirect uses* of water originally derived for certain water users, which may indirectly present a certain value for other users.

- The *net benefits from return flows of water* diverted for domestic, industrial and agricultural uses.
- The *adjustment for societal objectives*, such as poverty alleviation, employment and food security, particularly concerning water use in the agricultural sector and in rural areas.
- The *intrinsic value*, related to cultural, aesthetics and merit values of water.

The ideal situation for a sustainable use of water would require that the full cost of water should just equal its full value. At this point, according to classic economic models, the social welfare should be maximized.

In practice, as Rogers *et al*. (1998) point out, "the value in use is typically expected to be higher than the estimated full cost. This is often because of difficulties in estimating the environmental externalities in the full cost calculations. However, in many cases it may be lower than full cost, full economic cost, and even below full supply cost. This is often because social and political goals override the economic criteria".

UNESCO (2006) considers that the value of water does not only concern water itself, but also the consequences of a change in governance as a result of policy initiatives, and puts forward two different concepts related to the value of water: valuing and valuation.

Valuing water is a matter of applying adequate economic techniques and calibrating some water related goods and services in monetary terms. But it is also a process of, with the participation of stakeholders, determining priorities and making decisions aimed to help society to better meet its water-related goals. It is important that the stakeholders become able to understand the many values of water for society.

Valuation is the process of assessing the impact of various policies and initiatives, and then assigning weights to various policy outcomes based on the importance of various policy objectives and criteria. A distinction may be made between economic valuation and social valuation. *Economic valuation* assesses outcomes based on willingness to pay and willingness to accept compensation. *Social valuation* relates to values such as the rights to safe water and to adequate sanitation, irrespectively of ability to pay, gender, religious or cultural beliefs and environmental concerns, including concern for biodiversity preservation and wetland protection.

Another related issue is charging monetary fee for water use. Charging is intended to fulfil multiple objectives. It is presently recognized that the implementation of proper water charging schemes is necessary to ensure efficient water services. These charging schemes should progressively tend to attain full cost recovery and also to provide significant incentives for water conservation. This being said, there should be also a concern of keeping water supply affordable for all. Providing water free of charge or nearly free, i.e. heavily subsidized, may lead to important misallocations, overexploitation and inefficient use of water.

In some countries, water tariffs have been established at quite low levels and, for the benefit of the quality of water services and of the economy in general, an effort has to be made to adjust the level of these tariffs as quickly as possible. As this policy is not often very popular, it may be advisable to resort to transition periods. Also recommended is public information and education on water problems and the need of sufficient payment by the users.

Cost recovery is a solution for improving the conditions of water services which has received increasing support. The choices on the modalities of financing water services and how much to collect from the water users are based on multiple criteria. UNESCO (2006) identifies five main criteria:

- *Financial sustainability*, which means that the collection of sufficient revenue is required to meet present and future financial obligations, related to capital costs and operation and maintenance costs.
- *User-pays principle*, which means that water users should pay an amount equivalent to the burden their consumption places upon society.
- *Simplicity*, which means that the selected tariff plan should be understandable and straightforward.

– *Transparency*, which means that the way in which tariffs are set for different classes of water uses must be clear to all parties concerned.
– *Predictability*, which means that the water users should be able to reasonably anticipate their expense.

Ecosystems have been increasingly recognized as providing several services to water. Healthy ecosystems and their land substrate can benefit water in different parts of the hydrological cycle, e.g. by storing or filtering water. Forests and wetlands are examples of such ecosystems which may provide services to water, often in better economic conditions than some services provided by man-made infrastructures, such as dams for food production and water-filtering plants for drinking purposes. The increasing recognition of the benefits reaped from these ecosystems has put forward the idea of a *payment for the ecosystems service*s, which rewards human actions contributing to their preservation. This is part of a recently proposed conservation approach, which recognizes the need to bridge the interests of landowners and outside (usually downstream) beneficiaries. A number of researchers and organizations have been paying attention to these issues. UNECE (2006), for example, states that "under a payment for ecosystems services users of land upstream may accept voluntary limitation or diversification of their activities in return for an economic benefit". "Practice indicates that payments for ecosystem services schemes can benefit both *buyers* and *sellers* of ecosystem services while helping also to protect the ecosystems".

In a certain sense, paying for ecosystems services is an extension of the concept of cost recovery, mentioned above. The payments for ecosystem services correspond in practice to indirect operating costs.

4 WATER AND GLOBALIZATION

In recent years, the international trade of goods and services has been adopting new rules and procedures, reflecting an increasing influence of multinational firms. Further, this trade is materialized in international agreements with wide implications for consumers, governments and the environment. This leads to a global economy, characterized by an intensification of international trade, the whole process being referred to as globalization.

Globalization can thus be defined as a process of integration of trade, finance, technology and communications, and of market opening across national borders. The development of this process has been somewhat controversial, raising concerns related to national sovereignty, responsibilities of international firms, consequences for the more deprived people, and environmental protection.

The relevance of globalization in the context of water may be considered from two different perspectives. The first is related to the consequences of economic globalization on water resources management. The growing integration of world economy generates certain dynamics which tend to escape national control by the States and may have negative impacts on water, in particular regarding water contamination and associated environmental degradation.

The second perspective is related to water, itself, as an object of globalization policies and may be materialized by the possible development of an international water trade. Some natural resources, such as oil, natural gas, wood, agricultural products or fish have, for a long time, been the object of international trade, without this being the source of particular problems. When it comes to the export and import of water, however, more expressive reactions tend to develop. It is often stated that water is different and, often, nationalistic feelings tend to emerge in relation to water export.

The international trade of certain resources, such as agricultural products, livestock, fossil fuels, fish and wood always involves a certain degree of processing. Other resources, such as crude oil, wood logs or raw fish involve a much smaller degree of processing at the point of origin. Water can, in some cases, be considered as a raw good and, in others, as a product with high added value. Bottled water, for instance, is a product with significant added value, whose international trade has been growing considerably in several regions. The international trade of bottled water is, then, made according to the rules of international trade like any other product.

Actually, most of the controversy and concern around proposals of water globalization are related to the trade of raw water across national borders. Nevertheless, one form of *trade*, normally accepted without raising special problems, is the natural flow of water between countries sharing a river basin. This transaction is normally ruled by political agreements, rather than commercial trading agreements.

In practice, only a comparatively small number of agreements for long distance trade of raw water exist. The international trade of raw water is normally made through pipes or canals or by transporting water in tankers or in large plastic bags towed by a boat. The transport of water by towing icebergs wrapped in a plastic bag, from polar regions has also been proposed, but never put into practice. These forms of water transfer are normally expensive and not competitive with more usual practices such as desalination.

However, the export of bulk water may, in some cases, become economically attractive. For instance Barlow (2000) makes reference to transport of water from Alaska to China for use in assembling computer wafers, an industry which requires extremely pure freshwater. The economic justification for importing water lies in using cheap manpower available in China to assemble computer wafers and in the unavailability onsite of water with the quality required by this industrial process.

The high-tech industry although commonly perceived as a so-called clean industry is in fact one of the most water dependent and water damaging sectors in the world: a single 300 mm silicon computer wafer chip requires almost 9,000 L of de-ionized freshwater (Yaron, 2000). In fact, due to an increase of the value of water for certain industrial applications, particularly those related to high-tech industry, and the innovative forms of water transport there is an increased pressure for bulk water transport.

But the transport of bulk water for applications which are not so demanding may be too expensive when compared to alternatives, such as desalination. In fact, the cost of water desalination has been dropping consistently in the last decade due to increasingly efficient technologies. And this is true even with recent increase in energy costs, because energy input represents currently only about 10% of the desalination cost. Some now consider that desalination may become a viable alternative for water supply for domestic and industrial uses in coastal regions. If the cost of desalinized water drops low enough, following the trend observed in recent years, it may become cheaper to obtain fresh water from sea water or brackish water instead of obtaining water from other more traditional, but more expensive sources.

The damage caused by globalisation to the urban poor may, already, be a reality. However, indeed, the more affected are the poor farmers, particularly in developing countries subject to water shortages. In different regions of the world the value of water for urban use tend to be much higher than for agricultural use and, as a result, water markets, formal or informal, tend to cause a transfer of water out of agriculture. In some cases, farmers may prefer to sell water rather than using it, because this appears to be more profitable to them, but this may be, in fact, not the best solution for society in general, including the farmers. Economic globalisation will only tend to aggravate this type of situations.

Another consequence of globalisation is the development of international tourism, which is the cause, in certain regions, of seasonal peaks of water consumption, creating a competition with other water uses and particularly the water use for agriculture. However, tourism is normally an activity that can easily support the full cost of water, as paying will practically not affect the daily expense of a tourist.

5 WATER AND POVERTY

Water and poverty are inextricably linked and insufficient access to potable water and adequate sanitation will affect the health of the poor, their food security and economic conditions. But, although obvious, the relationship between water scarcity and poverty is more complex than often thought. The installation of a pump or of a water distribution system doesn't mean that the families

may benefit from safe and close water. Even though water might be available, poor water quality or inefficient water systems may always lead to poverty conditions.

Women in the developing world spend a very significant part of their time fetching water. This can, as it does in many regions of Africa, take up more than 25% of the total time available to women (DFID, 2001). Waterborne diseases are also not only a major cause of mortality and morbidity, particularly among children, but also an additional time burden upon women, which adds up to the time spent in fetching water. By simply avoiding this huge time sink, allowing the time to be allocated to more productive activities and to an increased access to instruction and education for women and children, this would contribute to a significant decrease of poverty.

The relationship between water and poverty is, in many cases, established trough the link of health conditions. Availability of sufficient water of good quality influences health in many ways, related to water-born diseases and water-washed diseases. The leading water related diseases are diarrheal diseases and malaria (in an indirect way as malarial mosquitoes breed in water). Hygiene plays an important role in health conditions and thus not only availability of good water supply is important, but also good sanitation is crucial.

In September of 2000, 189 UN Member States adopted the *Millennium Declaration*, which sets eight goals aimed to eradicate poverty in the world, the so-called *Millennium Development Goals* (MDGs), to be achieved by 2015, and defined targets related to each of those goals.

The goal more directly related to water is *Goal 7*, entitled *Ensure Environmental Stability*, which breaks down into three quantitative targets: 1) integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; 2) reduce by half the proportion of people without sustainable access to drinking water and adequate sanitation; 3) achieve significant improvement in the lives of at least 100 million slum dwellers. It should be noted that the reference to sanitation in target 2) was actually added at the *UN Summit on Sustainable Development* held in September 2002 in Johannesburg, thus recognizing the close relationship between water supply and sanitation.

Three aspects deserve reference concerning the MDGs:

First, it is important to realize that, presently, 1,100 million people around the world lack access to safe water, 2,600 million lack basic sanitation, and 4,000 children die each day of a preventable waterborne disease. An aggravation of this situation is to be expected throughout the development of the *Millennium Programme*, up to 2015, when an increase of the population by over 1,000 million is expected.

Second, it is also important to keep in mind that, since the MDGs' general purpose is to ensure a significant reduction of poverty and an improvement of the well-being of the more deprived people, meeting the water supply and sanitation target is particularly important. In fact, this target is crucial not only for the accomplishment of *Goal 7*, but also for the accomplishment of most of the other goals, which are related to hunger eradication, health conditions, gender equality and child education. That's why solving the problems of water would, in large measure, facilitate the solution of the world's problems of poverty.

Third, it should be understood that the *Millennium* target related to water supply and sanitation will only be achievable within the context of general progress in water management at the global, regional, and local scales. This should be achieved in particular through integrated water resources management and by insuring effective means of fighting corruption which, particularly in the case of some developing countries, tend to occur when implementing water supply and sanitation systems.

According to the most recent assessments (e.g. WHO/UNICEF, 2006; DFID, 2006) progress to date for the water and sanitation component of the MDGs is patchy, with particular concern for water supply targets in sub-Saharan Africa and Eastern Asia and concern everywhere for sanitation targets. The global sanitation target is actually expected to be missed by 500 million people based on current trends. There are also wide disparities between rural and urban areas. For instance, concerning water supply, city dwellers are twice as likely to have access to safe water as those living in rural areas. If the current trend persists, 1,700 million rural dwellers will still not have access to improved sanitation by 2015.

A *Water Poverty Index* (WPI) was developed at the *Centre for Ecology and Hydrology* in Wallingford in order to "enable decision makers to target crosscutting issues in an integrated way, by identifying and tracking the physical, economic and social drivers, which link water and poverty" (Sullivan, 2002). The WPI is an interdisciplinary index integrating various factors related to water, including physical, economic, social and environmental information, as well as information on the water users' ability to get access to water to use it for productive purposes. Caroline Sullivan (this volume), makes further reference to WPI and to other related indexes and considers some related recent developments.

Jimenez *et al*. (this volume), deal extensively with the use of WPI and its relation with the *Human Development Index* (HDI) and makes the case of the importance of good monitoring systems.

The water related actions to be taken in order to ensure an effective reduction of the poverty are linked to different aspects, such as: improving the conditions of access to adequate water services, which will benefit the health situation, welfare and food security of the poor; increasing the production capacity of the poor thus bettering their economic conditions; and perfecting the prevention and mitigation of water related disasters and the adaptation to their impacts. It will also be important to ensure, along with an improved water management system, the protection of the water and related land ecosystems, facilitating the access by the poor to the natural resources on which the improvement of their livelihood is based, such as agriculture, forestry, grazing and fishing.

6 WATER PRIVATIZATION

Water privatization, an issue which often appears as related to globalization, involves the transfer of the production, distribution or management of water or water services from the public to the private sector. It should be noted, though, that the comments made below, in relation to water privatization, also apply, in many respects, to the privatization of other goods and services. Nevertheless water is in some respects different because it is a *natural monopoly*.

Although water privatization has recently appeared with a growing impetus in many regions of the world, it is not, in fact, a new phenomenon. One can mention, for instance, the case of the USA, where more than 90% of municipal water services have been, for over one hundred years, since the beginning of the 19th century, under private control, having later passed, in large measure, to the public sector. A different situation is illustrated by the case of some European countries, such as France, where the opposite evolution has taken place. There, the municipalities, which were initially directly responsible for the water services, have progressively encouraged their privatization.

The recent interest in the problems of water privatization is related to several circumstances: the growing difficulties in ensuring a safe water supply in many parts of the world; the expansion of multinational firms dealing with water supply and sanitation; and the attention raised by a number of unsuccessful water privatization cases. Examples of such cases are the withdrawals of Suez from concession contracts in Argentina and the Philippines (Hall, 2003) and of SAUR from a water supply contract in Mozambique.

Different types of reasons have been put forward by various governments in support of privatizing water and water services. Neal *et al.* (1996) mention five types of reasons in favour of water privatization:

- *Ideological*, related to the belief that smaller government is better;
- *Societal*, related to the belief that privatization can help satisfy unmet basic water needs;
- *Commercial*, related to the belief that more business is better;
- *Financial*, related to the belief that the private sector can mobilize capital faster and better;
- *Pragmatic*, related to the belief that competent, efficient water-system operations require private participation.

As Gleick *et al.* (2002) point out, privatization efforts may tend to evolve with time: in Europe they were, in early times, ideologically driven, but afterwards became increasingly characterized

as commercial and pragmatic; in the USA they were initially pragmatic, but are now strongly ideological; in developing countries they tend to be mainly financially and pragmatically driven.

It should be realized that privatization does not imply a single type of intervention. Rather, it may assume several forms, from full privatization, involving a complete loss of public responsibility for the water systems, to several levels of private intervention and state regulation. In particular, privatization may or may not involve private ownership of the water facilities and equipment. As a matter of fact, this ownership may remain public, the private intervention being only in rendering a number of services agreed by contract. The private ownership implies the transfer of public facilities and equipment to a private firm, usually for a limited period of time.

The forms of privatization usually adopted are the following:

- *Public water corporations*, when the ownership of the water systems is shared by private partners and the public sector, this last one usually having a major share;
- *Service or lease contracts*, when governments outsource specific tasks to private firms, with investment funds often being provided by bank loans;
- *Concession contracts*, when the full operational responsibility and the commercial and investment risk are supported by the private sector;
- *Build-operate-transfer contracts*, when the private partners build and operate the water supply system, transferring all assets to the government after the term of the contract;
- *Fully private companies*, which can be large corporations or small-scale entrepreneurs.

In recent years the so called *Public-Private Partnerships* have been established for developing water supply schemes, particularly in developing countries, and with different degrees of success. A public-private partnership is a legally binding contract between government and business for the provision of water and the delivery of water services, which allocates responsibilities and business risks among the different partners. Usually, the public sector remains actively involved throughout the project's life scale. The private sector is responsible for the more commercial functions such as project design, construction, finance and operations.

Public-private partnerships are intended to ensure benefits to the government, the taxpayers and the private sector. For the government and taxpayers the partnerships provide an opportunity to improve service delivery, improve cost-effectiveness, increase investment in public infrastructure, reduce public sector risk, deliver capital projects faster, improve budget certainty and make better use of assets. For the private sector, public-private partnerships provide access to secure, long-term investment opportunities, payment being provided either through a contract fee for the service provided or through the collection of water tariffs. This can allow the capacity and expertise of the partnership in the water sector to be expanded, and then leveraged to create additional business opportunities.

Another possibility often neglected is that of the so-called *Public-Public Partnerships*. These partnerships are generally established between public services in developed countries, which have efficient water services, and public services in developing countries, which have, often, poor service and insufficient water supply coverage. The public-public partnerships make possible a transfer of institutional capacity between the two countries without involving the private sector. This has often the advantage of being less expensive, but also of facilitating efficient on-the-job-training in the utilities of the partner of the more developed country.

It should also be noted that any water privatization initiative must respect a number of principles related to certain societal objectives. These include the satisfaction of the basic water needs of the ecosystems and of the human communities (with special consideration of poor people), the equitable access to water by the most deprived groups, the existence of independent monitoring systems, the supply of water of good quality and the participation of all stakeholders in the water decision-making processes.

This being said, it should be noted that examples can be given of efficient and non-efficient water services in both developed and developing countries. But any form of water privatization should also imply the existence of a transparent water regulation system, ensuring public ownership or control of the water sources and efficient system of conflict resolution.

Several arguments have been put forward both in favour and against water privatization. In each case, the best solution depends largely on the political, economic, cultural and educational situation of each particular country or region. In general it can be said that there is a strong preference for water being under public property (even if in many countries, due to historical reasons, groundwater tends to be the property of the owner of the land where the water is withdrawn).

In regard to the water services, there are several examples of both public and private systems working perfectly or in very poor conditions. As mentioned, this greatly depends on exogenous factors and, indeed on the quality of the institutions for water management and/or regulation in place. Charles Sampford (this volume), discusses an extensive list of arguments related to the advantages and drawbacks of water privatisation raising many interesting issues.

7 WATER GOVERNANCE

In recent years the concept of governance has gained ground, in the context of water policy and is related to the concept of sustainable development. Good water governance is considered necessary in order to tackle water problems in all their complexity and to warrant efficient and equitable water use and management, ensuring economic, social and environmental sustainability.

Historically the concept of water governance appeared for the first time in 2000, at the *Second World Water Forum* in Hague (WWC, 2000). But the *Forum Declaration* referred to *good water governance* as water resource management involving public interest and stakeholders' participation, which corresponds to a comparatively narrow definition. Only one year later, at the *Bonn Freshwater Conference* (FMENCNS, 2001), a preparatory meeting of the Johannesburg Summit of 2002, the concept of water governance has been broadened, to include institutional reform, legal framework, equitable access and *Integrated Water Resources Management* and has definitely entered the vocabulary of the water professionals.

In general, *governance* may be defined as one way in which traditions and institutions balance power in the administration of a country. According to the definition put forward by GWP (2002) and accepted by the United Nations (UNESCO, 2003), *water governance* refers to "the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society".

Water governance aims to define who has access to water and under what circumstances, how is water quality guaranteed and how are decisions taken in case of water scarcity. Water crises would thus be the result of inadequate governance, more than of actual water scarcity. As Rogers & Hall (2003) state, "governance relates to a broad social system of governing, which includes, but is not restricted to, the narrower perspective of *government* as the main decision-making political entity". The water sector, as part of the socio-economic system, is conditioned by general politics and is, thus, influenced by decisions that lie outside of the water sector. Water governance determines who gets which water, when and how, and establishes who has the right to water and to water services. The representation of various interests in water decision-making and the role of politics are important in the definition of governance dynamics.

Thus, governance involves the government, private interests (agriculture, industry, energy, trade, etc.) and the civil society, including users and consumers. And this partnership is present at different scale levels of society: local, national and even international. The three types of partners should be present at the different levels to ensure effective water governance.

UNESCO (2003) has listed the following basic attributes of effective water governance:

- *Participation*: water users should have a voice in the decision-making process;
- *Transparency*: information should flow freely in society and the various processes and decisions should be transparent and open for scrutiny by the people;
- *Equity*: all groups in society should have opportunities to improve their well-being;
- *Accountability*: governments, the private sector and civil society organizations should be accountable to the public;

- *Coherency*: the complexity of water resource issues has to be taken into account in the development of coherent water policies;
- *Responsiveness*: institutions and processes should serve all stakeholders and respond properly to their changes in demand and preferences;
- *Integration*: water governance should enhance and promote integrated and holistic approaches;
- *Ethics*: water governance should be based on society's ethical principles, for example, it should respect traditional water rights.

Water governance includes not only the action of the government but also the underlying issues such as the different stakeholders' participation in the decision process, the sharing of investments in water issues and of benefits of water development, or even the exclusion of a part of the population due to their weak economic and social power. The concept of water governance raises a number of issues, such as the role of governments in the water decision-making processes, decentralisation (favouring action at a local level), the role of the legal and judicial system in matters of water or the relationships between water stakeholders, in present and future conditions.

As a matter of fact, effective water governance is also based on the partnership of the different stakeholders with the purpose of balancing the different levels of authority. Public participation in water governance takes place through the stakeholders' representatives. This approach is crucial if we mean to take in consideration the needs of the different communities, to weaken the resistance to change, and to promote ethical values such as human respect and dignity, transparency, equity and common well-being.

Thus, the development of effective water governance involves multiple aspects. One of the main aspects, as has been stated at the *Bonn Conference* of 2001, is the implementation of *integrated water resources management*, which has been defined as a process favouring a coordinated development and management of water, soil and other related resources, and aiming to maximize, in an equitable manner, the economic and social well-being, without compromising the sustainability of the vital ecosystems. Integrated management, as opposed to traditional management, which is fragmented, should value the interactions between the natural systems (which affect the quantity and quality of water) and the human systems (which affect water use, production of wastewater and pollution, as well as development priorities). Integrated water resources management should, by definition, be environmentally sustainable, economically efficient, and socially equitable. As already mentioned, governance is, therefore, not limited to *government* but includes the roles of the private sector and civil society. The character of relationships and the nature of the information flow between different social actors and organizations are key features of governance (Rogers & Hall, 2003), facilitating dynamic interactions among water stakeholders, which are important both in developed and developing countries.

Water governance is considered to have four different dimensions—social, economic, environmental and political—which have been identified by UNESCO (2006) in the following way:

- The *social dimension* points out the *equitable use* of water resources. Apart from being unevenly distributed in time and space, water is also unevenly distributed among various socio-economic strata of society, in both rural and urban areas. How water quantity and quality and related services are allocated and distributed has direct impacts on people's health, as well as on their livelihood opportunities.
- The *economic dimension* draws attention to the *efficient use* of water resources and to the role of water in overall economic growth. Prospects for aggressive poverty reduction and economic growth remain highly dependent on water and other natural resources. Studies have illustrated that per-capita incomes and the quality of governance are strongly and positively correlated across countries.
- The environmental dimension shows that improved governance allows for enhanced *sustainable use* of water resources and ecosystem integrity. The sufficient flow of quality water is critical to maintaining ecosystem functions and services and sustaining groundwater aquifers, wetlands and other wildlife habitats.

– The *political dimension* points at granting water stakeholders and citizens at large *equal democratic opportunities* to influence and monitor political processes and outcomes. At both national and international levels, marginalized citizens, such as indigenous people, women and slum dwellers are rarely recognized as legitimate stakeholders in water related decision-making.

In spite of the fact that it has strong impacts on settlements, livelihoods and environmental sustainability, water governance has not received the same attention as the application of technical measures. A water governance system must not only be able to allocate water for food and security, but also be able to define for whom and for what purposes water is provided. Water governance should be able to make decisions and trade-offs. Governance addresses the relationship between organizations and social groups involved in water decision-making, across activity sectors and also across regions, at local, regional and international levels.

In recent years, the concept of water governance has gained growing importance, evolving from a not very relevant idea in North-South cooperation dialogue to a respected concept with good acceptance at international, national and local levels. The observation of water problems from a perspective of governance has progressively led to the widening of the water agenda, so as to include the consideration of democratization processes, corruption and power imbalances between poor and rich countries and between rich and poor people.

One limitation to a wider acceptance of the concept of governance is the lack of good enough indicators for its evaluation. Water governance indicators should be useful to decision-makers as a tool to set priorities and to reinforce institutions' reactions to the needs of the water users. In fact, there has been recently a certain progress in defining governance indicators (see, for instance, UNDP, 2004).

8 CONCLUSIONS

The consideration of water both as an economic and social good assumes a comprehensive evaluation of the costs and benefits related to water use, complemented by a stakeholder participation process, with the aim of allocating water to the more valuable uses according to procedures which the various stakeholders accept as fair and reasonable.

The right to water is increasingly considered a fundamental human right recognized as an indispensable element of human dignity. This recognition tends to be more present in international and national law. The access to safe water seems to be a pre-condition to warrant many other human rights, such as the rights to life, health and food. The acceptance of the principle of a human right to water has reinforced the idea that water should be considered as a social good, as well as an economic good.

The *Millennium Development Goals* consider water and sanitation in one of its eight goals—*Ensure Environmental Sustainability*—a goal whose accomplishment is fundamental for the accomplishment of most of the others, all related to the eradication of poverty. The relationship between water scarcity and poverty is, indeed, very important and more complex than it is often realized.

Financing of water supply and sanitation to all, in order to comply with the requirements of the *Millennium Development Goals*, may prove to be unfeasible if resorting only to national funds. In developing countries there are only three alternatives for raising funds: the water users, the taxpayers and external donors, whether international or national. However, these funding policies should not only be more ambitious, but also be better controlled. In particular, a part of any investment in water infrastructures should be earmarked for the maintenance of the infrastructures, and for capacity building, namely for training the people in charge of their operation and maintenance.

The consideration of water as both an economic and a social good implies the adoption of an economic cost-benefit analysis, but accepting that certain environmental and cultural costs and benefits cannot, in practice, be accurately quantified. Thus, decisions on water allocation are,

apparently, seldom taken on pure economic grounds, and governments generally make decisions also on the basis of political considerations.

It is presently recognized that the implementation of proper water charging schemes is necessary to ensure efficient water services. Recently there has been a tendency to adopt charging schemes for water that progressively assume a full cost recovery to provide sufficient incentives for water conservation.

The relevance of globalization concerning water may be considered from two different perspectives: the first related to the consequences of economic globalization on water resources management and the second related to water trade at a global level. One issue that often appears in relation to globalization is water privatization, which involves the transfer of the production, distribution or management of water or water services from the public to the private sector. Several types of reasons have been identified in defence of the privatization of water and water services: ideological, societal, commercial, financial, and pragmatic reasons.

The problems of making water as an economic resource compatible with the human right to water can only be adequately solved by resorting to effective water governance. As was previously mentioned, water governance refers to the range of political, social, economic and administrative systems set in place to develop and manage water resources, and the delivery of water services, at different levels of society. In fact, water governance is considered to have four different dimensions: social, economic, environmental and political. Water governance involves the government, institutional and legal reforms, private interests and the civil society, including the water users and stakeholders.

One of the main aspects of water governance is the implementation of integrated water resources management, a process which favours a coordinated development and management of water, soil and other related resources, and aims to maximize, in an equitable manner, the economic and social well-being, without compromising the sustainability of the vital ecosystems. Integrated water resources management should be, by definition, environmentally sustainable, economically efficient, and socially equitable.

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CHAPTER 8

Water as a human right and as an economic resource: An example from Mexico

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ABSTRACT: The concept *Water as Human Right* is briefly explored as developing countries try to meet the *Millennium Development Goals*, particularly with respect to access to safe water. Although in most parts of the world, development dollars have been steadily decreasing, in this chapter, an example for the state of Guanajuato, Mexico, where water tariffs were raised between 60–200% during the period 2000–2006 is presented. The additional revenues have allowed improvements in institutional and capacity building, improving the infrastructure, and as less subsidies are needed for the urban areas, more money was available for the rural settings. The *Comisión Estatal del Estado de Guanajuato* (State Water Commission for the State of Guanajuato) was able to accomplish this through a strong communication and transparency campaign.

Keywords: Human Rights; Valuation; Water; Transparency

1 INTRODUCTION

The chapter by Veiga da Cunha (this volume) addresses the same topic as this chapter. Thus, to avoid repetition, we briefly discuss the shortfalls of adopting water as a human right for marginalized communities, in view of the fact that developing countries do not have the financial resources to meet the *United Nation's Millennium Development Goals*. This is followed by an example as to how the state of Guanajuato, Mexico was able to significantly increase its water tariffs through better governance.

2 WATER AS A HUMAN RIGHT

Why do we need to define water as human right? The statistics are staggering. *World Health Organization's* (WHO, 2003) data shows that more than 1,100 million people lack access to safe drinking water. Notably it is the poorest people that lack access to safe drinking water. This lack of water also impedes enjoyment of health and other basic human rights such as the right to food and

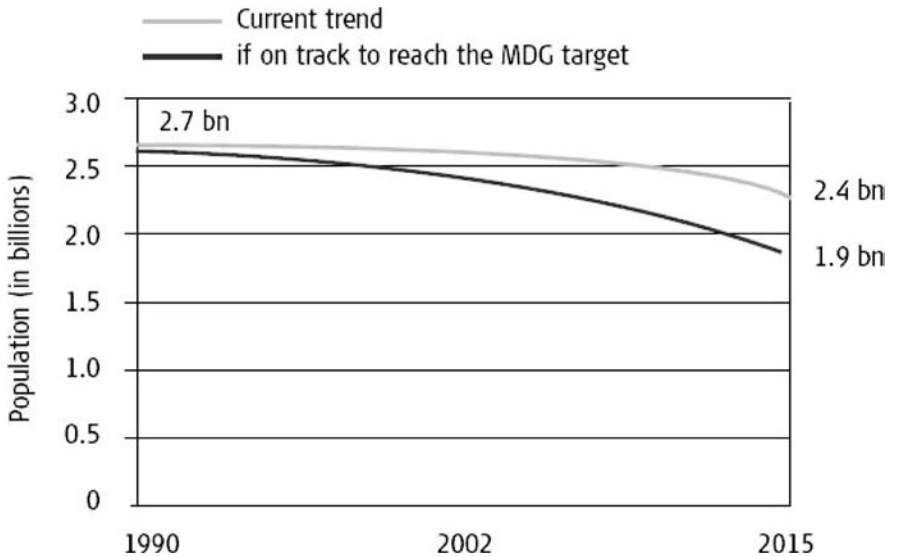

Figure 1. Trend showing gap in meeting the *Millennium Development Goals* for water.
Source: WHO/UNICEF, 2004.

adequate housing. Kofi Annan, the former *United Nation's Secretary General* stated that "access to safe water is a fundamental human need, and, therefore, a basic human right".

In the *Millennium Declaration* of 2000, delivered at the close of the *Millennium Summit of the United Nations* in New York, 150 heads of state and government pledged to "reduce by half the proportion of people without sustainable access to safe drinking water". The *Johannesburg Declaration* adopted at the *World Summit of Sustainable Development* in September 2002 extended this goal to include sanitation as well. Figure 1 shows gap in meeting the *Millennium Development Goals* for water, according to WHO & UNICEF (2004).

Lack of safe water kills more than two million people each year, with the vast majority being children from developing countries. Lack of water has a major effect on people's health, as poor health constraints development and poverty alleviation. So with these sobering facts, why must access to water be declared as a human right?

Human rights are protected by international guaranteed standards that ensure the fundamental freedoms and dignity of individuals and communities of the member states that recognize these rights. They include civil, cultural, economic, political, and social rights. Government obligations can be broadly categorized into the following: respect, protection, and fulfillment.

– *Respect*: State parties must refrain from interfering directly or indirectly with the enjoyment of the right to water.
– *Protection*: State parties must prevent third parties such as corporations from interfering in any way with the enjoyment of the right to water.
– *Fulfillment*: State parties must adopt the necessary measures to achieve the full realization of the right to water.

3 DOES DEFINING WATER AS HUMAN RIGHT MAKE A DIFFERENCE?

According to WHO (2003), declaring access to safe water as a basic human right will make difference in at least 5 ways as stated below.

1. Freshwater becomes a legal entitlement rather than a commodity or service provided on a charitable basis;

2. The *least served* are better targeted and therefore inequalities decreased;
3. Communities and vulnerable groups will be empowered to take part in decision-making process;
4. The rate of achieving basic and improved services will be accelerated;
5. The means and mechanisms available within the *United Nations* human rights system will be used to monitor the progress of State Parties in realizing the right to water and to hold governments accountable.

Although we agree with the principles stated here, we are not as optimistic as the *WHO* regarding the ground level benefits of declaring access to water as a human right. Following each one of the points made by the *World Health Organization*, we briefly mention some of the shortfalls.

The first three points are good starting points, but the citizens of each country that signed the agreement must know and understand the full implication of these issues. This is not necessarily the case, particularly when one refers to the poorest segments of the population, who in many cases are illiterate. Smith & Marín (2005) in their work have reported on the water conditions in a rural setting in Mexico. This area has significant lead and arsenic contamination issues. Although a NGO had tried for many years to have both state and federal agencies within Mexico acknowledge this situation, it was not until a major newspaper carried the story on its front page that the problem was acknowledged by the federal government. Thus, efforts need to be made to make sure that the population as whole knows about these rights. The biggest obstacle in accelerating basic and improved water and sanitation services (point 4) is that governments from many developing countries do not have the financial resources to cover such expenses. One must also take into account that often infrastructural services such as electricity, roads, etc. are missing, thus, raising considerably the financial investment needed to comply with these goals. As regards the final point (point 5), the UN system has a major drawback. The member states report directly to the United Nations. Thus, issues such as transparency and trust become important. There are cases where the *official* view as reported by the state agencies may not be shared by other members of that particular country.

Some additional problems with declaring *Water as a Human Right* include the following: 1) what does it exactly mean? Does water as a human right mean that everyone should have tap water in their homes, of a given minimum water quality standards? For example, the United Nations has suggested that each person should have access to at least 20 liters of water per day as a minimum. In some Latin American countries, the right to water has been understood as the right to have piped water at one's door step. The *WHO* has published some guidelines that may be used in countries that have not developed their own. What happens when the individual state guidelines are more lax than those proposed by the *WHO*?

Furthermore, *Water as a Human Right* does not give any individual the immediate guarantee that he or she will have access to safe drinking water. Within the framework proposed by *WHO*, an informed citizen can demand his rights to access to safe drinking water. However, at the local level, a rural community for example, it is neither direct nor clear how it will be instrumented, or who will pay for these services.

Each country should decide the minimum volume of water a citizen should have access to per day. Even if one is talking about small volumes of water, for example 20 L/day per person, good hygiene and eating habits are needed in order to improve the person's well being. Thus, perhaps one should consider establishing intermediate goals, such as supplying water taps on every street, instead of each home, as it has been done in Johannesburg, South Africa.

Upon the acceptance of the *United Nations Millennium Development Goals*, a lot of emphasis has been placed on the track record of both the donor countries and on the individual work that is being done by each country in order to meet these goals. Although there is no *accepted* figure as to how much money is needed to meet the MDGs, it ranges anywhere between U$ 11,000–30,000 million. An important issue of great concern, however, is that the amount of *Official Development Aid* (ODA) has been steadily decreasing since 1960 (Figure 2). In 1999, the developed nations pledged to commit 0.7 of the GNP to development; however, no country has kept this promise.

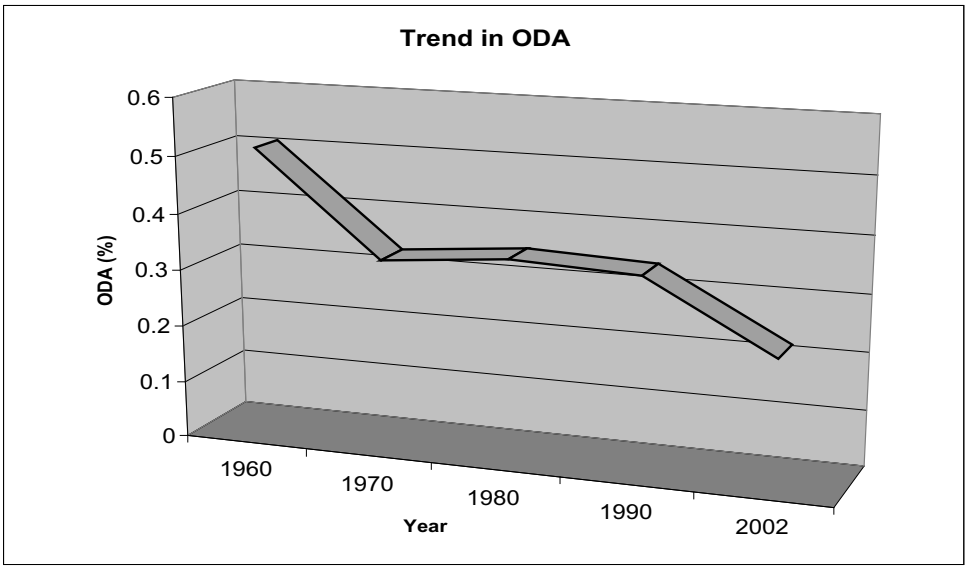

Figure 2. Decreasing *Official Development Assistance* (ODA).

Thus, it is clear that the *Millennium* Development *Goals* will not be met by the year 2015, and it would seem that the UN system is setting itself up for a major embarrassment.

Many developing countries in Latin America now have, or are in the process of writing water laws. This is certainly an important first step towards ensuring that citizens have access to water. To a lesser degree, developing countries are beginning to enact laws similar to the US *Freedom of Information Act*. Such a law was passed during the previous administration in Mexico, and for the first time, officially a citizen could get a copy of water-related studies conducted by the *National Water Commission*. Previous to this law, it was up to the public servant to decide whether or not to share this information that had been paid with the taxpayer's money. Thus, these types of laws are helping to improve both transparency and accountability in Mexico (Marín, 2002).

4 WATER AS AN ECONOMIC RESOURCE

There has been a long standing debate on how to value water on a global scale. Issues such as population growth, increasing costs of water service delivery, demands for better water quality, and increasing competition for scarce water resources (for example agricultural *vs.* municipal use), and a dwindling supply have resulted in recent attention with regards to the value of water. Nowadays it is recognized in addition to being an economic good, water also is social good. How to value water as a social good is not yet clear. Trying to give a global definition of the value of water has been controversial at best. For example, the *Camdessus Report* generated tremendous controversy as it was advocating a pure market approach (Camdessus, 2003). Clearly, water is more than just an economic commodity. This report was highly criticized because it left out issues such as affordability by the poor and marginalized communities. It focused primarily on the externalities associated with the implementation of the fourth *Dublin Principle* which deals with cost recovery.

Part of the problem arises with the conception of water. It has been regarded as a traditionally free resource of unlimited supply with zero cost at the supply point, and at best, water users only pay a portion of the costs associated with extraction, distribution, and treatment. In Mexico City, for example, individual citizens do not pay for municipal waste water treatment, and on average,

people who are hooked up to the municipal water supply system, pay only about 20% of the water distribution cost.

5 WHO PAYS FOR THE WATER?

There has been a lot of protest around the world against the privatization of water. However, while this argument is taking place, the reality is that an impasse has been reached, which is negatively affecting the marginalized communities. Just to cite one example, UNESCO (2003) reported that the cost of one cubic meter of water as charged by private vendors in some of the developing countries was 136 times that of price of water in the USA (US$ 0.11/m^3 in USA *vs*. US$ 14.68/m^3, as charged by water vendors in some developing countries).

Payment for water services occurs in several ways: 1) People in urban settings may either pay a fixed fee, or may have a water meter; 2) People in peri-urban settings not connected to the municipal systems must either buy water from the municipality or from water vendors. Trying to get water from the municipality is a difficult job, as delivery appointments are hardly honored, unless of course, one is willing to offer *additional compensatio*n to the concerned municipality employee. Even in that case, there have to provisions for storing the water, which is not always the case.

In some of the poorer areas of Mexico City, some sections of the city only get water through the municipal distribution system once in every seven to ten days. In rural Mexico, families may spend up to 30% of their daily disposable income for bottled water. People in rural Mexico may have to walk more than an hour to fetch water and that too of dubious quality (Smith & Marín, 2005). Inhabitants from rural Africa, most notably women and children, may spend over 26% of their time fetching water.

Currently governments are not able to allocate additional resources for water supply and sanitation. This is partly due to escalating costs of water, fiscal deficits and increased demands from other sectors of the economy. Thus, they have been trying to at least recover the cost of delivering these basic services. However, in some cases there has been slow progress as there is universally accepted formula to value water. In recognition of the individual cultures, water uses, social customs, etc., UNESCO (2003) has proposed that pilot studies aimed at valuing water be conducted either at a local or regional level, and then up-scaled to a national level.

Although models have been developed, primarily by researchers, in many cases, these models are complicated to use, and require the assistance of experts to interpret their results. Thus, applications of these models by the policy-makers have been limited at best.

The UNESCO (2006) report certainly recognizes that different cultures value water in different forms. As a result, they have proposed that within each country, pilot studies be carried out and up-scaled, as opposed to trying to impose *imported* models that have been developed for other parts of the world. We now report on two examples: Guanajuato State and Mexico City and illustrate the need for developing strategies that work best under local conditions.

6 THE GUANAJUATO STATE, MEXICO

The State of Guanajuato, located in the central part of Mexico, is in throes of a water crisis. This is due to a host of demographic, economic and industrial factors which has pushed the region into a permanent water-scarcity situation. This crisis has also caused increasing conflicts with downstream states and jeopardized the state's future economic development. Groundwater tables are dropping at a rate greater than 2.5 m/yr, while water pollution affects all surface water bodies and threatens groundwater sources, which incidentally supply almost all the water for human consumption.

Since 1996, the state authorities began implementing a reform in the water sector, initially targeted to the municipal water utilities. From 1998, the state's strategy covered wider aspects of water resource management, including social organization for watersheds and aquifers restoration, as well as the implementation of a state planning and monitoring system (CEAS, 2006; Lara & Sandoval,

2003). In 2000, a long term *State Water Program* was proposed for the period 2000–2025 following the guidelines given by Le Moigne *et al*. (1994) and Sandoval (2001), and a mid-term programme was implemented for the period 2000–2006. An *integrated water resources management* (IWRM) philosophy was introduced with this program. This focused on the assessment and development of six strategic assets for sustainability, namely, natural resources, infrastructure, financial resources, capacity building, social values, and strengthening institutional capacity (ECLAC, 1991).

Article 27 of the Mexican Constitution states that water is a national property. This article confers on the *Executive Branch* the responsibility of authorizing the extraction and management of the water resources of the nation. The *National Water Commission* (*Comisión Nacional del Agua*) is the federal agency in charge of water in Mexico. Water is currently being regulated through the *National Water Act and Water Practices* (*Ley de Aguas Nacionales* and its *Reglamento*) which were passed in 1992 and 1994, respectively. *The Ley de Aguas Nacionales* was revised in 2004 (Marín & Escolero, in preparation). The operating responsibilities lie under the municipal authority, directly or by means of decentralized operating utilities. In this context, a supporting approach was implemented by the State to strengthen seven areas to help restrain or enable sustainable operation of the municipal water systems. They were: 1) Water sources restoration or preservation; 2) Technical and financial support for the development of infrastructure and efficient services; 3) Political and technical support for the provision of adequate tariff structures and commercial operations; 4) Training and certification of personnel, linked to the access to public funds; 5) Legal and regulatory support; 6) Funding for research and development of technology; 7) The implementation of a network for promoting an enabling social values environment to encourage better use of water.

Thus, although improving the financial performance of the water utilities was a crucial objective, it was not taken as an isolated goal, but as a part of a more comprehensive program. In the financial area, an intense lobbying process to reform the tariff was successful and new tariffs were implemented by the municipal authorities, water utilities boards and the State Congress. Collection of water tariff has steadily grown since then, rising more than 50% on average from 2003–2006. This allowed water utilities to widen their investment capabilities. Technical efficiency was improved, lowering energy cost impact by half of what it was in 1996. The State of Guanajuato obtained three national prizes at an energy saving programs contest. With support from the State, every water utility in Guanajuato updated their water and sewage inventories, commercial software, users' records and some even developed network simulation models. Permanent assistance on accounting and legal issues was provided to the municipalities. In 1995, only 23 municipalities had decentralized utilities to deal with water supply and sanitation, but by the year 2000, 35 utilities were governed by a citizen's body and received support from both the Municipality and the State. Water and sewerage coverage were maintained in urban cities and improved in rural towns, while wastewater treatment capacity rose from 46 to 66% from 2000–2006, with projects under way to attain 90% coverage by 2007. The first system for training and certification of personnel in Mexico was implemented in 1998. This included training on technical, administrative, communications and rural promotion models. An annual set of awards for the municipalities has been initiated in 2001. Under this program the *best practices* in water and sanitation sectors are recognized and awarded. Guanajuato developed a system of indicators for assessing the technical and commercial performance trends in the 46 Municipalities since 1996 and this database is updated annually. Training and certification of the personnel in charge of meter reading, consumer relations, rural promoters and communication specialists has been initiated since 2000. Those municipal utilities who employed certified staff, received bonus from the state coffers. Finally, a network of people in charge of communication projects, named *water culture network*, was set up. In 2000, only 6 utilities had a department devoted to water communication but by 2006, 36 of the 46 municipalities already had a communication's office (Sandoval, 2001).

The underlying rationale behind the program for increasing water tariffs was to protect the human right to water. Water rights protect each individual as a member of a community by providing affordable access to a minimum quantity of water for satisfying his or her needs of hygiene and health. Thus, an institutional framework was set up in order to meet two objectives. The first objective was to avoid delivering water for non-essential uses at a price lower than their production

cost (as an initial goal). This was done to prevent eroding the community's capacity to ensure proper maintenance and extension of water and sanitation systems which in turn jeopardized the State's capacity to fulfill its commitments towards the protection of the community's water rights. The second objective was to ensure that no individuals could, by neglecting his or hers responsibilities towards the community, put also at risk the community's capacity to sustain the services and preserve the water for future generations. In other words, once a minimum and affordable access could be guaranteed for the population, there was a need to implement an efficient mechanism to avoid waste, to postpone unnecessary investments, avoid subsidizing secondary uses of water and reduce the pace of groundwater abstractions. For attaining these two objectives, the most simple and efficient mechanism was thought to be a rational pricing structure.

Nevertheless, the approach was not insensitive to political and social concerns, keeping in mind that implementation of new tariff structures had to be achieved through a multi-actor structure, in which each utility's board had to propose a tariff structure, balancing its needs for investment and operation with socially achievable financial goals. Once this was achieved, the proposal went to the municipal authorities, the municipalities and a collegiate body where citizens of different social, economic and political orientations voted on the project's tariff structure. Once the tariff structure was approved, this was sent to the State Congress, to be analyzed within the whole income structure proposed for each municipality. If the State Congress found that a proposal did not match with the equity, affordability and rationality criteria–it had the right to send it back to the municipal authorities with the proposed corrections. Clearly, previously, in this long chain, defective communication practices, short periods of analysis and political concerns resulted in weak tariff structures at the municipal level. In this context, the State authority was only expected to give technical support to water utilities, according to its legal framework.

The new strategy was directed towards the implementation of a different process for calculating, communicating and implementing the water tariff structure. A consultant was hired and he acted as a *pivot* between the different stakeholders, namely, the state authorities (the *Water Commission* and the *Finance Ministry*), the Congress, the municipalities, the water utility boards and technical staff. Through wide consultation with all these stakeholders, a state-wide tariff structure was proposed. In 2002, the tariff structure—that is, the categories and as far as possible, the criteria for calculating every form of income—were gradually revised and standardized. This sole measure brought a significant increment to the utilities' incomes. Before that effort took place, only five of the 46 municipalities had enough income to cover their operating costs; 15 others had increasing difficulties to recover operating costs; 20 utilities required regular subsidies from their municipal authorities and six municipalities, being too small to deserve a complex management structure and based in rural area, faced different kinds of problems in addition to financial problems. For the year 2001, the operating costs were equivalent, to 4.80 Mexican pesos[1] per m^3 (less than half a dollar), while the income per m^3 was around 3.80 Mexican pesos. Thus the water tariffs were outdated by at least six years [and this was only with reference to operation and maintenance (O&M) costs and not including capital costs]. There was also a wide variety of consumption ranges and different formulae applied for calculation of each, which made it difficult to understand the tariff structure and implement it as few people understood it. Thus, achieving a standardized water tariff structure was the first goal, which was met between 2002 and 2006.

Once this phase of standardization had reached a reasonable level, the reform of the pricing structures took place, although several municipalities performed both tasks simultaneously[2]. An important aspect that led to the success was that the pricing structures were developed by means of

[1] 1 US$ = 10.48 Mexican pesos in April 2008.

[2] It has to be pointed out that, from the beginning of the process, the municipality of Leon, accounting for nearly one million inhabitants and being one of the 5 most well developed systems in the country, decided not to be included in the State's project. Progressively, some other municipalities decided to take over the control of this process, as they reached higher levels of income and achieved the expertise to conduct the process by themselves.

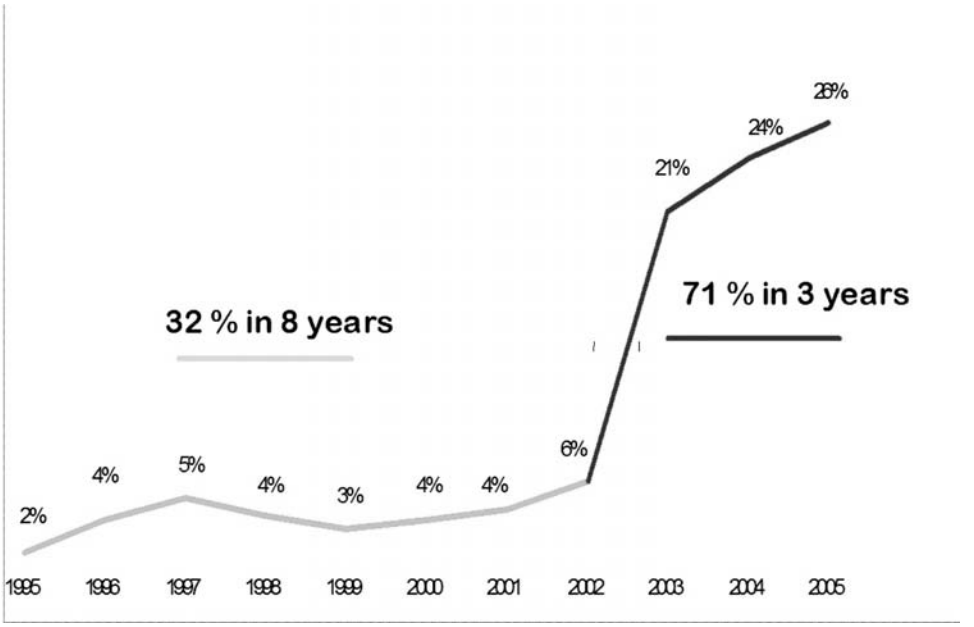

Figure 3. Percentage increase in water tariff rates in Guanajuato, Mexico.

periodic meetings with the financial staff from the water utilities, the municipal treasury staff, the municipalities, and the financial consulting unit at the State Congress. Figure 3 shows how water tariff rates increased.

No complex economic calculation was involved in the strategy of revising water rates. The initial aim in terms of pricing was set to be consistent with the following criteria:

a. To ensure that a minimum quantity of water remained affordable for the majority of the population.
b. To ensure that unjustified subsidies were not allocated to strata of the population that did not need them. The philosophy behind this was those who could pay the full cost, should pay it.
c. To avoid the allocation of unjustified subsidies to excessive water consumption for non-basic uses
d. To avoid transferring to water users the operating and economic deficiencies of water utilities, but to advance simultaneously on improving the efficiency of the utilities by concurrent measures.

In general terms, it was sought that the first pricing block—up to 10 m^3 per month per household—would cover the first 30% of the water distribution costs; from that block on, water users with higher consumptions (due to sumptuary uses, wasteful practices or the presence of leaks) were asked to pay progressively higher rates. Non-metered households were assessed higher rates in order to induce the installation of water meters. It is somewhat surprising that this approach was successful, as there was a wide range in the technical and administrative settings of each one of the municipalities of the state of Guanajuato.

The process was successful due to three factors primarily:

a. An external consultant acted as a facilitator, and took charge of explaining and getting the opinions of the stakeholders, giving the results a collective sense of belonging and highly improving the communication between the parts.
b. The public acceptance that it was the State Government, through the *State Water Commission*, who was responsible for the proposal; so, that even during election periods, the reform was

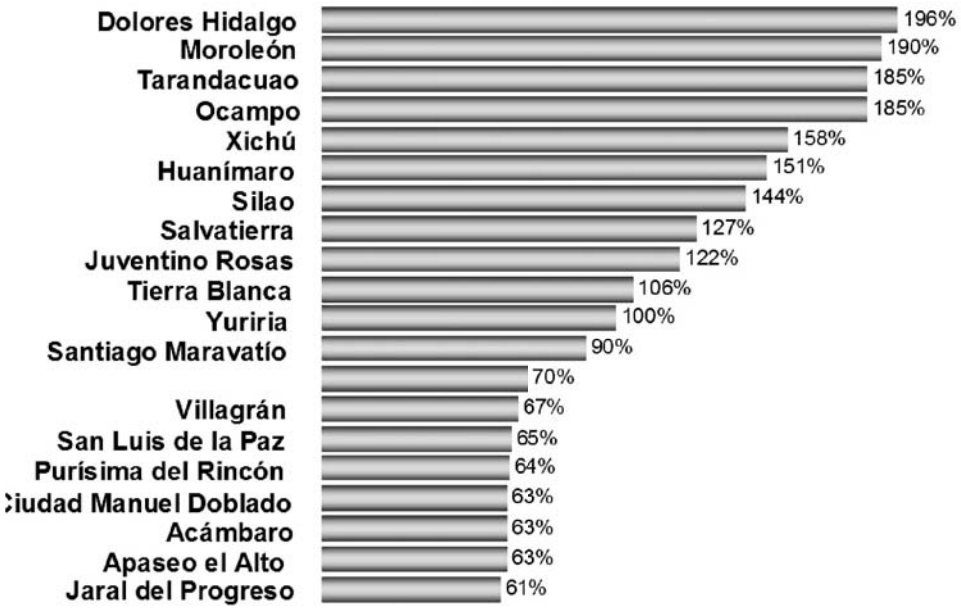

Figure 4. Average rate raise for different municipalities in Guanajuato, Mexico (cumulated raise for the period 2003–2005).

presented by municipal policy-makers as a *request* from the State authority to get access to state funding programs, which indeed was the case, to some degree.

c. The set of measures implemented simultaneously to improve the utilities accounting systems, the installation of water meters, training programs, and an intensive communications program throughout the State promoting the *fair payment* of water.

From 2003 to 2005, the increase in water tariffs accounted for 71% on average for the State which, compared to the 32% achieved in the preceding eight years, gives an idea of the success (Figure 3). The cumulative rise in income in four municipalities, surpassed 180% in the same period, and for other seven others it was more than 100% (Figure 4). If we look at the figures for the different blocks, the extent of the reform was even more noteworthy, as the different municipalities were able to recover the O&M costs, and in some cases, there were cash surpluses that allowed money to be invested for better coverage of services in un-covered or under-covered areas.

The raising of the water tariffs was achieved without any social unrest. The simultaneous program for the construction of wastewater treatment plants was also supported by the sustained financial strengthening of the involved municipalities. For instance, in the city of San Miguel de Allende, an 18% raise in water tariff for meeting wastewater treatment expenses was passed. This was in addition to the average raise in water distribution rates and this received a positive response from the population.

A fundamental goal of rational water pricing was achieved since an indexation mechanism was approved for 40 municipalities. The final goal is, nevertheless, far from being reached. The gap between unit costs and income was reduced (Figure 5), but the gap still persists, even in the state of Guanajuato where water charges are approximately double the national average water charge. The *Comisión Estatal de Aguas* (State Water Commission) conducted regular audits to make sure that the municipalities where spending the money the way they were supposed to. This helped to gain public trust, and thus, there were few complaints with respect to the higher water tariffs.

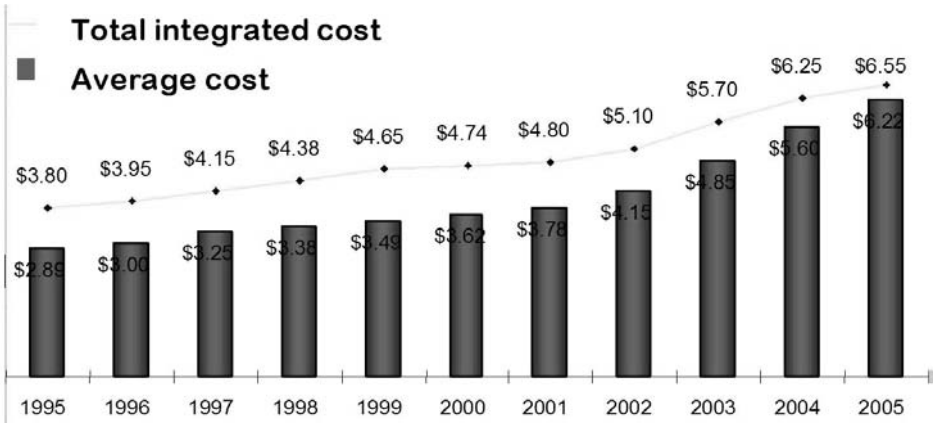

Figure 5. Evolution in water prices (Mexican pesos/m^3 of water) for Guanajuato State, Mexico. 1995–2005 (Mexican pesos)[1].

The example from Guanajuato, Mexico demonstrates how the state can works towards initially recovering the cost of water, while at the same time, starting to move in the direction of obtaining the full economic value of water.

6.1 *Communication strategy*

The *Universidad Nacional Autónoma de México* in close collaboration with UNESCO (International Hydrology Program, World Water Assessment Program, and WHYMAP) has recently launched a pilot project to improve people's knowledge on water. If successful, it will be implemented throughout Latin America. It has been developing non-traditional ways to communicate information on the water cycle, groundwater, and the importance of good governance. The next phase will attempt to explain concepts such as cost and value of water. The information is web-based, and it includes 2-D animations, videos, comics, and books that are fun to look at, and learn from.

In an effort to realize the full potential of the proverb that *information is power*, attempts are made towards making available water-related information that is not protected by copyright laws. This obviously includes publications produced by the United Nations System, the Mexican Academy of Sciences, and others. The Mexican journal, *Geofísica Internacional,* has graciously agreed to give permission so that its water-related papers may be made available on the web free-of-charge. Under this pilot project, scientists who have conducted research in any water-related fields in Mexico (hard sciences, social sciences, etc.) will be encouraged to share their work so that the rest of society may access it. Currently, there is a wide body of information in local universities that is not easily accessible either to the regional or to the federal policy-makers, or for anyone else. Essentially a network is being built with the local universities, and non copyrighted material will be posted to the website whose address is: www.aguaenmexico.org.

7 CONCLUSIONS

Every day more and more people are beginning to recognize the importance of access to safe drinking water. Although defining water as a human right will probably commit member states to try to improve access to water in the developing world, this act by itself will not give access to those without it, nor will it provide the financial resources needed to do it. It is clear that the *United Nation's Millennium Development Goals* will not be met by the year 2015.

An alternative to way to meet the UN's MDG is to better communicate with society the full value of water (in a culturally acceptable fashion), to work towards having greater transparency and accountability so that water tariffs may be raised. That such improvements are possible was presented through the Guanajuato example. It will be important to share successful examples such as the one presented here.

ACKNOWLEDGEMENTS

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IV
Water and poverty: Is there a link?

CHAPTER 9

Poverty and the ethics of water development

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ABSTRACT: The development process generates increases in economic and financial capital, requires vast amounts of natural resources, and generates huge amounts of waste. In many places, development also can bring social disruption and a significant loss in biodiversity. Poverty is often a consequence of structural change and income redistribution. Poverty and inequity are not issues only relevant in the less developed parts of the world—in the USA and the EU too, there are many thousands of people who live below their respective national poverty lines. The main drivers of poverty in urban areas tend to be related to social exclusion, migration and inequitable access to services, while in rural areas, it is more driven by lack of access to resources and infrastructure, droughts and floods, and low levels of educational enrolment. In sub-Saharan Africa, most poor people tend to live in areas where livelihoods depend on exploitation of natural resources (FAO, 2007). In this chapter, the ethical dimensions of development are discussed. Some suggestions are made as to how this can be better understood through a range of techniques, and an illustration of a rapid appraisal approach linking water to poverty is provided through an example of the *Water Poverty Index*.

Keywords: Water resources assessment; Poverty; Ethics; Indicators; Water Poverty Index

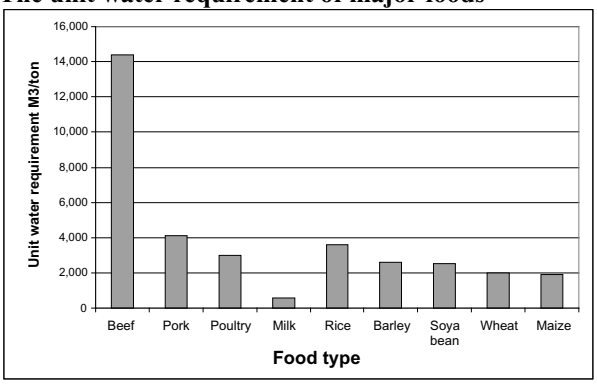
1 INTRODUCTION

There are a number of common conditions which gives rise to poverty. These include unemployment, landlessness, natural disasters, lack of adequate legislation, institutional weakness, lack of access to resources such as water, energy sources, etc., and a concentration of the benefits of modernisation in urban areas. In particular, the role played by water, or the lack of it, has not been fully understood, and this has given rise to situations world wide where water management decisions have resulted in an inequitable outcome.

Water resources of the Earth are part of a finite closed system, but it is a large system amounting to some 1,400 million km^3 (Maidment, 1992). For humans, the problem arises when we consider that only about 2.5% of that is freshwater This currently must be shared not only by the huge number of humans depending on that water, but also by all other terrestrial species as well. This is made worse by the fact that most of this fresh water is held in polar ice caps or inaccessible aquifers, and so the small remainder which is feasibly accessible to humans is a mere 11 million km^3. This, and the fact that our own population is predicted to rise to between 8,000 and 9,000 million by 2050 (Molden, 2007), indicates that per capita water availability will inevitably decline in the foreseeable future.

Choices, even at the individual level can effect water consumption (see Figure 1), and since agriculture uses more than 70% of all water consumed by humans, our food security will depend on how well we manage that resource, and the choices we make as individuals. According to the now well-established *Dublin Principles* (International Conference on Water and the Environment, 1992), which recognises that freshwater is a finite and vulnerable resource that must be managed in a participatory manner, acknowledging the economic value of the resource, and the role of women in its use. Under such a system of *Integrated Water Resources Management* (IWRM), water would

The unit water requirement of major foods



Human consumption (daily)	Water requirement (Lts)
Drinking water	2–5
Vegetarian Diet	2,000
Grain fed Meat diet	5,000

Based on FAOSTAT mean 1996–2000

Figure 1. How our choices influence our water needs.

not only be distributed more equitably, but also managed in such a way as to minimise ecological impacts.

Figure 1 illustrates the water requirements of various food items. Each individual influences water demand through their food choices, and since agriculture accounts for so much water, changes in food demand patterns can have a significant effect. This also applies to other goods such as clothing: cotton garments requiring much more water to produce for example, than those made of hemp[1].

There is clearly an ethical issue associated with human consumption, given that the *footprint* of such consumption can be widely spread across the world. Is it right for example, for pigs in the Netherlands to be fed cassava as a winter feedstock, since its trade on the international market will inevitably push up prices of that crop in producing countries in the tropics, where it is a staple food for millions of people living at subsistence level. Is this impact really being incorporated into the price of European pork production? Similarly, when pressure to grow *lifestyle* crops like tobacco leads to forest conversion in developing countries, the long term ecological impact may be very high compared to the economic gains made from its trade. These ecological costs are usually borne by local people, often increasing their vulnerability through a weakening of the livelihood base. While such a *normative* discourse can be viewed from many perspectives, there is do doubt that it results in a *positive* reality, the impacts of which are not necessarily positive for local communities in the developing world.

2 LINKS BETWEEN WATER AND ECONOMIC DEVELOPMENT

Securing ecological integrity through wise water management is a cornerstone of sustainable development, and there is no doubt that the future of our own life support system depends upon this (McNeely *et al*., 1990). Such global efforts as the *World Commission on Dams* (WCD, 2000), the *World Summit on Sustainable Development* (WSSD, 2002) and the *World Water Forum* (WWC, 2003; 2006) are testimony to the increasing degree of public and political awareness of this need for change. The way development has been viewed in the past has changed, with the realisation that a simple increase in per capita income does not necessarily bring about positive changes in human wellbeing.

[1] In some parts of the world, including Australia, shops selling hemp clothing are not uncommon.

The development process has impacts on all aspects of life, it influences societies in many ways, not least by generating aspirations for lifestyles and behaviours which are often not in keeping with those currently in place. It generates migration patterns which disrupt social and ethnic linkages, and capital investment flows which distort local financial systems. As a result of development, countries are becoming more and more dependent on globalised resources and international trade, and this is likely to increase vulnerability and dependence in many parts of the world. If a comparison is made between expenditure on electricity and water, it is clear (Figure 2) to see a very significant difference. This may lead to the question of why is there much more investment in electricity (which for many is considered a luxury) than there is in water supply and sanitation (which for all is considered a necessity)? This is a clear example of how infrastructure investment is most often made on the basis of profit rather than need. In order to address this type of inequities, there is a need for this process to be reversed.

Another aspect of the conventional view of economic development that urgently needs to be reviewed is that concerning the role of the environment. From the conventional economic perspective, the environment is considered as a source and a sink, but the carrying capacity of Earth to fulfill these functions is limited, as first pointed out decades ago by Rachel Carson in her novel *Silent Spring* (Carson, 1962). An increasing body of scientific evidence confirms that natural capital cannot infinitely be substituted by financial or physical capital (Daly, 1999), and that it has significant economic value (Costanza *et al.*, 1997). This has now finally been internationally recognized through the increasing attention being paid to the issue of climate change, and the need to address this through economic measures (Stern, 2007). By highlighting the potential costs of climate change, this report has brought the issue into sharp focus in the policy arena, but nevertheless, the poor throughout the world still remain the most vulnerable, both in large cities and rural areas, and mostly as a result of increases in water stress (See Figure 3). It is interesting to note that this influential report has emphasized the ethical dimension of the problem of climate impacts, and has highlighted the importance of taking economic action for ethical outcomes.

In recent years, there has been increasing interest in the concept of *Virtual Water* (Allan, 1998a; 1998b). This concept suggests that there may be merit in meeting the food needs of a population through the import of food rather than local production, requiring significant water infrastructure development, especially in arid zones. Such an idea can be supported from both a positive and negative perspective, for both the exporting and recipient countries. On one hand, it can provide trade and employment opportunities in the exporting countries, while on the other it can also lead to exploitation, and the creation of environmental problems, through the application of agrochemicals,

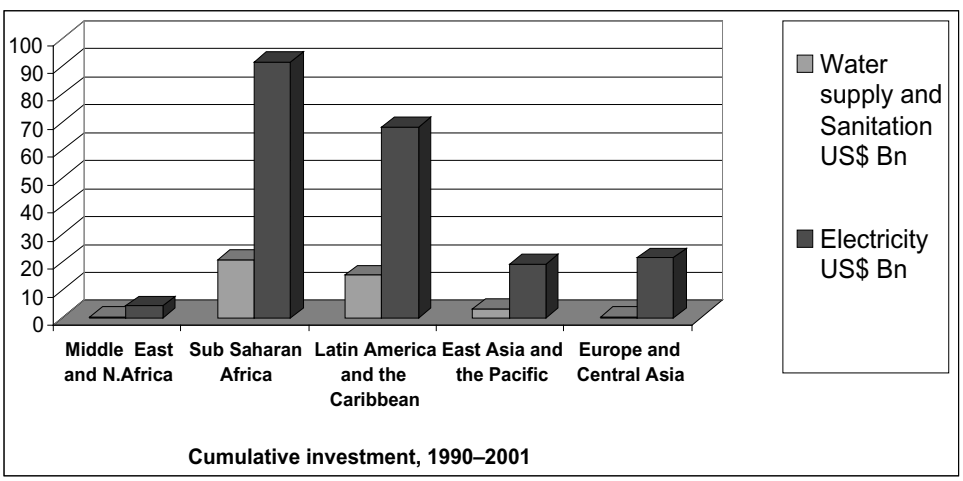


Figure 2. Development motivations—who benefits most?

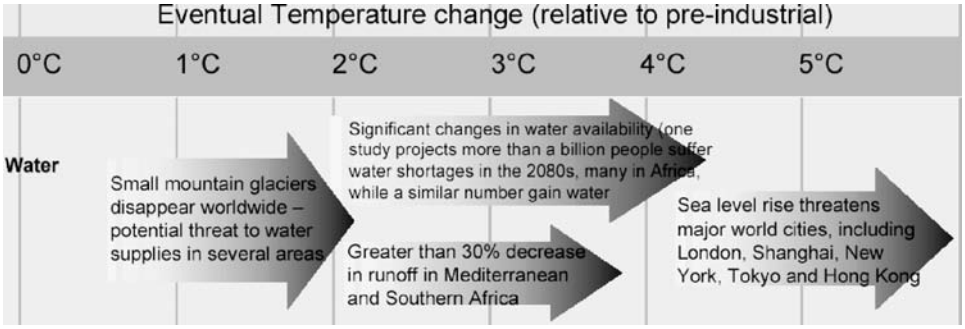


Figure 3. Potential impacts of climate change (after Stern, 2007).

etc. In the recipient countries, it can also create a dependency on imported food, with the inevitable significant level of strategic risk associated with that. The whole issue of trade and development is one in which the ethical question can be ambivalent, and as with all other such situations, its efficacy and distributional impact will depend on agreed regulation, and strong enforcement of legislation.

Water is essential for the survival of life, and it is a fundamental factor of production, but in spite of these qualities, when the level of internal renewable water resources is correlated with GDP (*Gross Domestic Product*), there appear to be few linkages[2]. Furthermore, it is often provided free, or at a very low price. This is an example of a well known phenomenon in economics which illustrates the difference between price and value (Ayres, 1998). Many users across the world equate water as *falling free from the sky* or *a gift from God*, and therefore do not feel that pricing is needed. This sometimes makes cost recovery for water systems difficult, and in many countries, the problem of *unaccounted* for water (i.e. unpaid) is a severe problem for the day to day management by water authorities. An unfortunate result of this is the fact that when water authorities try to deal with this problem, the easiest way is to simply stop water provision at free sources, such as public stand pipes. This clearly has a major impact on the poorest elements of society who depend on such water sources. This problem associated with billing is a major factor in the willingness of water companies to provide efficient services, and this often leads to poor water provision in many poorer areas. This is further exacerbated by illegal water connections which are widespread in many parts of the world.

It is very difficult to link the level of economic development to water resource availability. It has been shown (Briscoe, 1996; Sadoff & Grey, 2002) that water does play an important part in economic development and there is much potential to consider how benefits from it can be shared equitably across society. How this can relate to realities within a basin is illustrated for the Nile in Figure 4.

These figures show how countries with the lowest levels of poverty are not always those with the highest degree of water availability.

This demonstrates that a nation endowed with water does not necessarily succeed in achieving a high level of development (e.g. Uganda), while when combined with other factors, higher standards of living can be achieved even when water is scarce (e.g. Egypt). In this case, Egypt, a desert country, has had a guaranteed share of the water of the Nile through international treaty (Government of the

[2] On the basis of an examination of the *purchasing power parity* level of GDP per capita of 163 countries (1999), and the per capita level of internal water resources (FAO, 2003), a correlation of only 0.1 has been found. This highlights the fact that water alone cannot generate wealth, and thus its provision alone cannot reduce poverty. It must be seen as part of a suite of developmental tools. It must be noted however that when international water transfers are made (e.g. through transboundary rivers), water does become more important, e.g. as in Egypt.

Hydrological and Economic variation in the Nile basin

Country	Average Rainfall in the Basin Min (mm/year)	Average Rainfall in the Basin Max (mm/year)
Burundi	895	1,570
DR Congo	875	1,915
Egypt	0	120
Ethiopia	205	2,010
Kenya	505	1,790
Rwanda	840	1,935
Sudan	0	1,610
Tanzania	625	1,630
Uganda	395	2,060

Source: D.R. Karyabwite, 1999

Country	Population 2005 millions (Estimated)	Rural population below national poverty line (%)	Per capita GDP (constant 1995 $US) 2001
Burundi	7.48	36.2	140.7
DR Congo	58.36		85.1
Egypt	69.91	23.3	1228.9
Ethiopia	71.89	45	120.5
Kenya	32.94	46.4	325.1
Rwanda	9.24	51.2	253.1
Sudan	34.84		328.4
Tanzania	37.22	49.7	196.9
Uganda	25.29	55	354.8

Source: (WDI, 2003), WDR (2004)

While it can be shown that in economies highly dependent on agriculture (eg Kenya), GDP values can be matched by rainfall figures, (see D. Grey 2003), this is certainly not always the case

Figure 4. Links between water resources and poverty.

United Kingdom, 1929), and it has been able to couple this with other factors of production (finance, education, etc.), to achieve strong economic growth. The challenge today is how to achieve the requirement of international water law (United Nations, 1997), on *equitable and reasonable use*. When considering this issue across the basin, it has to be decided how the benefit of water use can be maximised. This must be done on the basis of agreement between the riparian states.

3 THE NEED FOR ETHICS IN WATER MANAGEMENT

Humans cannot live without water, and modern life dictates that control over water has become an important prerequisite to human development. Allocation of scarce resources always requires a trade-off or opportunity cost, and as resources become scarcer, the need to incorporate ethics into decision making becomes paramount. As a result of the seemingly unlimited demand for water for different purposes, there is a need for water storage and provision systems to become more efficient, for example, by addressing the high levels of infrastructure leakage currently occurring[3].

Since 1900, human water abstraction has increased by a factor of 6.5 as a result of both population increase and increased water use per capita. From a hydrological perspective, water which is absorbed into plants and other organisms is considered unavailable for other users. This consumed water amounts to some 2,100 km^3 of the total of 3,800 km^3 of water which is withdrawn for human use. The remainder is returned to streams and aquifers, but often in a polluted state. If water is polluted to the extent to which it becomes unusable, the overall quantity of water available is inevitably reduced. While total withdrawals equate to only a small fraction (10%) of the estimated

[3] Some however argue that such leakage is an important component of groundwater recharge in urban areas.

total renewable resource, there is concern that human utilization of freshwater is causing serious ecological and hydrological disruption. This concern about the extent of human use has arisen for a number of reasons:

- While the fraction of renewable freshwater used may globally be relatively small, this fraction is significantly higher (even reaching close to 100%) in many arid and semiarid areas. Furthermore, in some places (e.g. parts of India and China) groundwater reserves are being used faster than they are being replenished.
- In many river basins, particularly in the tropics, a large amount of water is available on an annual basis, but unequal temporal distribution means that much is either unusable or massive infrastructure has to be built (i.e. dams) to store it for when it is required.
- In many temperate zone river basins, adequate water resources are relatively evenly distributed over the year, but they are so intensively used that surface and groundwater resources become polluted. The withdrawal and consumption figures commonly used in hydrology do not include adequate recognition of that large share of water resources which are degraded through pollution and reduced ecological functions.

Society is increasingly faced with situations where the use of water is limited by its quality. It has been shown that impacts on water quality spread widely both spatially and temporally (Meybeck, 2003) but that our understanding of the problems, and identification of their solutions, are still limited by our assessment methods. Today, the emphasis on monitoring has moved from chemical approaches to the social and ecological ones. The need to involve stakeholders and define indicators of performance underlies the EU *Water Framework Directive* (European Commission, 2000). For example, within the incorporation of the concept of *good ecological status*, it is necessary for society to determine what is meant by *good*, in this context. This is clearly a value judgement and depends on the priorities and preferences of society, as defined through citizen participation. At the same time, in many parts of the EU, pollution continues to be a policy focus, as nitrates from agricultural run-off percolate slowly through to the aquifers, which, in the UK for example, provide some 50% of potable water.

Since climate conditions and water resources are parts of the same global hydrological cycle, attention has become more focussed on the need to consider how these interlinked global processes are likely to change in the future. Without water storage, human societies would be dangerously vulnerable to the impacts of climate variability. Dams, while generating a huge debate, are an essential part of societal infrastructure, and the many and frequent extreme climatic events we have observed throughout the world over the last ten years are evidence of the reality of our changing climate (IPCC, 2001; 2007). Increasing public awareness of this issue has placed it on a higher level of political importance, as demonstrated by the increasing degree of disparate protest groups active at global level political meetings such as the G8. The decision to award the 2007 Nobel peace prize jointly to Al Gore and the IPCC (BBC News, October 2007) does underline current concern about the fact that climate change has a clear ethical dimension, and one which needs to be more seriously addressed in global legislation.

In order to understand more about freshwater, it has been conceptualised and partitioned by some (Falkenmark & Rockström, 2006) as being either *green* or *blue* water. The term *Green water* is that proportion of rainfall (amounting to some 60% globally), that is soaked up by the soil and then incorporated in plants and organisms, or evaporated. Contrasting to this, *Blue water* is that proportion of rainfall (about 40% globally) that enters into streams, and recharges groundwater. Human water withdrawals are taken primarily from blue water, and this part of the water cycle is the usual focus of water resource management. In conventional assessments of the world's renewable water resources, only the blue water portion is considered and counted as economically usable water. It is estimated that globally, renewable *blue water* equates to about 40,000 km^3/year (Shiklomanov, 1997).

The importance of stakeholder involvement in water management decisions is considered to be an important prerequisite to sustainability. The formalisation of this concept in water legislation in Europe (European Commission, 2000), Australia (Heaney & Beare, 2001) and South Africa

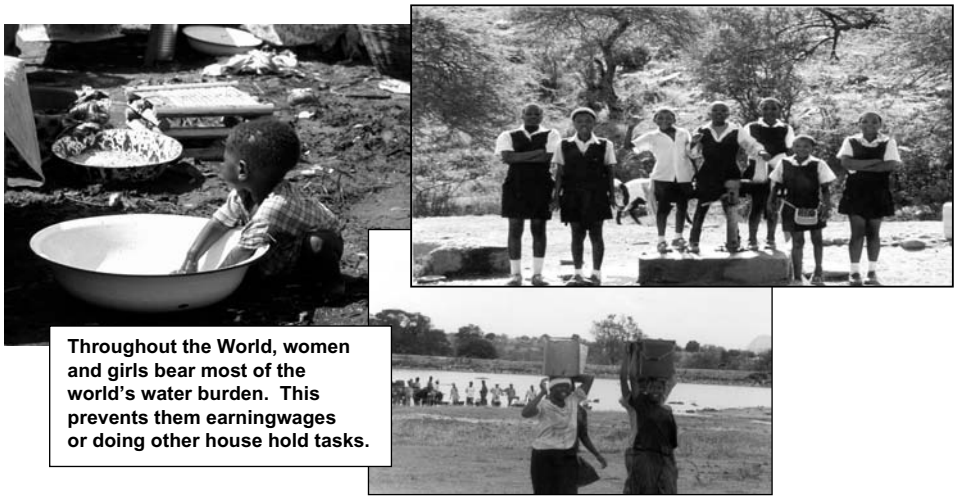


Figure 5. Water rights, gender and future generations.

(Rowlston & Palmer, 2002), supports the general process of government decentralization that is occurring in many places. Where the need for such involvement is explicitly recognised, it applies to stakeholders as individuals, communities, businesses and government, and there is also a need to remember that in this context, *nature* is a stakeholder too. Bearing this in mind, the concept of *equity* in water management must be expanded to recognise the need for ecological water allocations to be secured.

With water being so integral to our own survival, it is surprising to find that to date, there has been no inclusion of *rights to water* as part of our basic human rights. The first time this was identified as an explicit right was under the *Convention on the Rights of the Child* (United Nations, 1989), and this has since been expanded in the *UN statement on water rights* (United Nations, 2002). While there is an almost unanimous international consensus on the need for recognising water as a basic human right (Figure 5), this statement has yet to be ratified by the government of the USA, amongst others.

For current water managers, meeting the water needs of future generations and addressing the gender imbalance in water use which is just another dimension of water inequity is a great challenge.

Throughout Europe, access to piped water supply and sewerage may be taken for granted by whole populations, but in some Eastern European countries, the current state of water and wastewater infrastructure is still inadequate, especially in rural areas. In particular, in the EU *accession countries*[4] only 60% of the population has access to piped water supplies. In Romania in 2000, for example, only 66% of the population had piped water and 52% had proper sewerage facilties. In the USA, while national statistics will claim 100% water access, there are several thousands of people at least who are faced with collecting water by bucket in urban areas, as a result of urban poverty which means they cannot pay their water bills and supplies get cut off. This illustrates how the issue of water provision is still closely related to the level of economic development (of households, regions, and countries), and some form of regulation is needed to ensure public safety. This underlines the need for public influence in the political domain.

In terms of equitable access to the benefits of water use, there is no doubt that women are often less likely to benefit than men. In general, throughout the world, women have much less influence and political power than men, they hold tenure over less land, and own a much smaller proportion of financial capital. In terms of water access, this usually means that their needs are met less

[4] Countries expecting to join the EU (or have recently joined).

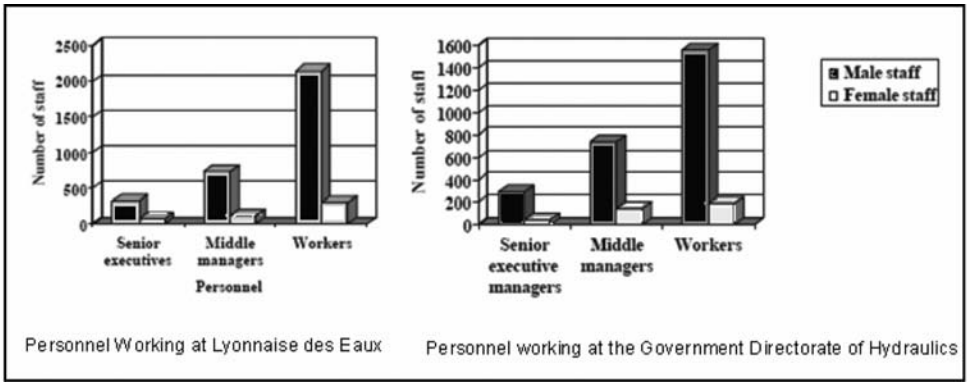


Figure 6. Female involvement in the water sector in Morocco.
Source: Based on data from Tortajada (2003).

effectively, and indeed, even provision of water and sanitation services often acts as a barrier to their involvement in decision making, and education. In a study of female involvement in water management (Tortajada, 2003), it has been shown that in both the private and public sector, women are poorly represented amongst the ranks of workers in the water domain. The extent of this lack of equitable representation is demonstrated in Figure 6.

While the differences in Figure 6 can be explained by differences in educational opportunities and preferences, the situation still provides a reflection of the fact that in general, there is very little gender equity in the water sector, and ethically, there is a clear and urgent need to address this.

4 WATER AND HEALTH

Water availability influences human (and animal) health in various ways:

- Faecal-oral (water-borne and water-washed).
- Strictly water-washed.
- Water-based intermediate host.
- Water-related insect vector.

Without a doubt, most human disease relating to water is likely to be of our own making. With 90% of water borne diseases being diarrhoeal, there is a clear need to increase hygiene awareness and improve wastewater and sewerage management. Lack of water for washing and hygiene exacerbates diseases largely related to skin and eyes, particularly scabies, trachoma and conjunctivitis, and louse-borne typhus.

Water-based diseases are those that are spread through aquatic intermediate hosts. Aquatic organisms such as snails act as hosts to parasites, which then infect humans either by being swallowed or through contact in water (for example through entering the skin). Diseases include guinea worm and schistosomiasis, both of which have major health impacts in less developed tropical areas. In addition to this, diseases transmitted by water-related insect vectors are rife in some areas, carried by insect vectors such as mosquitoes which breed in or near water. In this case, they transmit diseases such as malaria, filariasis, yellow fever, dengue and onchocerciasis (river blindness), to humans, usually through bites. Table 1 provides an indication of the relative importance of water related diseases, which the potentially treatable condition of diarrhea being clearly the one needing the most urgent attention.

Table 1 shows the annual mortality rates from various water related illnesses, and includes data for *Disability Adjusted Life Years* (DALYs) for the year 1999. These are "the sum of life years

Table 1. Water and sanitation related diseases (number of cases).

	Mortality estimates for 1999	DALYs estimates for 1999
Faecal-oral		
Diarrhoeal disease	2,213,000	72,063,000
Poliomyelitis	2,000	1,725,000
Water-washed		
Trachoma		1,239,000
Water-based		
Schistosomiasis	14,000	1,932,000
Water-related vector		
Malaria	1,086,000	44,998,000
Lymphatic filariasis		4,918,000
Dengue	13,000	465,000
Intestinal nematode infections	16,000	2,653,000

Source: Data from WHO/UNICEF (2000).

lost due to premature mortality and years lived with disability, adjusted for severity". DALYs are very high for diarrhoeal disease, because the calculation takes into account the number of premature deaths which for diarrhoeal disease is high. These figures illustrate the effect of poor sanitation combined with conversion of natural habitats promoting a growth in the incidence of malaria as a result of increased prevalence of mosquitoes, with over 1 million deaths per year. Overall, pneumonia (and other acute respiratory infections) and diarrhoeal disease are the two leading causes of child deaths in *the South*. Despite this, only 0.2% of total *Health Research and Development* spending worldwide is invested in addressing these two diseases. This suggests that investment in research and development into these health problems should be significantly increased, but in many cases, there is little motivation for pharmaceutical companies and other organizations to support this, due to the perceived low financial return on such investments. It is ironic that this perceived low financial return is not viewed in the context of the massive economic benefit that can be gained by having a healthy and productive population. This could be an area which could benefit from increased collaboration between the private sector and the global public.

Another health impact arising form poor water management occurs in situations where chemical pollution results from industrial activities. Many of the chemicals released from print works, textile mills, chemical plants and other industrial activities have severe health implications, many of which are to date still poorly understood. As a result of unregulated industrial activity, water pollution in many countries reaches levels which are likely to have serious health implications. In Morocco, for example, a pollution *hot spot* has been identified in the city of Casablanca, where it has been estimated that up to 80,000 tons of oxidable material is discharged into rivers, having inevitable consequences for downstream community water provision (World Bank, 1995). In terms of ecosystems, there are literally millions of examples worldwide where ecosystems have been damaged by human induced pollution (Millennium Ecosystem Assessment, 2005).

5 THE NEED FOR BASIN SCALE MANAGEMENT STRATEGIES

One of the main reasons why the provision of drinking water services needs to be linked with water resources management at the basin scale is due to the fact that the quality of water abstracted for domestic use affects the costs of drinking water treatment. As illustrated in Section 4, the quality of available water resources at a local level depends on the management of the river (or the aquifer) upstream. This is also illustrated in Figure 7, which indicates the importance of early adoption of good practice to manage water quality, and to reduce the likelihood of inequitable impacts, especially downstream.

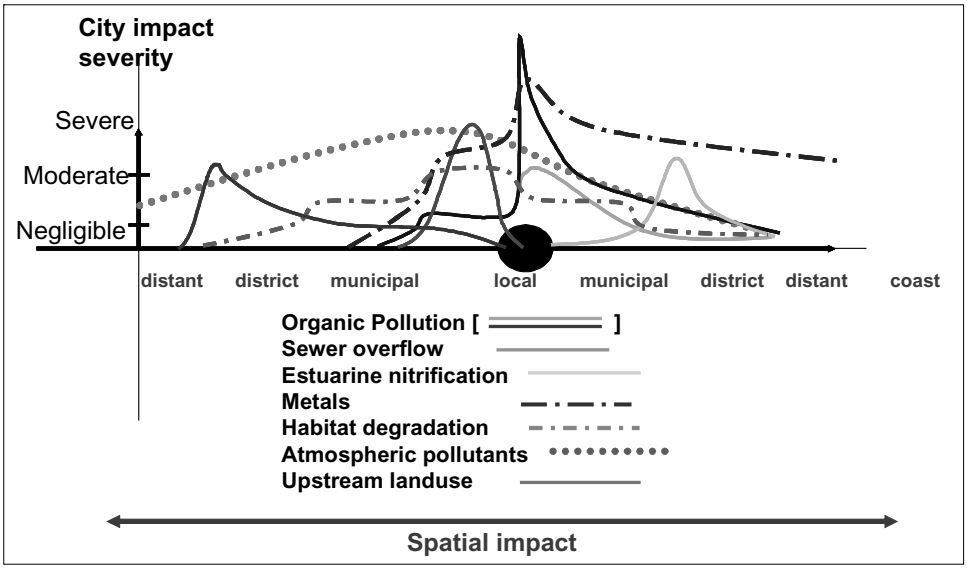


Figure 7. Catchment impacts of urban settlements (after Meybeck, 2003).

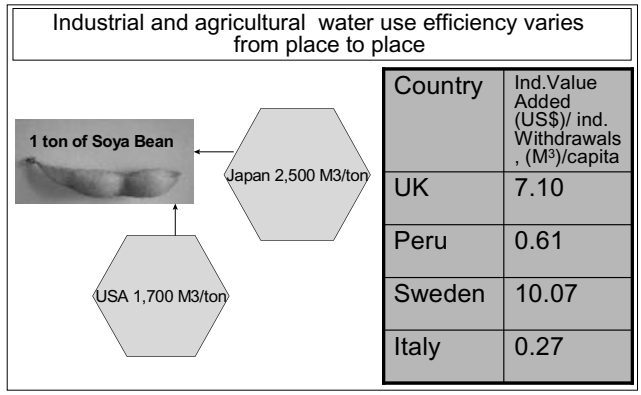
This relation between catchment water quality and land-use provides a clear link by which municipalities and other local government bodies can have a real impact on the effectiveness of *Integrated Water Resource Management* (IWRM). Through the implementation and enforcement of development planning regulations, industrial control and other mechanisms, best practices can be implemented in key areas where water quality impacts are most severe. Full implementation of an IWRM programme would be a major step forward to achieving *sustainable* water management, and as such, would certainly give rise to a more *ethical* distribution of access to the resource.

Water *quality* is also an important issue when it comes to water use by different sectors. In most parts of the developed world, water delivery systems are linked, making it almost impossible to differentiate water quality for various uses. This means that in the USA, EU and many other places, potable water quality is being used where such a level of purification is not needed (e.g. certain industrial processes, cooling processes, irrigation, etc.), when in fact, water of lower quality, or recycled water could be used. It of course must be realized that water reuse has health implications, but this can be appropriately addressed at the sector level, and within industrial plant, water reuse can be achieved cost-effectively through blending, to reduce potentially toxic concentrations.

6 COMPETITION IN WATER USE

In an economic interpretation, the process of competition must exist when the demand for a commodity exceeds the supply. This is the basis of the market mechanism, where prices will rise and fall according to what is wanted by society, and what can be provided from its resources. The issue with water is that its *value* is much greater than the *price* determined by its commodification. The problem is that ecological and cultural values can have great significance, but methods to incorporate these into economic policy are still not well developed.

Competition on water use between sectors is a significant issue which brings about much inequity in many countries. It has often been the case that infrastructure developments have been implemented to support powerful economic groups, rather than those living in poverty that has the greatest need. This can be illustrated in places where large dams and other major infrastructure



Country	Ind.Value Added (US$)/ ind. Withdrawals, ($M^3$)/capita
UK	7.10
Peru	0.61
Sweden	10.07
Italy	0.27

Figure 8. Comparative returns to water as a factor of production.

have been developed to support large business interests such as the sugar industry, paper production, etc. In these cases, the main beneficiaries are usually far removed from the local impacts, while local residents get few of the benefits. As economies are endowed with different resource bases and industrial practices, there are wide differences in the efficiency of water use. As a factor of production in both industry and agriculture, such efficiency is very variable. This will be influenced by the level of technology within a country, the specific industrial process or irrigation technique, the way water is used (and recycled) internally in the production process, and the price of water delivery. Variations in this aspect of water use efficiency are illustrated in Figure 8, and it demonstrates how there is much potential throughout the world to reduce water demand through increased efficiency of use.

7 TRANSBOUNDARY ISSUES

The question of competition for water also goes well beyond the economic domain in the context of international basins. In many areas, the sharing of transboundary waters is largely based on historical legacies and power relations, but there can be potential for cooperation rather than conflict, if the right conditions can be established between riparian states (Salman & Boisson de Chazournes, 1998). Sharing water between independent nations or states is a difficult challenge in all continents (as illustrated in Table 2), and there is an urgent need to address this if equity and ethical issues are to be considered.

While efforts have been made to regularize water sharing in transboundary basins (United Nations, 1997), only a handful of countries have signed up to this. Some of the main criteria for agreements under the UN Convention are shown in Table 3.

The need for international agreements like that described in Table 3 is illustrated by the case of the Nile Basin, where both water supply and demand varies between countries, as shown in Figure 9. In this case, historical legacy allows Egypt priority access to the waters of the Nile, while other countries in the basin (e.g. Sudan) have no guaranteed rights to that water[5]. In this example, it can be seen that currently all of the countries (except Egypt) contribute a net increase to the flows of the river Nile. Egypt has many advantages in terms of industrial growth, with its skilled workforce and strong capital base, but it is however still very dependent on the water of the Nile flowing from upstream. Currently, the allocations of water from the Nile are regulated through international treaties (Government of the United Kingdom, 1929), and while there is no clear indication that

[5] Egypt depends on the Nile for 97% of its water, while for the Sudan, this figure is 77%.

Table 2. Selected major transboundary basins.

River Basin	Countries involved
The Senegal	Mali, Senegal, Mauritania, Guinea
The Mekong	Thailand, Laos, China, Vietnam, Cambodia, Myanmar
The Tigris Euphrates	Turkey, Syria, Iraq, Iran, Saudi Arabia
The Danube	Hungary; Austria, Romania, Slovenia, Slovakia, Serbia and Montenegro; Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic and Moldova; Germany and Ukraine; Albania, Italy, Macedonia, Poland and Switzerland
The Bravo Grande	USA and Mexico
The Orange	South Africa, Lesotho, Namibia and Botswana

Table 3. Characteristics of equitable and reasonable use.

The 1997 UN Convention on Shared Watercourses Article 6. Factors relevant to equitable and reasonable use
1. Utilisation of international watercourses in an equitable and reasonable manner within the meaning of article 5 requires taking into account all relevant factors and circumstances, including geographic, hydrological, climatic, ecological, and other factors of a natural character, along with social and economic needs of the watercourse states concerned.
2. The population dependent on the watercourse in each watercourse state.
3. The effects of the use or uses of the water course in one watercourse state on another watercourse state.
4. Existing and potential uses of the watercourse. Conservation, protection, development and economy of use of the water resources of the watercourse and the costs of measures taken to that effect.
5. The availability of alternatives, of comparable value, to a particular planned or existing use. The weight to be given to each factor is to be determined by its importance in comparison with that of other relevant factors. In determining what is a reasonable and adequate use, all relevant factors are to be considered together and a conclusion reached on the basis of the whole.

Source: UN *Convention on International Watercourses* (United Nations, 1997).

this treaty is likely to be revised, there have been some periods of severe tension between Egypt and the upper basin countries (Zeitoun, 2005). It seems likely that this situation may be reviewed in the future, but in the mean time, the concept of *benefit sharing* is promoted within the *Nile Basin Initiative* (NBI) to overcome the difficulties associated with trying to implement a practical reallocation of the waters of the Nile. In this way, the benefits of water use are shared, rather than the water itself (Sadoff & Grey, 2002).

This illustrates how, with the exception of Egypt, all the countries in the Nile Basin contribute more to the flow than they abstract from the river. In spite of this, Egypt gains more economic benefits from the river than all other riparian states. It is in response to this situation that the concept of *Benefit Sharing* has been introduced.

In order to operationalise an approach towards greater equity of access to water resources, there is a need for an integrated tool which can address this issue from a variety of viewpoints. Bearing in mind the recommendations from the UN convention (as shown in Table 3), an interdisciplinary evaluation tool for transboundary basins has been developed (Sullivan *et al.*, 2007). This tool (illustrated in Figure 10), is designed to provide a heuristic device by which the various differences between the ecological, socio-political, economic, institutional and legal conditions in riparian states can be examined. The objective is to provide a means by which representatives of riparian countries can be exposed to the various pressures and requirements facing each country, in order to foster conditions by which cooperative agreements can be more easily achieved. Clearly, such a tool in itself cannot provide a solution to how transboundary waters can be shared, but it can provide the necessary background information by which conflict resolution can be achieved.

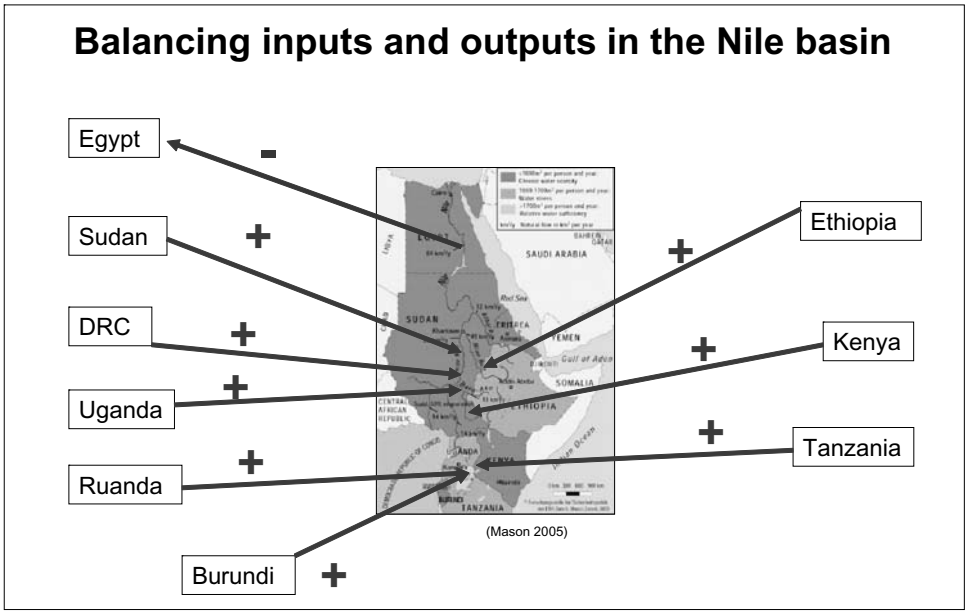


Figure 9. The balance of water abstractions and runoff in the countries of the Nile basin.

As illustrated for the Jordan river in Figure 10, the results of the interdisciplinary analysis required by article 6 of the UN *Convention on Shared Watercourse* can be displayed in an integrated manner, to facilitate a comparison of the various conditions each country in the basin is facing. By making these comparisons more transparent, it becomes more difficult for any specific state to monopolise benefits from the watercourse, in the face of a public and international critique.

In this approach, the situation in each riparian state is reviewed on four key criteria: socio-political; legal and institutional; economic and finance; and hydroecology. A *traffic light* approach is used to provide simple guidance for the user. It is suggested that by confronting the riparian states with a standardized set of information that they can all relate to, it is more likely that they will be able to get round a table and come to an agreement on how water should be shared equitably amongst them.

8 VULNERABILITY, POVERTY AND WATER

The threat of water shortages giving rise to food insecurity has been highlighted (Postel, 1999), and there is no doubt that poor people are more vulnerable to changes in water resources than those from higher income groups. This is due to the fact that they have little access to capital, and possibly lack information and experience. This fact was clearly demonstrated by what actually took place after Hurricane Katrina in New Orleans in 2005. Those who suffered most, both during and after the hurricane, were principally from the lowest socioeconomic groups. On receiving warnings on the impending hurricane, thousands of the better-off members of society took action to put themselves out of harms way, while the poor were not in a position to do so. This confirms that better access to finance and information has the effect of reducing vulnerability through enabling adaptation.

Poor water provision is recognised as being a major cause of poor outcomes for households. This is often manifested as the spread of disease and loss of household labour. Both of these factors will in themselves increase the level of poverty within a household or community, as labour is

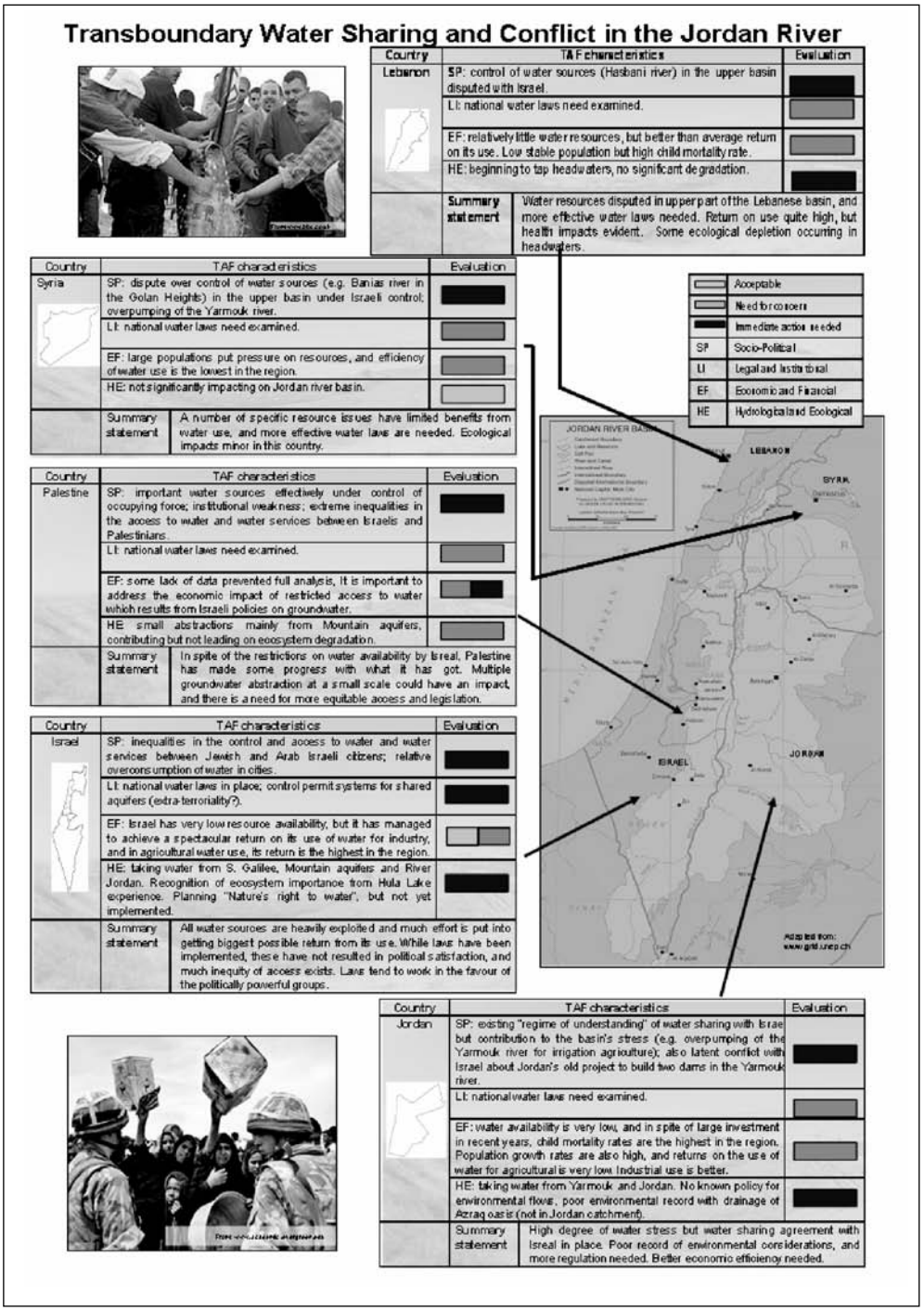


Figure 10. *Transboundary Analytical Framework* (TAF) in the Jordan basin.
Source: Sullivan *et al*. (2007).

the one commodity that most households have to sell to secure their livelihoods. This is further complicated by the fact that it is often difficult to establish property rights over water and thus it may be difficult to both provide a supply, and to charge for that provision. In addition to this problem, another practical difficulty arises due to the fact that water supplies are usually characterised by high fixed costs, and low marginal costs, again creating problems for charging for water supplies. With the issue of *unaccounted for water* being a major concern for most water providers, these factors do create problems for organisations involved in water provision in poor countries. Since water has many of the characteristics of a public good, reliance on the market mechanism results in an under-provision of services, leading to the conclusion that efficient provision of water services will inevitably require some form of government intervention. In the face of much predicted climate change, and other changes in the economy and society, the relationship between people and water resources is likely to become more strained. As society becomes more vulnerable to these changes, it will be important to develop strategies for adaptation, but the key question remains as to how, and what, to adapt to.

Adaptation is usually the response to an undesirable stimulus, enabling an organism to avoid threatening situations. If we are to reduce vulnerability by promoting more effective adaptation by society (especially people within poorer or disenfranchised groups in society), it is important that we understand more about what gives rise to these threatening situations of vulnerability or *water poverty*. In order to do this we need to identify key indicators which can be used to evaluate this, and how a situation may change in the future. When using these indicators to communicate with decision makers, there is a need to use a summarising strategy to simplify understanding. One way in which this can be done is through the combination of these within a composite index structure. Such a structure is widely used in policy circles, most notable in the form of the *Human Development Index* (UNDP, 2006).

In structuring an effective composite index, it is important to examine relations between factors selected for use within it. There are a variety of ways this can be done (on the basis of expert consultation, epistemological study, statistical analysis, etc.). In an attempt to develop a rapid appraisal technique to assess the relationship between water and poverty, Sullivan *et al*. (2003) developed a *Water Poverty Index* (WPI), which provides a holistic assessment technique to facilitate investment prioritization in the water sector, on the basis of a range of relevant factors. In this study, following extensive consultation from a range of scientists, practitioners, and policy makers, five key components were identified as being crucial to the effectiveness of water management for poverty reduction. These components: *Resource*, *Access*, *Capacity*, *Use* and *Environment*, are represented by a variety of sub-components, each of which can be represented at various scales. Although the original objective of the development of the *Water Poverty Index* was to provide a management and prioritization tool for *in-country* middle level water managers and policy makers, it has also become widely known internationally, and can be used as a tool for international comparison. Such a comparison is presented in Figure 11.

From this illustration, it can be seen that in general, countries have both strengths and weaknesses in the water sector. For example, while Germany has a high level of *capacity* in water management and a high level of *access* to water, the *resources* it has available are relatively low, and its efficiency of *use* could be improved. In terms of *resources*, Brazil and Cambodia have a similar level, but better *capacity* and *efficiency* in Brazil results in a significantly better outcome overall (WPI of 61.2) than in Cambodia (WPI of 46.1).

It must be noted however that at this scale, one score to represent whole countries (with all their diversity) cannot be taken as being representative of an accurate picture of all areas within the country (Sullivan & Meigh, 2007). Nevertheless, this technique has been widely applied at a variety of scales, and has come to provide a tool by which links between water and poverty can be examined, revealing strengths and weaknesses of the system. At this scale, such data can be of use to international agencies and donor organizations, to help them to prioritise attention to where it is most needed.

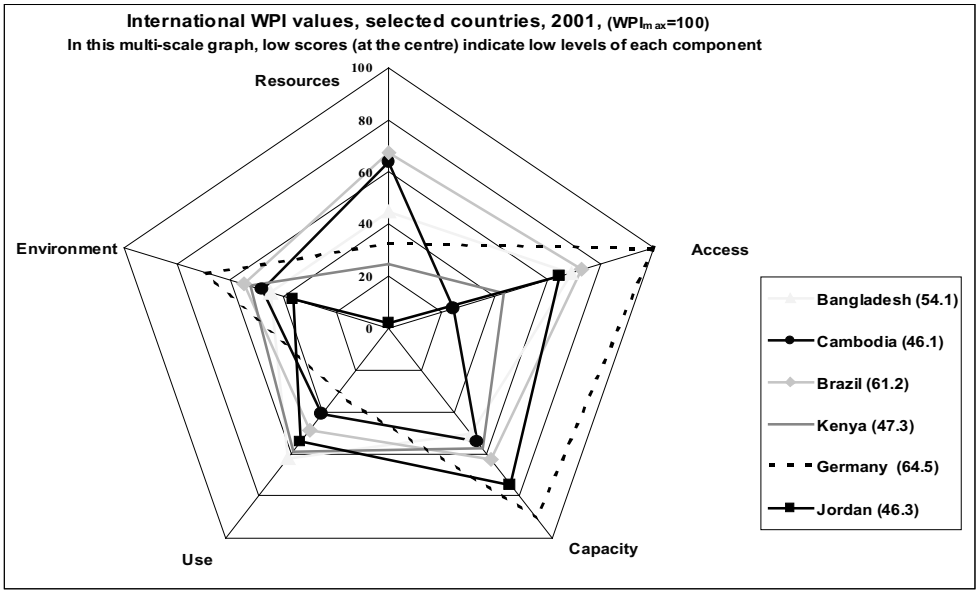


Figure 11. Applying the *Water Poverty Index* to national data from a selection of countries.

9 RESHAPING THE KUZNETS CURVE TO ADDRESS WATER POVERTY?

Another econometric approach that can be used to examine water poverty can be based on the Kuznets curve. A relationship has been shown to exist between the level of economic development and the level of environmental degradation (Kuznets, 1973), and this is depicted as a *Kuznets curve*, a graph where measures of increased economic development (over time) are plotted against measures of income inequality. Kuznets (1973) suggested this curve would have an inverted-U-shape, showing that when an economy is primarily agricultural it has a low level of income inequality, and during early industrialization income inequality increases over time, then at some critical point it starts to decrease. The explanation of this is that in early stages of development, investment in physical capital is the main engine of economic growth. Inequality spurs growth by directing resources towards those who save and invest the most, whereas in more mature economies human capital accumulation takes the place of physical capital accumulation.

In the context of the environment, the theory of the environmental Kuznets curve indicates that at low incomes, environmental impact per unit of GDP increases with increasing GDP per capita, while at high incomes it declines (Rothman & de Bruyn, 1998). Some economists however have argued that environmental degradation is an inevitable consequence of economic growth (Munasinghe, 1999), while others have suggested that it is only through economic growth that the environment can be protected (Beckerman, 1992). What is increasingly accepted however, is that income growth without institutional reform is not likely to be enough to produce a sustainable future, as improvement of the environment depends on policies and institutions. GDP growth creates the conditions for environmental improvement by raising the demand for improved environmental quality, and makes the resources available for supplying it. The achievement of environmental quality depends critically on government policies, social institutions, and the completeness and functioning of markets. In the context of water and economic growth, it does seem that the pattern of the Kuznets curve does apply, as highly polluted rivers result in conditions of rapid industrialization (for example in Europe in the 1950s and 1960s, China and India in the 1990s), but when the economy reaches a certain level of development, pressure rises to improve river water quality (as occurred in Europe in the 1970s and 1980s, and is beginning to take place in Asia at present).

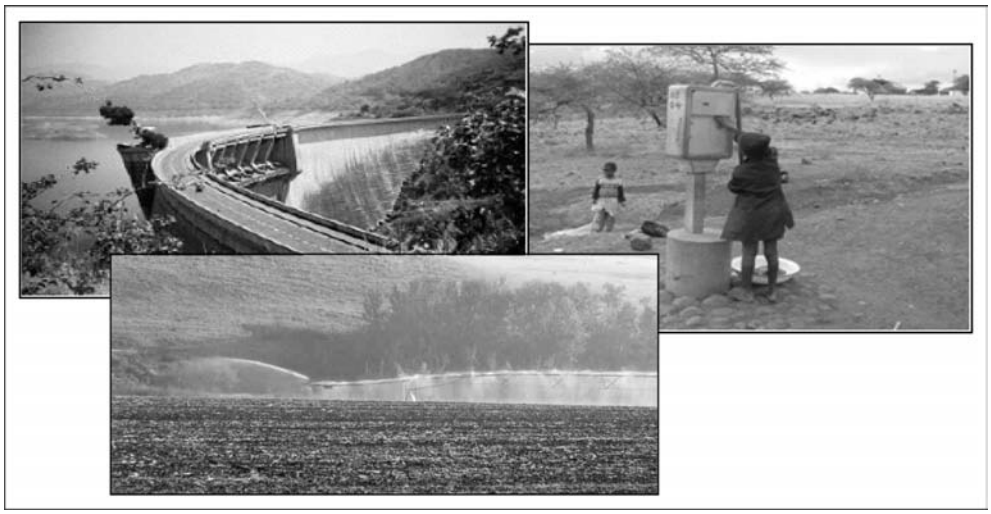


Figure 12. Differential subsidies: who benefits most?

Today, the implementation of the EU *Water Framework Directive* is attempting to ensure that all partner countries address the issue of river water quality, and as such a move against the shape of the environmental Kuznets curve has occurred in that region.

In a global context, the agreement on the *Millennium Development Goals* (United Nations, 2000), has ensured that there is no doubt that the provision of water is going to be an increasingly important activity over the next ten years, and the issue of who holds the rights to water is generating intense economic and political interest. Observation of the profitability of multinational water companies suggests that market-based instruments for water management will become increasingly more commonplace throughout the world, and as an economic good, water will become increasingly scarce, and consequently, recognised as being more valuable. In order to manage this valuable resource more effectively, there is a need to move away from straightforward engineering solutions towards the more *soft water paths* advocated by Peter Gleick (2002), where demand management, increasing water use efficiency and more effective water allocation can all contribute to a more ecologically sensitive solution to the challenge of water provision for the 21st century. Through a greater commitment to the UN *Convention on Shared Watercourses* (1997), there is a chance that a more equitable solution between different water users can be developed, as long as political commitment to that is established.

Pragmatic approaches to the problem of allocating water to support ecosystems have been developed, involving novel policies and legislation to address inequitable resource allocation and use. Examples of this could include the new *South African Water Act* (DWAF, 2002), which explicitly recognises human rights to water, while putting in place mechanisms to secure the ecological integrity of freshwater systems[6]. To investigate the distributional impacts of water management decisions, economic tools such as indices (Sullivan, 2002), logit and probit modelling, multi-criteria analyses (De Marchi *et al.*, 2000) and input-output analysis (Hubacek & Sun, 2005) can be used.

The potential application of these types of tools has increased with our computing power, which has also increased our ability to examine the many complex and interrelated processes that underlie our earth system. This better understanding of ecological and physical linkages has recently given rise to new perceptions, and institutions such as the *World Commission on Dams* (WCD, 2000) have

[6] Although these principles are now enshrined in the national law of that country, their full implementation will take time.

formalised these perceptions in such a way as to change the way we think about how we manage our world (Permpongsacharoen, 2002). The urgency for these new approaches is illustrated in Figure 12, which highlights the issue of the unequal distributional impacts of subsidies.

Another econometric approach which can be used to provide an insight into income inequalities is the *Gini Coefficient*, which is a widely used measure which represents the distribution of income within an economy. This can be used as a proxy for water access, as households at higher income levels tend to have better water services (possibly through private investments). While this approach can serve as an indicator of inequality in water allocation, but accuracy of data at the lower end of the spectrum (poor access), is unreliable.

10 CONCLUSION

As our knowledge of earth systems have developed, so too has the recognition of the importance of better representation of different peoples' views and values (Jacobs, 1997; Foster, 1997). The relationship between poverty and politics has been highlighted (Sen, 1999), and the need to reconsider our approach to resource management and use has been widely discussed (Meadows, 1972; Kuznets, 1973; Schumacher, 1993; Acreman, 2001; Wallace *et al*., 2003; Gleick, 2003). When land and water allocations are made on the basis of expected financial returns, non-food crops may be considered more profitable than food, and in such cases, business decisions made by individual farmers can have the cumulative effect of creating food shortages which impact badly on society at large. When market and policy failures such as these coincide with unfavourable climatic conditions, they can have the effect of bringing about catastrophic famines such as the ones that have occurred in Niger, Sudan, Ethiopia and other parts of Africa. Possible reasons for these failures have been suggested (Sullivan, 2006; Kneese & Schultze, 1985), but it is unlikely that we will see a significant reduction in such failures until we reconsider our understanding of the differences between *financial gain* and *human wellbeing*.

In order to more effectively address the current level of inequitable access and use of resources, including water, we need to promote more democratic governance, empowerment of stakeholders and the development of more equitable, transparent and accurate tools for resource allocation. Inequity influences the poor in many ways: through the lack of property rights, as a result of globalisation of trade patterns, unbalanced power relations, poor infrastructure, failure to recognise the rights of all parts of society, and, in the context of river basins, upstream downstream impacts, especially in terms of water quality.

There is an important need to recognise the diversity of human values (Sullivan, 2000), to reconsider the inequity of world trade agreements, the unprecedented power of multinational companies, and the responsibility of individuals as consumers (SIWI & IWMI, 2004). Evidence that this is beginning to happen can be seen in the rapid growth in demand for organic, locally produced food, fair-trade products, eco-tourism and ethical investment portfolios, and together, these can give us some grounds for optimism. By recognising the need to manage our resources dynamically (Pahl-Wostl, 2002; Wallace *et al*., 2003), within whole systems, rather than as disparate parts, we will continue to reap the benefits of those essential ecosystem services on which we all depend. If we fail to do this, the current inequity both within and between species will continue, inevitably bringing about increasing levels of tension and conflict over natural resource use. To prevent this, ethics and equity need to become not only a more explicit part of natural resource management, but also the foundation of all aspects of our own individual lives.

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CHAPTER 10

Monitoring water poverty: A vision from development practitioners

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ABSTRACT: The target of the Goal 7 of *Millennium Development Goals* (MDG) is to halve by 2015 the number of people without sustainable access to safe drinking water and basic sanitation. The last few years have witnessed a relevant increase in the international concern towards water sector in developing countries, and an investment increase is envisaged for the next decade. In view of increased investments, monitoring efforts are required for the sake of efficiency and sound decision making in the water and sanitation sector. Available methodologies for measuring water poverty and water access show some drawbacks when applied to practical tracking of the water sector performance. A case is made in this chapter for the adoption of EASSY (**E**asy to get at local level, **A**ccurately defined, **S**tandard and internationally applicable, **S**calable at all administrative levels, **Y**early updatable) variables locally collected for monitoring water and sanitation sector. Implementing EASSY indicators will certainly require a proper definition from the scientific community and academia, the involvement of donors and civil society, and government willingness to implement measures to collect them.

Keywords: Water and sanitation access; Human development; Water poverty; Monitoring indices

1 INTRODUCTION

Nowadays, reducing poverty is thought to be a responsibility of the governments and as an objective of donors support. This driving idea was heavily reinforced at the *UN Millennium General Assembly*, when the *Millennium Development Goals* (MDG) of halving the proportion of the world's population living in extreme poverty by 2015 was agreed by all member countries of the United Nations.

Traditionally, poverty reduction was focused on increasing economic growth at the national level. Whilst this may be necessary, it is not sufficient, since it neglects the distribution of assets and income. Poverty reduction is indeed a complex issue and many factors need to be taken into account, such as education, employment generation and food security, among many others. Water sector has also very much to do with poverty reduction strategy: goals and targets specific to water and poverty were also agreed at the *Millennium Assembly* and at the *World Summit on Sustainable Development*.

Goal 7 of the *Millennium Development Goals* deals with environmental sustainability and addresses the water supply issue directly. One of its targets, Target 10, is to "halve by 2015

the proportion of people without sustainable access to safe drinking water and basic sanitation", with 1990 being established as the baseline year. As a consequence, more attention was drawn from international donors to the water and sanitation sector by Target 10 and, in the past few years, several reports were written, attempting to assess the investment requirements for attaining it. Results obtained are disparate, the actual cost required to fulfill Target 10 being estimated in a range that spans from US$ 9,000 million to 30,000 million per year (Toubkiss, 2006), which to a certain extent reflects the utter difficulty that such forecast entails. Whatever the actual required investment would be, it can be foreseen that a relevant growth on investment for water and sanitation in developing countries is going to take place in the next few years. Moreover, increasing awareness in donor countries on aid efficiency and alignment with receiving countries priorities will lead to channeling of additional funds through national budgets. Then, sound water sector performance monitoring will be required for the sake of efficiency and for the effective resources allocation at the national level.

This chapter tackles the challenge of analyzing the current status of monitoring water poverty in developing countries. It is worth noting that the chapter will necessarily provide a biased vision from development practitioners, due to the experience of the authors in the Spanish NGO *Ingeniería sin Fronteras* (Engineering without Borders). The economic study of the current state of water and sanitation sector is addressed in Section 2, and a demonstration is provided as to the need for proper monitoring of water sector performance at the national level. Neither traditional indicators of water supply access are able to provide a sound methodology for water sector monitoring, as it is shown in Section 3. An analysis of characteristics of *Water Poverty Index* (WPI) (Sullivan, 2002; Lawrence *et al.*, 2002) for tracking the water and sanitation sector in developing countries is made in Section 4. The relationship between water poverty, human development and human poverty is analysed and it is seen that, even though WPI is the best tool available nowadays for measuring water poverty, it is still not appropriate for tracking the performance of water sector at the national level. Appendixes containing the detailed statistical analyses in which the conclusions are based in are included at the end of the chapter. Finally, the chapter ends with a discussion where it is concluded that there is a urgent need of EASSY (**E**asy to get at local level, **A**ccurately defined, **S**tandard and internationally applicable, **S**calable at all administrative levels, **Y**early updatable) variables for the sector, which could be included in sector information collection routines in low income countries. It is firmly believed that all stakeholders such as academia, governments, civil society and donors should reach a consensus as to the adoption of the above mentioned EASSY indicators.

2 THE IMPORTANCE OF MONITORING WATER SECTOR PERFORMANCE

According to OECD data, committed *Official Development Assistance* (ODA) for Water Sector amounted US$ 46,360 million between 1995 and 2004 (Jiménez, 2006). According to other estimations (Briscoe, 1999; Global Water Partnership, 2000), annual investment in Water and Sanitation in developing countries (excluding waste water treatment) amounted to US$ 16,000 million at that time. In the mid-1990s, the estimation of contributions coming from main agents was the following (Camdessus, 2003):

- Local public sector: 65–70%
- Local private sector: 5%
- International donors (including NGO's): 10–15%
- International private sector: 10–15%

Nevertheless, the situation has changed in later years. On the one hand, international donors and NGO's have increased their participation (OECD, 2006), and on the other hand, international private contribution has decreased from US$ 3,700 million average engagement in the late 1990s down to less than 2,000 millions in the last four years (World Bank, 2006). The contribution of local public sector must be considered as stationary at best (Camdessus, 2003), as many developing

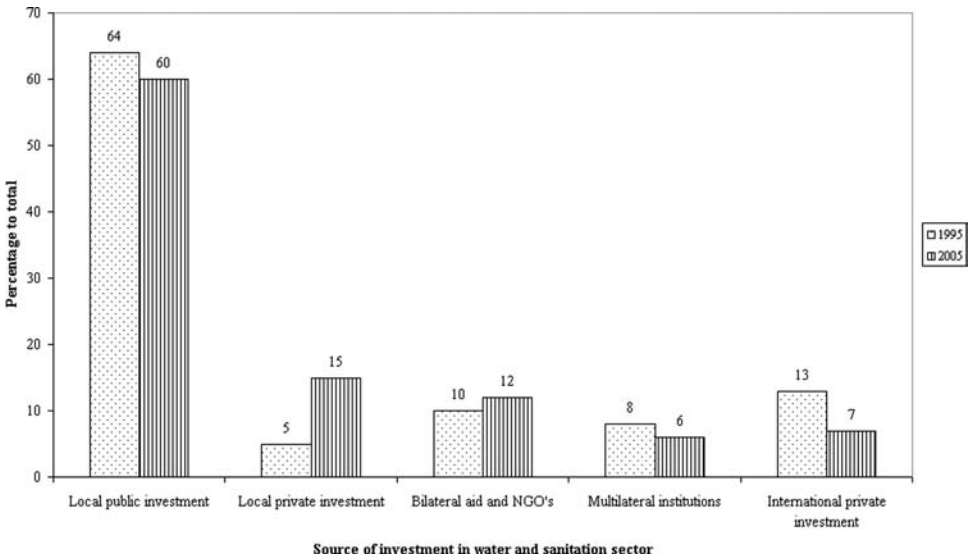

Figure 1. Water sector financing evolution (estimation).

countries have adopted economic plans that limited public expenditure, sometimes as a requirement to receive international aid.

Reducing infrastructure investments has been a normal mechanism to decrease public expenditure, while expecting that the international private investment would cover the shorfall.

This fact also explains the reduction of *World Bank* financial support for infrastructures in later years (World Bank, 2003). An estimation of actual sector financing is shown in Figure 1.

As Figure 1 shows, the total ODA contribution has increased up to around 20%, international private sector has decreased down to around 7%, local public sector remains at around 60%, and there is an important growth on local private sector to around 15%. This increase is due to their share of participation in operation and maintenance, as well as to the lack of response from national governments to the demographic pressure in large cities.

International aid for water sector have attracted more attention from donors which are making an effort to improve aid effectiveness, as expressed in the *Rome Declaration on Aid Harmonization*, in February 2003, and the *Paris Declaration on Aid Effectiveness*, in March 2005. The European Union has adopted its own commitment in the *European Consensus on Development*, February 2006 (EU, 2006). Aid effectiveness improvement is based on the principles of:

– Ownership, meaning that partner countries exercise effective leadership over their development policies and strategies, and coordinate development actions.
– Alignment, meaning that donors base their overall support on partner countries' national development strategies, institutions and procedures.
– Harmonisation, meaning that donors' actions will become more transparent and collectively effective.
– Managing for results, meaning that they would have results-oriented frameworks.
– Mutual accountability, meaning that both donors and partners are accountable for results.

In practical terms, at least 85% of aid flows will be reported on government's budget and will use public financial management systems (*Paris Declaration*). That will lead to the fact that the great part of aid will be channelled through sectoral or general budget support, thereby considerably increasing the concerned ministry's budgets. Research evidence shows that so far budget support has not improved national accountability significantly (de Rienzo, 2006). Moreover, the OECD

has committed to raise the amounts destined to aid with respect to the 0.25% of *Gross National Income* (GNI) which was registered last year (Gupta *et al.*, 2006). In keeping with that trend, the 15 wealthier countries of EU have agreed to spend 0.51% of GNI in 2010, and 0.70% in 2015 (UN, 2005). Furthermore, United Nations has declared the decade 2005–2015 "*International Decade for Action: Water for Life*" (UN, 2004). The Resolution states that the main goal of the Decade should be a greater focus on water-related issues at all levels and on the implementation of water-related programmes in order to achieve internationally agreed water-related goals (UN, 2006). With this background, it is to be expected that funds for water sector channelled through national governments in aid recipient countries will increase. According to our estimates, this means that around 70% of total financing for the water and sanitation sector in those countries, and around US$ 20,000 million a year will be channelled through national governments (Jiménez, 2006).

This context highlights a very important problem for NGO and development agencies in the field, namely, how to monitor national government's policies in a short term basis to ensure an effective expenditure of funds. As an example, the last revision of the *Global Budget Support* for Tanzania (years 1995–2005), states that "poverty impacts remain uncertain for the last half decade, the most relevant period, because there has been no household survey since 2001" (Lawson & Rakner, 2005). Thus, the ability for tracking the performance of national governments remains crucial to fight water poverty and increase access to services, water and sanitation included.

Sectoral Budget Support such as water or health is usually based on annual reviews done jointly by donors, government and other actors (private, civil society) where performance is to be assessed. The main problem is the inexistence of reliable and objective indicators to make this assessment. Continuing with the same example as above, *Joint Water Sector Review* in Tanzania 2006 occurred without having a set of appropriate indicators and therefore, being impossible to measure results. A too big time-lag between funds disbursement and outcome measurement should be avoided, since that would prevent political accountability regarding poverty reduction decisions. That is why, from development practitioners' perspective, there is a strong need to set international indicators that fulfil some requirements:

- Sensitivity in short term period, that allows performance monitoring.
- Possibility to be measured in a bottom-up approach, allowing the establishment of regional trends.
- Easy to measure and cost-limited, allowing those to be integrated in the sector information system in low income countries.

3 TRACKING WATER SECTOR PERFORMANCE USING MDG INDICATORS

The most important monitoring task in the water sector is being carried out at the international level by the WHO and UNICEF *Joint Monitoring Programme for Water Supply and Sanitation* (JMP), whose main goal is to track the fulfilment of the *Millennium Development Goals*. The target being "to halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation" (UN, 2003; WSSD, 2002), the most suitable indicator for it is the number of people having "access to improved" water sources (WHO/UNICEF, 2000, 2005). Improved and not improved sources are defined in Table 1.

According to the *Water Supply and Sanitation Collaborative Council* (WSSCC) task force, people are said to have access to improved water supply if they have access to sufficient drinking water of acceptable quality, as well as sufficient quantity of water for hygienic purposes.

There are several examples of how these definitions can be differently interpreted. Only recently have countries like Mozambique recognized rope pump water points as *improved access* (WaterAid, 2005), even if it fits into the definition given above. In rural Tanzania, "the basic level of service for domestic water supply in rural areas shall be a protected, year-round supply of 25 L/day of potable water per capita, through water points located within 400 m from the furthest homestead

Table 1. Improved and not improved water sources (WHO/UNICEF, 2005).

	Improved	Not improved
Water supply	Piped connection into dwelling, plot, or yard	Unprotected well
	Public tap or standpipe	Unprotected spring
	Borehole	Vendor—provided water
	Protected dug well	Bottled water
	Protected spring	Tanker truck—provided water
	Rainwater	River, stream, pond, or lake

and serving 250 persons per outlet" (Government of Tanzania, 2002). However, this very water point would serve 500 people in a radius of not more than 500 m in Mozambique (Government of Mozambique, 1995). On the other hand, whatever the definition, access is usually calculated through household surveys, thus including personal interpretation about what *access* means and therefore not as objective as police provisions say. Much more could be discussed about this issue, since the coverage figures produced by technology indicators do not give enough information about the quality of the water provided or about its use (WHO/UNICEF, 2000). Similar analysis could be made with the indicator for sanitation access, but many of its limitations and drawbacks are described elsewhere (WHO/UNICEF 2005). Then, even though these are the most widely used indicators relating to water and human poverty, as the above examples show, they have not proven to be accurate enough, leading to difficulty in interpretation of available figures. Independently of the results provided by this short analysis, tracking water sector policy and performance is not only related to access, but to several other aspects that need to be measured, as *Integrated Water Resources Management* approaches indicate (European Union, 2006). Next Section focuses on the characteristics of *Water Poverty Index* (WPI) for that purpose.

4 TRACKING WATER SECTOR PERFORMANCE AT NATIONAL LEVEL USING WPI

WPI is an aggregated indicator with a broader scope than those of MDG, defined by a large number of scientists in consultation with concerned stakeholders (Sullivan *et al.*, 2003). It contemplates five subcomponents: *Resources*, *Access*, *Use*, *Capacity* and *Environment*, thus being a much more comprehensive approach ever used for measuring water poverty.

This section deals with the applicability of the index for water sector monitoring at the national level through two different approaches:

- Sections 4.1 and 4.2 show the results of an analysis of the relationship between WPI and the most relevant country development indicators, such as the *Human Development Index* (HDI), the *Human Poverty Index* (HPI), the *Gross Domestic Product* (GDP) per capita expressed in *purchasing power parity* (PPP) in current international dollars, and the *Falkenmark Index* (FI). This provides an overview of the added information provided by WPI, as well as new ideas for its definition. Section 4.3 studies the ability of WPI index to differentiate among countries in terms of key indicators. Some limitations are identified: narrow ranges of variation and population concentration (especially in the *Environment* subcomponent of the WPI). Detailed analysis is presented in the statistical annex.
- Section 4.4 makes an overview of WPI applications at different scales, including an analysis of key issues identified for monitoring use.

4.1 *Water poverty and human development*

This subsection is intended to provide insight into the relationship between *Water Poverty Index* (WPI), and *Human Development Index* (HDI). Detailed figures are provided in Appendix 1.

The relationship between WPI and HDI has been pointed out recently (Mukherji, 2006). The author concluded that the water poverty of a nation is not related to water scarcity but, rather, with the development level and per capita GNP. As analysis shows, there are many different HDI situations for a given value of the WPI resources index. This confirms that the initial conditions in terms of water resources have not been significant for countries development.

According to the WPI methodology (Sullivan, 2002; Lawrence *et al.*, 2002), the sub-index of resources is computed by taking into account internal water resources and external water inflows in each country. Resources are expressed on a per capita basis (Lawrence *et al.*, 2002). However, as pointed out by Sullivan *et al.*, (2003), the variability of water resources is a factor that is often overlooked in water and poverty analyses. The key factor on defining the contribution of resources in the overall water poverty of a given community (both at national or local scale) should be the *actual resource availability* rather than the quantity of water resources. Water is fugitive (Savenije, 2002) and either costly infrastructures or good hydrogeological conditions are required for water storage. This is why an interesting relationship to be studied would be the one existing between WPI and exploitable water resources (instead of total water resources). Exploitable water resources are defined as "the water resources considered to be available under specific economic and environmental conditions" (FAO, 2003). The computation of exploitable water resources contemplates factors such as dependability of the flow, extractable groundwater, and minimum flow required for non-consumptive use. Unfortunately, estimations of exploitable water resources are not easy and needed data are only available for a limited number of countries in the AQUASTAT database (FAO), most of them being either developed countries or developing countries of semi-arid or arid regions.

Traditionally, the key indicator for water poverty is the access to *improved* sources of water. *Access* is the second sub-index integrated to the WPI methodology, accounting for three indicators, namely, *percentage of safe water access*, *percentage of sanitation access* and an *index of irrigation* (Lawrence *et al.*, 2002). Analysis shows (see Appendix 1) that there is a fair linear relationship between HDI and WPI *Access* sub-index, with a correlation coefficient of 0.75. Extreme poverty cannot be overcome without adequate access to water (Sullivan *et al.*, 2003), so this relationship between HDI and WPI *Access* appears to be meaningful.

The WPI *Capacity* sub-index is the one which shows the best relationship versus HDI, with a correlation factor of 0.88 (see Appendix 1). Quantitative indicators for the *Capacity* sub-index are: *GDP per capita*, *under-5 mortality rate*, *UNDP education index* and *Gini coefficient* (Lawrence *et al.*, 2002). Then, the high degree of correlation between WPI *Capacity* and HDI can be expected since the sub-index is based on the same data that contribute to the HDI. It is obvious that assessing the capacity of people to manage their own water resources is crucial for a sound assessment of water poverty. However, a discussion could be opened as to whether current WPI *Capacity* sub-index is really giving added information to the WPI or just mimicking HDI. It is worth noting that no specific information about water sector itself is considered for WPI *Capacity* estimation at a national level. Data such as the number of water technicians per capita, the people with university degree in water sector, or the number of water management entities could perhaps enhance the *Capacity* sub-index by adding sector-specific information.

No relation is found between WPI *Use* sub-index and HDI (see Appendix 1). Misuse of water is common in some developed countries (e.g. Spain scores 9.8), and some medium and low HDI countries can score better in this factor, like Sudan (14.6) or Mauritania (14.3). Mukherji (2006) found a direct relation between WPI *Use* sub-index and per capita GNP to a given threshold (about US$ 10,000 PPP), after which the relation become reverse as a possible indicator of efficiency achieved after a certain level of development.

Values of the WPI *Environment* sub-index display considerable scatter when plotted against HDI (Appendix 1). It is seen that only highly developed countries are able to score high values (i.e. 14 or above) in this factor (in particular, those of temperate and humid climatic conditions, as can be derived from a closer look at the WPI database), while almost every situation is possible under a value of 13. There is a clear *preference* of countries to get 11 points, whatever their level of development (Appendix 1). As a consequence, no clear conclusion about environmental conditions and its relationship with poverty or development appears to be possible below a WPI value of 13.

Further analysis of HDI–WPI relationships has been performed using Factorial analysis with the same dataset used previously by Mukherji (2006). A detailed presentation of the analyses done is shown in Appendix 2. Main results show the follows: First, it is worth stressing that *Use*, *Environmental* and *Resources* components of WPI contribute in a similar amount to the description of the variability of the dataset. *Capacity* and *Access* components, which are highly correlated, contribute also in a similar amount; however, both contribute in the same factor. Specific contribution of *Access* component of WPI has been found, but marginal. Almost null contribution of factor specifically related with *Capacity* component has also been found.

It is also remarkable the high correlation between *Capacity* component of WPI and HDI. This could be used in two different manners. Firstly, as an argument to redefine that component, provided that the results are almost identical to the HDI itself. Note that this supports the previously introduced notion that the *Capacity* component should be revised in order to include specific information related to water and sanitation sector. And conversely, provided that HDI and *Capacity* component are so much correlated at state level, HDI distributions at smaller geographical scales (local, regional, etc.) could be used to approximate *Capacity* component at those scales if other data is unavailable. Although the correlation using data at other scales has not been checked, the hypothesis seems reasonable. The same analysis could be applied to *Access* component of WPI and HDI, however it is worth noting again that *Access* component contribution is small but much higher than that associated to *Capacity* component (compare sixth and seventh unrotated factors in Table 3 of the Appendix 2).

Finally, another result of the analysis concerns the contribution of *Falkenmark Index* (FI), introduced in the analysis following a previous work by Mukherji (2006). It can be concluded that the correlation between *Falkenmark Index* and *Resources* component of WPI is strong enough to consider only one of both at a first level description. In that situation more than 90% of the variability of the overall system is kept, and variability of all variables is explained in, at least in 85% of cases. However, for a detailed comparison between countries, its inclusion could be considered, as it provides more information about the variability of the system than, for instance, *Access* or *Capacity* components (especially if HDI is available).

4.2 *Water Poverty and human poverty*

Relationship between WPI and the *Human Poverty Index* (HPI) has been analysed with factorial analysis, following same steps of previous subsection (Appendix 3). Also the decimal logarithm of the *Gross Domestic Product* (GDP) per capita has been included.

Results show that the inclusion of logarithm of GDP and HPI modifies neither the statistical behaviour nor the conclusions of the analysis of just WPI and HDI presented in previous subsection. On the other hand, logarithm of GDP, has the same behaviour as HDI, consequently it shows also a high correlation with *Capacity* and *Access* of WPI. Instead, HPI tends to discriminate cases (countries) more relevantly than FI, although the specific contribution of HPI to the overall variance is much lower than that of FI.

In any case, it is worth noting that WPI has much lower statistical correlation with HPI than with HDI or GDP. Or, in the same direction, WPI is more strongly related to HDI and GDP than to HPI. A corollary is that HPI provides more complementary information to WPI than HDI or GDP. Appendix 3 presents details and further analyses of results.

4.3 *Water Poverty Index and population distribution*

Previous sections have focused on the analyses of WPI and its relationships with other indices using data at country level. All countries have been treated as equally relevant cases from a statistical point of view. However, population varies significantly among different countries, thus the capacity of discrimination of the different variables as regards to people will be distinct from that indicated previously. In this subsection, results from a first approach to the influence of countries' population are presented as a tracking indicator for WPI usefulness at the state level. Firstly, a comparison between

HDI and WPI was made in terms of population distribution among index's values. Secondly, analysis was deepened to the WPI sub indices. Detailed analysis is presented in Appendix 4.

WPI concentrates population in a short range: 2,822 million people, i.e. 45% of world population, lay in 1/20 of the index scale. Country's concentration without considering their population shows more even distribution, yet 51% of the countries fit into 3/20 of the WPI scale, and three values are taking more than 15% of the total number of countries each. In both cases, *Human Development Index* gets a better distribution of countries along the index scale, with a maximum of 28% of population in 1/20 of the scale, and only one case of 1/20 of the scale with more than 15% of countries.

A separate study of population and countries distribution against each WPI sub-indices was made in order to shed light as to why WPI minimizes the differences in the final result. The resolution of WPI drops dramatically by the *Environment* sub-index, whilst *Resources* and *Access* sub-indices show the highest resolution. This seems to reflect the fact that *Resources* and *Access* are apparently the WPI components which are easier to quantify by traditional indicators and variables. On the contrary, environmental conditions are more difficult to quantify by objective indicators in the WPI. Sullivan & Meigh (2007) state, from a comparative study of pilot sites at local scale, that further work needs to be done in order to identify variables to represent the *Environment* component, particularly in urban areas. This improvement is also needed at the national scale.

4.4 *Application of Water Poverty Index at different spatial scales*

Several methodological applications of WPI at different scales have been published in recent years (Lawrence *et al.*, 2002; Sullivan *et al.*, 2003; Cullis & O'Reagan, 2004; Heidecke, 2006; Sullivan & Meigh, 2007). These include national, district, basin and community levels. The authors have analyzed in detail the particularities of the application of WPI methodologies at different scales, and the suitability of the index to make comprehensive assessment of the water sector in a given region has been demonstrated.

The above mentioned WPI methodology was applied to the case of Benin at regional scales (Heidecke, 2006). In that work, the performance of the WPI was analyzed in terms of the accuracy of the data integrated to the WPI. The calculation of the WPI would be influenced by the quality of the datasets, which may vary with their countries of origin. A straightforward conclusion which can be derived is that WPI results can only be as accurate as the data involved in the calculation (Heidecke, 2006). This is an event that a proper evaluation of the WPI should always contemplate. Most variables included in WPI calculation need to be collected from country official departments (either at local, regional or national scales) but many of that variables are defined differently among countries. Then, countries with loose definitions with respect to, for instance, water access or sanitation might score better than others with a stricter regulation, which might not necessarily reflect the actual situation of those countries. This fact is a common drawback for all water indicators and has been also pointed out recently by Sullivan & Meigh (2007).

Some problems have been reported when applying WPI for monitoring purposes. For instance, at a national scale, current WPI cannot be used for tracking the water sector performance of a given country since the WPI definition used is related to the rest of the countries (Lawrence *et al.*, 2002). This national WPI methodology is able to produce a ranking of water poverty for all countries. However, the increase of WPI in a country during a given time period may not reflect a real improvement but could actually be due to the worsening of other countries.

The ability of tracking the time evolution of water poverty in particular areas, where a given action or program is (or has recently been) implemented is crucial for development practitioners. Cullis & O'Reagan (2004) applied the WPI methodology to study the water poverty status in South Africa. *Access* and *Capacity* sub-indices needed to be computed with the last census available which has not been updated since 1996, which entails that the impact of actions developed to improve both subcomponents since 1996 could not be reflected in the final WPI results.

From our point of view, the main challenges facing the application of the index at various scales are as follows:

1. Data collected to compute the sub-indices are not consistent between different spatial scales, meaning that spatial comparison is only possible between the same scale units (two countries, two regions, or two communities). The contribution of a given improvement in one scale may not be reflected in the upper level, thus it is not integrative as to be up-scaled in a bottom-up procedure. In fact, variables at the community scale can be quite qualitative whereas variables at national scale are based on quantitative assessment of international organizations and research centers, which makes it very difficult to establish the relationship between different scales.
2. The possibility to update national WPI data, as currently defined, is very time-distanced. The fact that some data sets are based on household surveys, or similar national level data collection routines make very difficult to asses the improvements made in a given country in a given period.

5 CONCLUSIONS: THE NEED OF EASSY INDICATORS

There is an urgent need for having adequate performance indicators to track improvement in water sector in developing countries. The volume of funds channeled through local public entities represents around 60% of total investment in the sector, and will increase in the next years with the majority of funds from international cooperation being channeled through the public sector.

The *Water Poverty Index* has proved to be highly reliable to describe the water situation, since, unlike other deterministic water-resource assessment models, it explicitly contemplates the importance of political, institutional and environmental issues. Recognizing this fact, some constraints have been described in this chapter about WPI as a practical tool to be widely used by development practitioners.

Comparison with other relevant country development indicators, as HDI and HPI, has helped to understand WPI itself and relationships between its sub-indices. Factorial analyses of data presented by Mukherji (2006) and some additional indicators have been presented. WPI has been confirmed to display a higher correlation with HDI and logarithm of GDP than with HPI or *Falkenmark Index*. Highest correlations have been found between HDI and *Access* and *Capacity* sub-indices of WPI. Also a high correlation between *Access* sub-index and WPI as a whole has been observed. A detailed look at the results has shown that contributions of *Environmental*, *Use* and *Resources* sub-indices of WPI are *equilibrated*, i.e. they describe variability in a similar amount and in complementary aspects of the data. Instead, *Capacity* and *Access* sub-indices both represent fundamentally the same variability; different from ones of three previously cited sub-indices, but equivalent to that of HDI and GDP. A reduced contribution of *Access* sub-index by itself, apart from that included in HDI and WPI *Capacity* sub-index, has also been identified, with a weight less than 20–25% of other sub-indices. Thus, as a general rule, HDI can be used to accurately approximate *Capacity* sub-index, at least at state level while its non-sector-focus nature is unsolved; and even more, *Access* sub-index can be also approximated by HDI, if a small reduction in WPI variability is admissible. On the other hand, a preferred relationship of *Falkenmark Index* with *Resources* sub-index has been confirmed. Extension of these analyses to sub-state WPI applications could confirm these trends and could open the discussion about the information contained in the variables definition.

Finally, with respect to WPI statistical analysis, world population histograms among WPI fractions at country level have been presented (see Appendix 4). It has been found that a narrow range of variation of the WPI *Environment* sub-index concentrates, not only number of countries, but also world population, situation more evident among Aid recipient countries. Thus, WPI methodology at state scale shows reduced sensitivity to discriminate country and population situations, especially in relation with environmental issues. The application of WPI at national level is based on internationally available data to rank countries, which make its use for monitoring national water policy performance not possible, since some variables are based on census repeated every 5 to 10 years in the best case scenario or in the information contained in world atlases. Moreover, ranking does not give direct information on the performance of a given country but its comparison with others performance.

The application of WPI at other scales (basin, region, community) has been proved to be valid and meaningful, but since the variables used at different levels are not exactly the same, the establishment of comparisons is not straightforward. This might happen as well within the same geographical level in a given country, when variables are not accurately defined (thus allowing different interpretation) or are taken from different years. Actual differences on the variables used at different scales makes impossible to define a nested bottom-up index that could be integrative. On the other hand, even the use of very simple practical indicators, such as those defined for tracking the *Millennium Development Goals*, need further improvement in definition and application to ensure appropriate implementation.

Given the importance of tracking water sector's performance on a yearly basis, it is crucial to include water sector-specific data collection routines, as it is implemented in other basic social sectors such as health. This entails that, in the short term, information has to be easily available at the local level at a reasonable cost, even if some measurement of some variables, such as resources or environment, have to be oversimplified. Including routine data collection at the lowest appropriate level would enable at the same time a better tracking of transparency and accountability at all levels, as well as national awareness on the importance of systematic data collection. Existing data provided by international institutions has the advantage of making a first cut comparison possible, but it suffers from the lack of reliable country owned information.

The adoption of EASSY (**E**asy to get at local level, **A**ccurately defined, **S**tandard and internationally applicable, **S**calable at all administrative levels, **Y**early updatable) variables for monitoring water sector performance will certainly require a proper definition from the scientific community, the involvement of donors and civil society, and government willingness to implement measures to collect them. It will be needed to complement other geographical, environmental and hydrological information systems in order to define an internationally agreed reliable and updatable *Water Sector Indicator* that can be useful to monitor national water sector's performance over time and space.

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APPENDIX 1 WATER POVERTY INDEX VERSUS HUMAN DEVELOPMENT INDEX

Appendix 1 illustrates the relationship between *Water Poverty Index* (WPI), and *Human Development Index* (HDI), from data included in the UNDP Report (2005) and Lawrence *et al.* (2002). A total of 146 countries are considered. Donors and aid recipient countries have been separately identified.

Figures 2 to 7 present HDI versus WPI relationships. As Figures 2 to 4 show, there is a well-defined linear relationship between HDI and WPI (R^2 = 0.66) which becomes more strongly correlated with WPI *Access* component (R^2 = 0.75), and WPI *Capacity* (R^2 = 0.89). On the other hand, Figures 5 to 7 show no correlation among HDI and the *Resources*, *Use* and *Environment* WPI components.

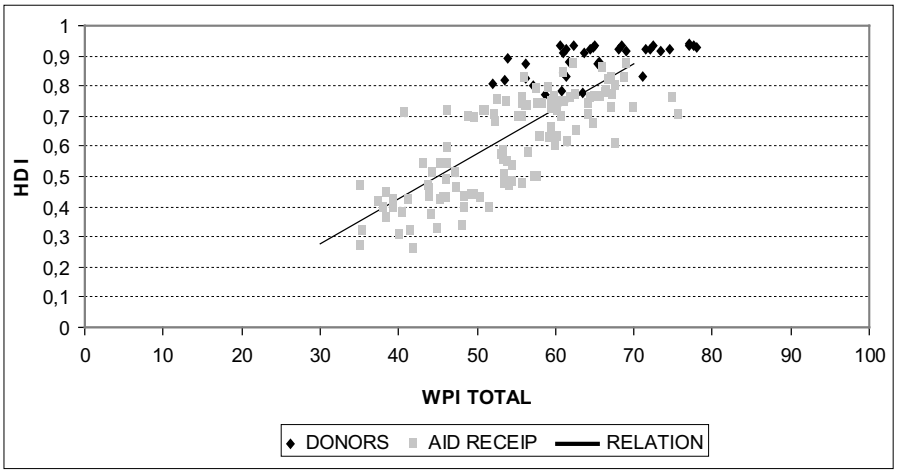

Figure 2. Human Development Index versus Water Poverty Index.

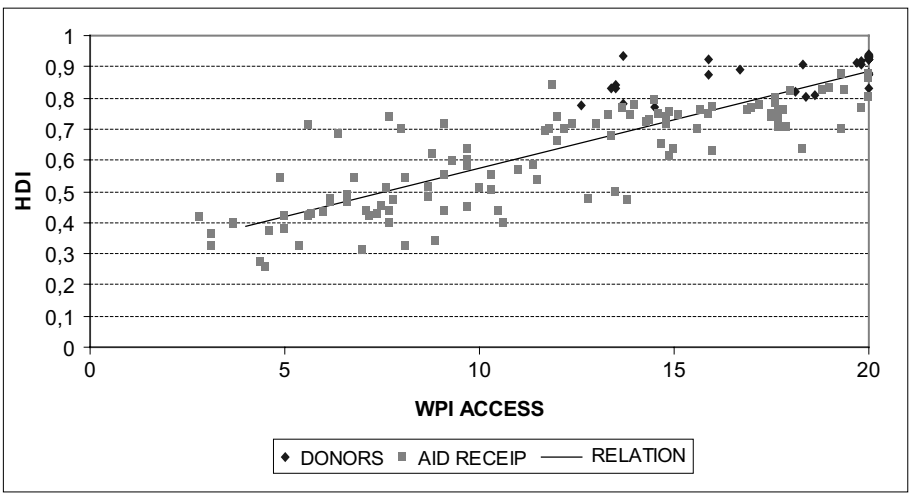

Figure 3. Human Development Index versus Access component of Water Poverty Index.

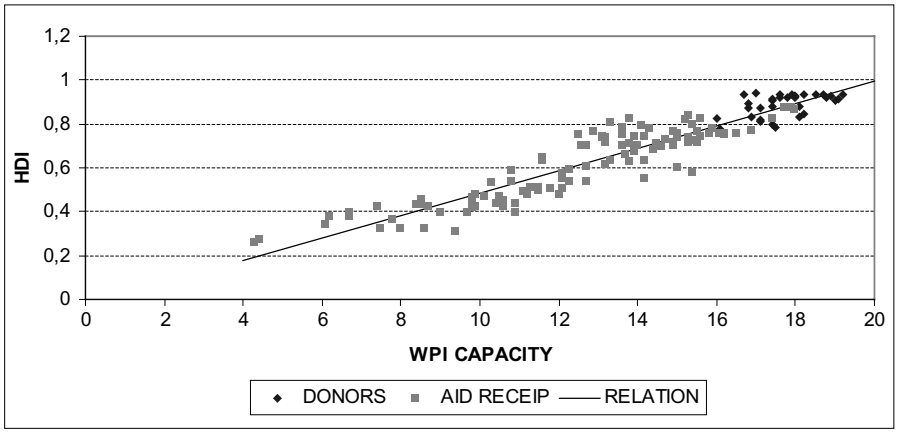

Figure 4. Human Development Index versus Capacity component of Water Poverty Index.

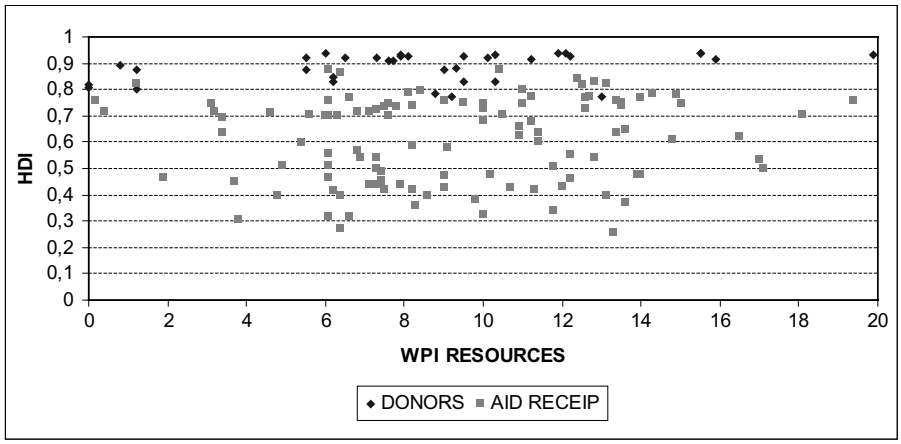

Figure 5. Human Development Index versus Resources component of Water Poverty Index.

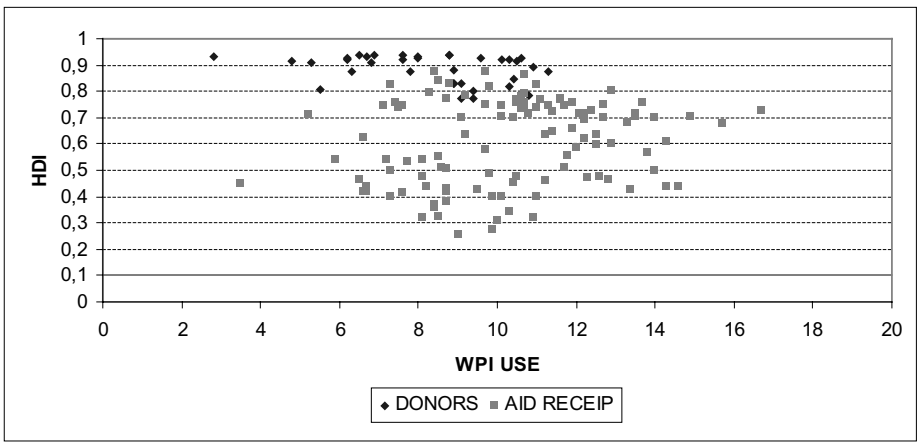

Figure 6. Human Development Index versus Use component of Water Poverty Index.

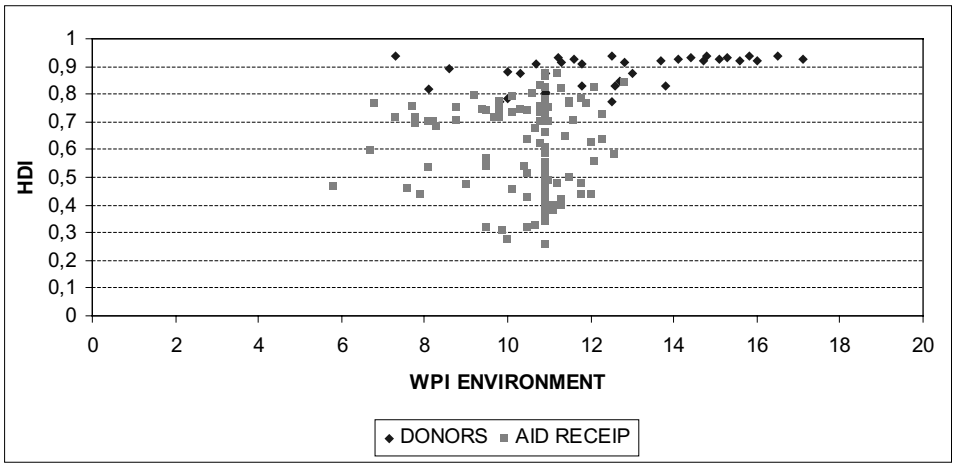

Figure 7. Human Development Index versus Environment component of Water Poverty Index.

APPENDIX 2 FACTORIAL ANALYSIS: WATER POVERTY INDEX AND HUMAN DEVELOPMENT INDEX

Appendix 2 provides a factorial analysis of HDI—WPI relationships using with the dataset previously used by Mukherji (2006). Table 2 presents the correlation matrix. Boldfaced numbers indicate correlation higher than 0.8 and underlined numbers correspond to relationships shown in Figures 2 to 7. Relationships between HDI and WPI, WPI–*Capacity* and WPI–*Access* are reflected here. The table shows the relatively high correlation between *Access* and *Capacity* subcomponents, and *Access* and overall WPI.

Table 3 presents the factors (linear combination of initial variables) that explain the variability of the dataset. It is worth noting that the first three factors account for about 83% of the variability, a proportion that rises up to more than 99% when six factors are considered. The most redundant factor is the last one, with a nil contribution to the total variance. It corresponds, as expected, to the linear relationship between WPI and its five components. Next one, number seven, can also be deemed irrelevant. Furthermore, two more, numbers six and five, represent less than the 5% of the total variance each, because of which the relevance of their contributions can be also neglected.

Table 4 summarizes the communality of the set of factors considered (the variability of each variable explained by these factors). Results considering 3 to 6 factors are presented. Values lower than 0.9 are in boldface. Note that the variability of all initial variables can be explained by six factors (at least in 97% of cases), with five factors in a 90% and with four factors in an 87%. Considering only three factors, that threshold drops down to 60%. Therefore, the approximation of the eight variables with only the first four factors can be considered statistically acceptable (a global variance of 92%, and at least 87% of each variable contribution). Factors appearing in fifth and sixth positions complete the description of the variability of the dataset, with a 99% of global variance and a 97%, at least, of variance of each variable.

Before analyzing the relationship between factors and the initial variables, a rotated set of factors is computed for each case (sets of 3 to 6 factors). They are computed using *Varimax* criteria, responding the aim of a simple identification of the factors in terms of the variables. Table 5 summarizes the percentage of the total variance explained by the set of rotated factors. Main factor retains the 43–45% of total variance, regardless of the number of factors considered. The second to fifth factors have a similar weight, amounting between 13 and 15% of total variance each. The sixth factor only represents 2.5%.

Table 6 includes the definition of each set of rotated factors in terms of the initial variables. Only values higher than 0.1 are listed. Boldfaced numbers are used for coefficients higher than 0.8 and other punctual representative values. Results allow for a clear interpretation of all factors found. The first factor includes *Capacity* and *Access* components of WPI, WPI itself and HDI. The second factor is directly related to *Resources* component of WPI, although it also includes the *Falkenmark Index* if less than five factors are extracted (the *Falkenmark Index* constitutes the core part of the fifth factor). The third and fourth factors are specifically related to *Environmental* and *Use* components of WPI and, finally, the sixth factor (the one with the lowest relevance) is related to Access component of WPI. It is reminded that the *Access* component is already part of the first factor, where it contributes more significantly than in the sixth one. Note that the first factor includes *Capacity* and *Access* components of WPI, HDI, and WPI, but later one has null contribution, so three main variables amount for a 43–45% of the total variance.

Table 2. Correlation matrix. Data from Mukherji (2006).

	WPI–RES	WPI–ACC	WPI–CAP	WPI–USE	WPI–ENV	WPI–TOT	HDI–2001	FI
WPI–RES	1.000							
WPI–ACC	0.057	1.000						
WPI–CAP	−0.056	**0.821**	1.000					
WPI–USE	−0.014	−0.053	−0.109	1.000				
WPI–ENV	0.275	0.275	0.282	−0.278	1.000			
WPI–TOT	0.457	**0.855**	0.767	0.123	0.468	1.000		
HDI–2001	0.031	**0.868**	**0.941**	−0.117	0.318	**0.809**	1.000	
FI	0.585	0.144	0.108	−0.037	0.056	0.345	0.108	1.000

Table 3. Variance explained by the factors.

Factor	% of total variance	% accumulated
1	47.578	47.578
2	20.616	68.194
3	14.794	**82.989**
4	9.700	**92.689**
5	4.340	**97.029**
6	2.331	**99.360**
7	0.640	100.000
8	0.000	100.000

Table 4. Variation of each indicator explained by the 3, 4, 5, 6-factorial analysis.

Communality	3 Factors	4 Factors	5 Factors	6 Factors
WPI–RES	0.859	**0.870**	0.992	1.000
WPI–ACC	0.883	0.890	**0.896**	1.000
WPI–CAP	0.907	0.928	0.932	0.982
WPI–USE	0.802	0.981	0.999	1.000
WPI–ENV	**0.601**	0.937	1.000	1.000
WPI–TOT	0.962	0.989	0.996	0.998
HDI–2001	0.937	0.947	0.948	0.969
FI	**0.687**	**0.874**	0.999	1.000

Table 5. Contribution of each rotated factor to total variation. Cases obtained from 3, 4, 5, 6-factors.

% of Total variance	3 Factors	4 Factors	5 Factors	6 Factors
Total	82.989	92.689	97.029	99.360
1	44.450	43.505	43.519	43.212
2	22.498	21.350	14.329	14.221
3	16.041	14.471	13.131	13.203
4		13.363	13.126	13.113
5			12.924	12.944
6				2.667

Table 6. Normalized coefficients of the factors expressed in terms of the initial variables. Cases obtained from 3, 4, 5, 6-factors analysis are included.

	1	2	3	4	5	6
HDI–2001	**0.958**		0.136			
WPI–CAP	**0.944**		0.113			
WPI–ACC	**0.937**					
WPI–TOT	**0.874**	0.445				
WPI–RES		**0.920**	0.112			
FI		**0.824**				
WPI–USE			**−0.890**			
WPI–ENV	0.308	0.248	**0.667**			
HDI–2001	**0.964**		0.107			
WPI–CAP	**0.957**					
WPI–ACC	**0.937**					
WPI–TOT	**0.831**	0.371	0.340	0.215		
FI	0.131	**0.908**	−0.157			
WPI–RES		**0.858**	0.352			
WPI–ENV	0.221		**0.923**	−0.175		
WPI–USE			−0.144	**0.980**		
HDI–2001	**0.964**		0.107			
WPI–CAP	**0.947**	−0.130				
WPI–ACC	**0.942**					
WPI–TOT	**0.843**	0.387	0.273	0.187	0.158	
WPI–RES		**0.930**	0.150		0.325	
WPI–ENV	0.213	0.143	**0.955**	−0.150		
WPI–USE			−0.131	**0.990**		
FI		0.301			**0.948**	
HDI–2001	**0.973**		0.106			
WPI–CAP	**0.963**	−0.101				−0.174
WPI–ACC	**0.914**					**0.394**
WPI–TOT	**0.834**	0.377	0.279	0.185	0.165	0.148
WPI–RES		**0.935**	0.149		0.321	
WPI–ENV	0.210	0.142	**0.956**	−0.150		
WPI–USE			−0.131	**0.991**		
FI		0.300			**0.949**	

APPENDIX 3 FACTORIAL ANALYSIS: WATER POVERTY INDEX AND HUMAN POVERTY INDEX

Appendix 3 focuses on the relationship between WPI and the *Human Poverty Index* (HPI) through factorial analysis, following same steps of Appendix 2. Also the decimal logarithm of the *Gross Domestic Product* (GDP) per capita, expressed in PPP terms at current international dollars, is included in the analysis, referred to as LG10_GDP. Data of both indicators refer to year 2004. Also updated HDI data from 2004 are used. All new data were obtained from *EarthTrends* data service (see http://earthtrends.wri.org). Analyses including HPI have been done involving 120 countries, and with also LG10_GDP with just 107 countries. Table 7 presents the main rotated factors of the system obtained with a seven-factor analysis. Partial contributions to total variance are included, as well as the total value represented by the seven factors, i.e. 98.799%.

First conclusion of analyses is that the inclusion of logarithm of GDP and HPI modifies neither the statistical behaviour nor the conclusions of the analysis of just WPI and HDI presented in Appendix 2. A strong relationship between HDI, Logarithm of GDP, and *Capacity* and *Access* components of WPI has also been found. Moreover, the second to fifth factors are related respectively with FI and *Environment*, *Resources* and *Use* components of WPI, with around 9–12% of contribution to total variance each. And finally, the *Access* component appears, apart from its contribution on the first factor, leading the seventh factor, with less than 2.5% of contribution to total variance, and less than a quarter of that from fifth and higher factors, which represents the *Environment*, *Resources* and *Use* components of WPI (compare 2.267 with 9.568 and so on in Table 7). Thus, its specific contribution can be easily neglected.

Main difference with Appendix 2 is found when analysing HPI, which have a negative influence on the first factor and it appears leading the sixth factor. Sixth factor contribution represents 4% of total variance, about 40% of any from higher factors (compare 3.912 with 9.568 and so on in Table 7), so its contribution can be considered not negligible.

HPI appears leading a specific factor when five-factor (or greater) analyses are computed. This factor appears first, with fewer factors, than that representing FI. Thus, HPI tends to discriminate cases (countries) more relevantly than FI. However, the specific contribution of HPI to the overall variance is much lower than that of FI (note that part of HPI contribution is also represented by HDI and others in factor 1).

Apart from the role of HPI and GDP, note that new HDI data, from 2004, present higher correlations with WPI's *Capacity* and *Access* components than those obtained in Appendix 2 with data from 2001. It can be caused by the number of countries considered, which has been reduced in these analyses. In any case, this fact confirms that HDI can approximate robustly both components of WPI, especially the *Capacity* one, at least when considering states.

Table 7. Coefficients of the rotated factors, obtained with a seven-factors analysis. Contribution of each one to total variation is also included.

% of Total Variance	1	2	3	4	5	6	7
98.799	49.829	11.798	10.809	10.615	9.568	3.912	2.267
HDI–2004	**0.967**					−0.173	
WPI–CAP	**0.964**						−0.111
LG10–GDP	**0.946**		0.183	−0.135			
WPI–ACC	**0.901**						**0.418**
WPI–TOT	**0.847**	0.174	0.280	0.170	0.323		0.186
HPI—2004	**−0.797**					**0.597**	
FI		**0.953**			0.299		
WPI–ENV	0.236		**0.950**	−0.167	0.115		
WPI–USE			−0.144	**0.987**			
WPI–RES		0.486	0.144		**0.861**		

APPENDIX 4 WATER POVERTY INDEX AND POPULATION DISTRIBUTION

Appendix 4 analyzes the ability of the WPI to represent differences among countries. Firstly, a comparison between HDI and WPI is made in terms of population distribution among index's values. Secondly, analysis is deepened to the WPI sub indices.

Figure 8 shows the world population distribution (UNDP, 2005) among the index fraction for both HDI and WPI (data from Lawrence *et al*., 2002). It can be seen that WPI concentrates population in a short range: 2,822 million people, i.e. 45% of world population, lay in 1/20 of the index scale. Analyzing the number of countries in each fraction of both indices, it is noticeable that countries concentration without considering their population shows a more even distribution, yet 51% of the countries fit into 3/20 of the WPI scale, and three values are taking more than 15% of the total number of countries each. In both cases, HDI gets a better distribution of countries along the index scale, with a maximum of 28% of population in 1/20 of the scale, and only one case of 1/20 of the scale with more than 15% of countries.

To deepen in this analysis, population distribution of water sector's aid recipient countries (excluding China and India) against WPI values has been made. As can be seen in Figure 9, WPI lacks the ability to discriminate the countries situation among developing countries. Considering 2,653 million people as the rest of aid recipient countries population (after excluding China and India), 29.63% of them lay in 1/20 of the scale, and 3 consecutive fractions include 65% of

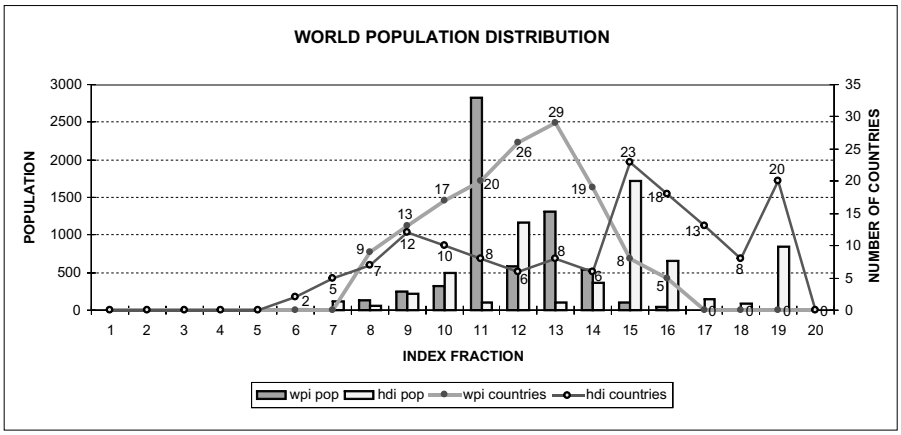

Figure 8. Population distribution and number of countries distributions among fractions of the *Human Development Index* and the *Water Poverty Index*.

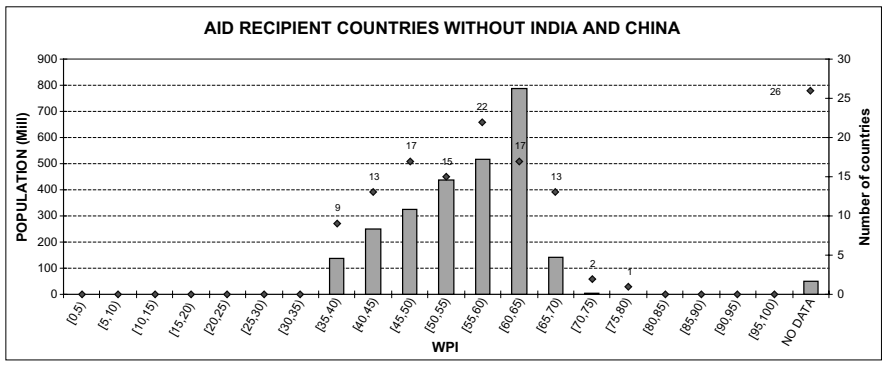

Figure 9. Population and number of countries distribution among fractions of the *Water Poverty Index* (aid recipient countries without China and India). Population is given in millions units.

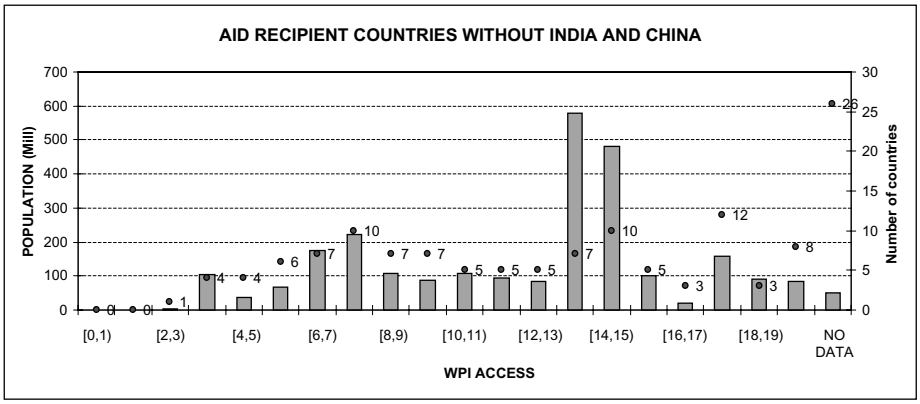

Figure 10. Population and number of countries distribution among fractions of the WPI-*Access* component (aid recipient countries without China and India). Population is given in millions units.

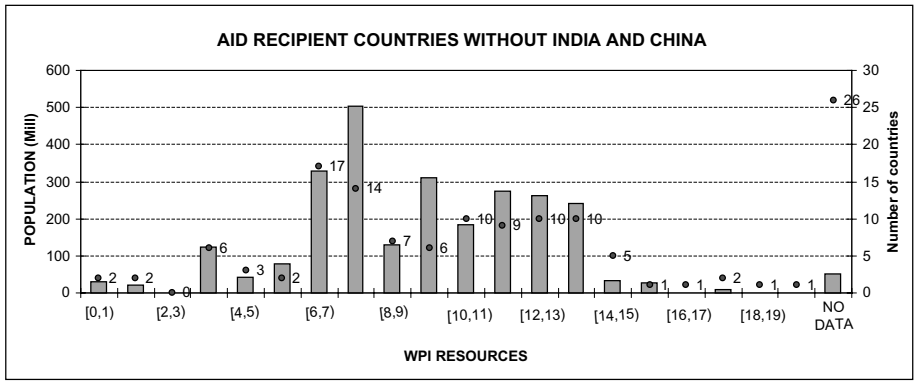

Figure 11. Population and number of countries distribution among fractions of the WPI-*Resources* component (aid recipient countries without China and India). Population is given in millions units.

the population. Only 8 out of 20 fractions of the index scale include some country or the other. In terms of number of countries, the WPI performs better, but we still find almost 29% of countries represented in 10% of the scale, and almost 50% of them among four consecutive fractions.

A separate study of population and countries distribution against each WPI sub-indices is presented, in order to shed light as to why WPI minimizes the differences in the final result. Figures 10 to 14 show the population distribution over the range of possible values in the 5 independent components of the WPI. Figure 10 shows that *Access* sub-index classifies the world population along almost every possible value. None of unity ranges of the sub-index includes more than 10 countries. The *Resources* sub-index seems to have resolution enough to show differences between the countries. Computed values range from 0 to 18, and world population distributes over all possible situations (Figure 11). *Capacity* and *Use* sub-indices distribute world population less than *Resources* and *Access*, lacking resolution to represent the actual differences among different countries. It can be seen in Figures 12 and 13 that in neither case sub-indices vary over their full range. *Capacity* component starts at 4 and ends at 19 (i.e. 75% of the full range) and *Use* component starts at 3 and ends at 17. The *Environment* sub-index is actually the component responsible of minimizing the differences in WPI values between people. Figure 14 shows how 2 consecutive fractions of the *Environment* sub-index (of a total of 20 fractions) are covering 66.41% of the population and 54.81% of countries. All countries lay between WPI-*Environment* values of 5 and 13, and one single fraction includes 55 countries.

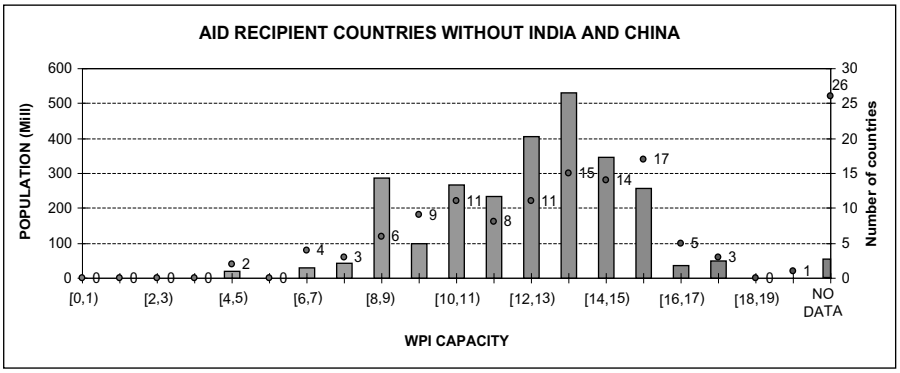

Figure 12. Population and number of countries distribution among fractions of the WPI-*Capacity* component (aid recipient countries without China and India). Population is given in millions units.

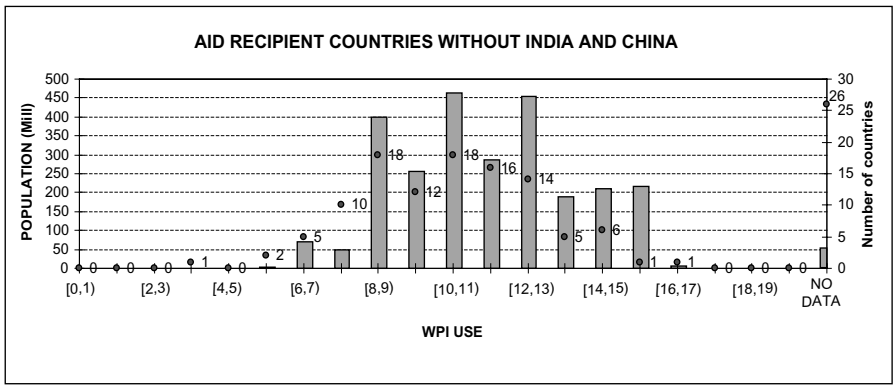

Figure 13. Population and number of countries distribution among fractions of the WPI-*Use* component (aid recipient countries without China and India). Population is given in millions units.

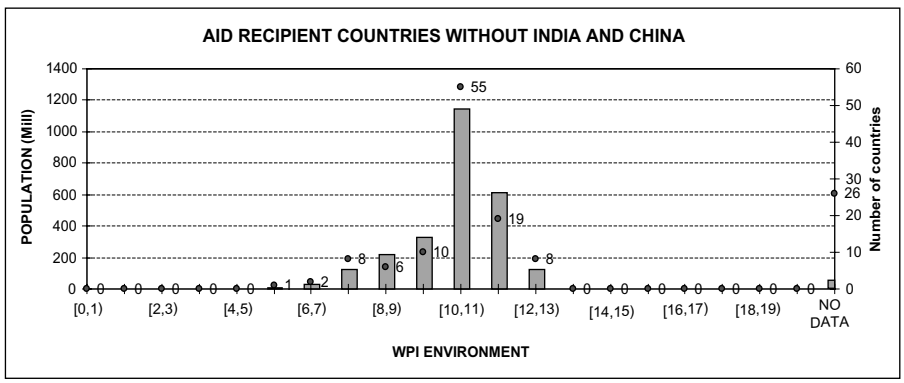

Figure 14. Population and number of countries distribution among fractions of the WPI-*Environment* component (aid recipient countries without China and India). Population is given in millions units.

CHAPTER 11

Water and the twin challenge of feeding 3 billion new people and ending rural poverty

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ABSTRACT: By 2050 the world's farmers must feed 9,000 million people—3,000 million more than the current population—without much expansion in the amount of land and water devoted to agriculture. The most efficient way to feed 3,000 million more people is by increasing food production efficiency on the world's larger farms through green revolution and modern agricultural strategies, but this will require doubling crop per drop efficiency of irrigation. Since the vast majority of population growth will take place in developing countries, the biggest challenge will be to find practical ways to end poverty and gain food security on the one-acre[1] farms where most dollar-a-day poverty is now centered. But lack of access to irrigation, significant investments in inputs and perceived risks will continue to constrain the smallholders from investing in green revolution strategies. This dictates major new investments in low cost and low risk food production enhancing strategies like urea sustained release pellets and *System for Rice Intensification* (SRI) for small farmers, coupled with the creation and mass marketing of a whole new range of affordable irrigation tools like treadle pumps and low cost drip systems, suitable for one acre farms and quarter acre plots.

Keywords: Smallholder irrigation; Food security; Poverty eradication; Affordable irrigation; Smallholder agriculture

1 THE ANSWERS TO POVERTY

A current *answer to poverty* is the UN-sponsored *Millennium Development Goals Initiative*, led by Jeffrey Sachs and backed by 189 governments. This highly publicized initiative plans to make dramatic improvements by the year 2015 in eradication of poverty and hunger and access to water and sanitation. In 2004, about the midpoint between the 1990 and 2015 time period for accomplishing all this, the *World Economic Forum* in Davos concluded that the efforts towards achieving the UN's *Millennium Development Goals* were faltering badly.

From 1990 to 2002, the percentage of dollar-a-day people in sub-Saharan Africa, where most of the people in Africa live, stayed at around 44% (see Figure 1), and the absolute number of very poor people increased by 140 million. In sub-Saharan Africa, we are moving backward in our attempts to eradicate poverty.

IDE, the organization that the first author of this article founded, has already sold more than 2 million treadle pumps to dollar-a-day farm families, and helped them increase their net annual income by more than US$ 200 million a year and created a multiplier impact on poor villages of at least US$ 500 million a year (Polak, 2007). Early market demand suggests that the global demand for low-cost drip systems will reach at least 10 million families, increasing their net annual income by US$ 2,000 million a year.

[1] 1 acre $= 4,047\ \mathrm{m}^2 = 0.4047$ ha.

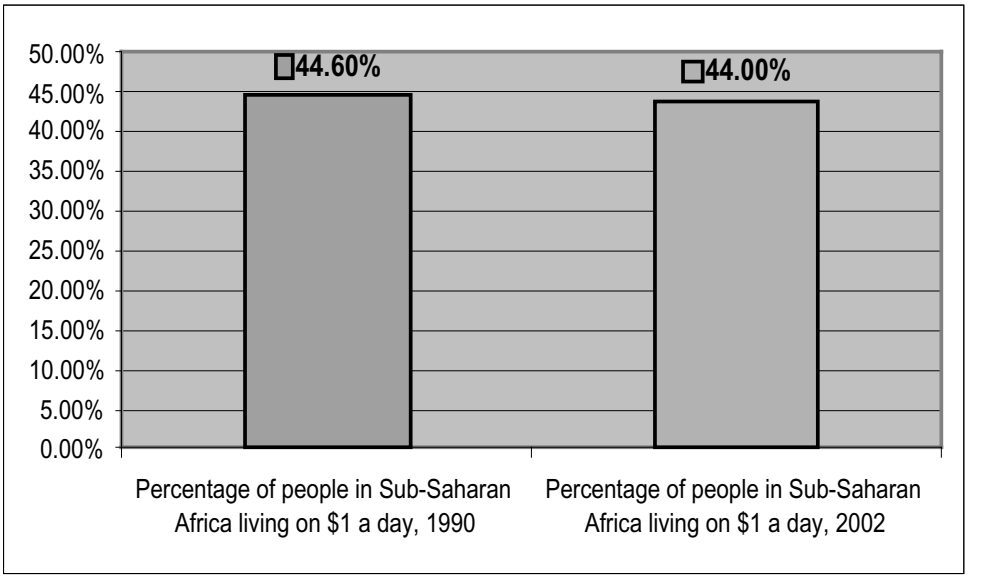

Figure 1. Millennium Development Goal Progress in Sub Saharan Africa.

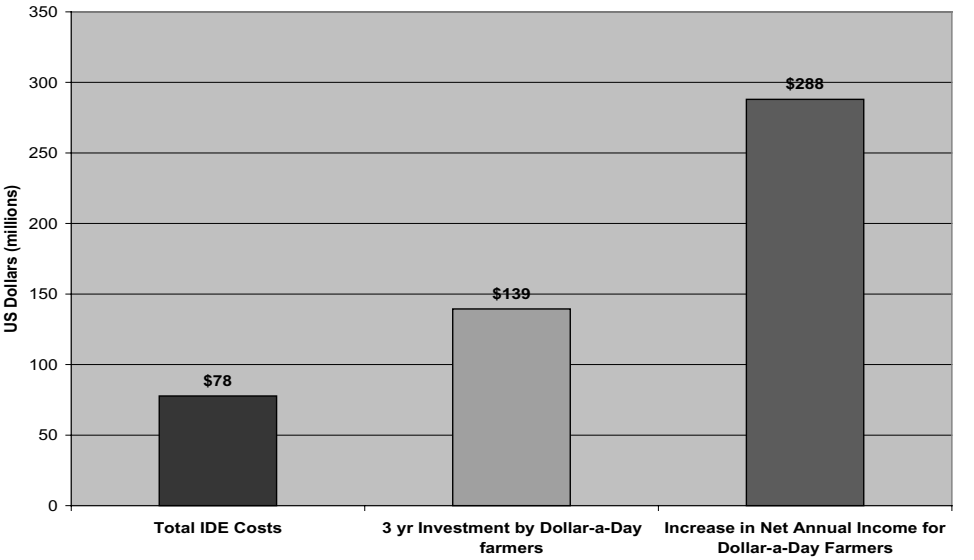

Figure 2. IDE's impact over 25 years (Polak, 2007).

While the approaches of current development experts are dominated by myths such as the belief that we can donate people out of poverty, dollar-a-day families themselves have clear views about the main reason for their continued poverty-insufficient income. They also have clear ideas about what can be done to increase their income. By adopting their views, IDE has encouraged small-acreage farmers to invest in diversified, high-value, labor-intensive cash crops such as a variety of fruits, vegetables, and herbs. Stimulating the emergence of private-sector supply chains

has provided access to affordable irrigation, seeds, and fertilizers. IDE, TechnoServe, and many other organizations have stimulated access to markets where one-acre farmers can sell their crops through private-sector value chains. By applying these principles, IDE has been able to help between 2.5 million and 3 million dollar-a-day families to increase their net annual income significantly. Each of these families made considerable investments of their own time and money to move out of poverty.

Total investments by IDE and its donors in initiatives to end rural poverty over the past 25 years were US$ 78 million. During the same time period, dollar-a-day farmers invested a total of U$ 139 million in income-generating tools promoted by IDE. Their investments generated U$ 288 million per year in permanent new net income (Figure 2). Taken over seven years, the net return to dollar-a-day small-acreage farmers is more than US$ 2,000 million on a total investment by both IDE and its small-farm customers of US$ 217 million. There is a clear pattern for most farmers to increase steadily both their investments in high-value farming and the net income they earn from it over time.

It is clear that without a revolution in thinking and practice on the part of the development community, the business community, and poor people themselves, we will never be able to end poverty. But if we learn to listen to poor people, understand the specific contexts in which they live and operate, and find ways to harness their entrepreneurial energy to increase their income, we have no doubt that at least 500 million families now surviving on less than a dollar a day will find practical ways to end their poverty within one generation. In order to start this revolution, we must first recognize what is not working.

2 THE THREE GREAT POVERTY ERADICATION MYTHS

2.1 *Myth 1: We can donate people out of poverty*

The most important poverty eradication myth is that we can donate people out of poverty. In the 1970s, the World Bank invested some US$ 35 million in projects to install deep and shallow diesel-pump irrigation tube wells in Bangladesh. At that point in time just after the war of independence, Bangladesh needed to increase national food production, which dictated a major increase in irrigated acreage. The Bank gave loans at such low rates of interest to the government of Bangladesh that they amounted to an 85% subsidy. The Bangladesh government in turn passed on this generosity to richer farmers who could afford to pay bribes. The shallow tube wells funded by this project were capable of irrigating 15 acres (6 ha), and farmers were given loans to buy them from local banks. The farmers that got them paid bribes to the government officials responsible for distributing them. Then the farmers dutifully defaulted on the loans guaranteed by the government of Bangladesh, which, of course, never paid back the loans to the World Bank, and everyone involved knew that this would happen from the beginning.

The deep tube wells could irrigate 100 acres (40 ha), and were given to farmers at zero cost, which meant that they had to pay bigger bribes to get them. One of the problems that the World Bank and government experts never anticipated is that because farms in Bangladesh are so fragmented, there were 50 or more farmers in the twelve-to-fifteen-acre (5–6 ha) command area of a shallow tube well, and hundreds in the hundred-acre (40 ha) command area of the deep tube well. This significantly increased the complexity of water distribution.

Not surprisingly, a typical shallow tube well ended up irrigating four or five acres (1.6–2 ha) instead of its fifteen-acre (6 ha) capacity and deep tube wells rarely irrigated 40 acres (16 ha) of their one-hundred-acre (40 ha) capacity. A more sinister problem was that the richer farmers who could get mechanized pumps became water lords, sold water at exorbitant prices to poor farmers, foreclosed their loans, and seized their land. The rich got richer, and the poor got poorer. Because they weren't financially sustainable, most of the deep tube wells were abandoned when the subsidy ran out. Because they were smaller and cheaper, the shallow tube wells proved profitable from

the beginning, and they continued making rich farmers richer. Of course, the goal of expanding national irrigated acreage was achieved—but much less acreage came under irrigation than the experts predicted.

At about the same time, poor farmers began buying much smaller and cheaper manually powered treadle pumps introduced by the *Rangpur Dinajpur Rural Service* (RDRS), a Lutheran-sponsored rural development organization, and mass-marketed by IDE. Most development and irrigation leaders in Bangladesh agreed that these small, low-cost pumps produced a much more positive impact on poverty alleviation and social justice, but because each one irrigated only half an acre, irrigation experts were convinced that only the bigger pumps could put enough land under irrigation to grow the rice the nation needed.

Twelve years later, 1.5 million poor farmers had purchased treadle pumps at an unsubsidized market price of U$ 25 and placed 750,000 new acres (300,000 ha) under irrigation in Bangladesh at a fraction of the US$ 35 million public cost of the World Bank project that provided larger-acreage farmers with shallow and deep tube wells at no cost other than the bribes they had to pay to government officials to receive them.

In the late 1980s, when treadle pumps were becoming increasingly popular, Bangladesh's president, Hossain Mohammad Ershad, announced that he would donate 20,000 of them to his home province a few months before election time. Farmers there immediately stopped buying and waited for free treadle pumps to appear. Many small-volume manufacturers, dealers, and well-drillers in the region went out of business. The government gave the treadle pump contract to a large-volume manufacturer with political connections who never had made treadle pumps, and he produced 2,000 or so of very poor quality. The promised 20,000 treadle pumps never came, and thousands of farmers who could have made US$ 100 a year on an investment of US$ 25 to buy a treadle pump tube well lost big.

But this type of subsidy solution is endemic in the development world. It is used by the governments, the World Bank, UNICEF, the United Nations, politicians, and many development leaders who look for photo opportunities with the poor but have little concern about producing measurable results. Price subsidies for goods and services for poor people just about always end up making things worse.

To move out of poverty, poor people have to invest their own time and money. The path out of poverty lies in releasing the energy of the Third World entrepreneurs. The good news is that the small-acreage farmers who make up the majority of dollar-a-day people are already entrepreneurs, and they are surrounded by thousands of other small-scale entrepreneurs operating workshops, stores, and repair shops. All these entrepreneurs are willing and able to invest in creating their own wealth if they can gain access to opportunities that are affordable and profitable enough to attract them.

In the first 20 years of work with the IDE, development leaders were outraged by the notion that you can and should sell things to poor people at a fair market price instead of giving things to them for nothing. *Business* was a dirty word to development organizations.

"It's exactly the multinational corporations that use the business approach you advocate who have caused the problem of poverty in the first place", they would say. "Poor people simply can't afford to buy the things they need, and they need these things very badly. The only way to make a real difference is to donate these things to them".

It's happy to note that all this is now changing. With the abject failure of central planning in socialist countries, there is a new awareness in development circles that unleashing the energy of the market place is the best help we can give to poor people in their efforts to escape poverty permanently. Now people in the development field regard IDE's success in selling treadle pumps to 1.5 million poor farmers in Bangladesh as a pioneering piece of work. Suddenly leaders in irrigation, agriculture, economics, and design are keenly interested in what we have to say and we have more invitations to give keynote talks than we can handle.

Most importantly, more and more people are beginning to realize that making it possible for very poor people to invest their own time and money in attractive, affordable opportunities to increase their income is the only realistic path out of poverty for most of them.

2.2 *Myth 2: National economic growth will end poverty*

The second myth is that poverty will be carried away on the coat tails of national per capita economic growth. 250 years ago, 80% of the people in the world were just as poor as the 1,100 million people today who survive on less than a dollar a day. Then the steam engine came along, and coal power, and the market forces that created the industrial revolution. This triggered 250 years of successive waves of economic growth that eradicated the poverty of the great majority of the people in the world. Accordingly, we may fall prey to a second myth: all we need to do is maintain a consistently high per capita *gross domestic product* (GDP) in developing countries, and dollar-a-day poverty will end.

But in the USA, one of the richest countries in the world with persistent national economic growth over many generations, the *US Census Bureau* reported in 2005 that 37 million people, 12.6% of its total population, remained poor. India has sustained economic growth of 6% a year for many years; but in 1999, 36% of its population, some 360 million people, still survived on less than a dollar a day. China has had an even more impressive sustained per capita GDP growth rate of 8%, and 16.6% of its 1,300 million population, a total of 216 million people, were surviving on less than a dollar a day in 2001. If sustained economic growth does end poverty, how is it that India and China, two developing countries with admirable sustained growth rates, still have some 575 million people who live in extreme poverty, most of whom also experience hunger? (UNDESA, 2006).

It is because most of the poor people in the world live in remote rural areas that will likely continue to be bypassed by successive waves of urban-centered industrial growth. Industrial growth in urban areas leads to national per capita GDP growth, and it generally bypasses the three-quarters of the dollar-a-day people who live in isolated rural areas and earn their living from tiny farms. Of course, many people who can't make it in rural areas migrate to cities to look for work, and some of them find it. Many end up in slums, and most quickly move back to their village if attractive jobs become available there.

It's true that we need growth to end poverty. But it is economic growth in remote rural areas on one-acre farms where poor people live that we need, not generic per capita GDP growth that takes place primarily through industrialization in urban areas. Ending urban poverty requires economic growth in slum areas, stimulated by creating new markets for informal slum-based enterprises that provide the jobs that poor people come to slums to get. This chapter will describe many new ways for the poor farmers to increase the income they can earn from one-acre farms, and new ways for slum enterprises that employ poor people to increase their profitability.

Unless we can create economic growth and prosperity in the specific context of small, remote rural farms and of urban slums, the industrial growth that creates national GDP per capita growth will continue to bypass most poor people.

2.3 *Myth 3: Big business will end poverty*

Some people see a sickle as a weapon to start a revolution, others as a tool to bring in the harvest. But it is inherently neither one of these. It is a curved piece of metal with a sharp edge and a wooden handle.

When IDE was set up 25 years ago, poverty workers saw multinational corporations as evil oppressors of the poor, and business as the enemy. Now many see them as white knights ready to slay the poverty dragon. But a multinational corporation is inherently neither one of these. It is an organizational structure for doing business. If most multinationals continue to operate the way they do now, the belief that big business will end poverty will remain nothing more than a tantalizing myth.

They will need to make radical changes in how they design, price, and deliver products and services to the poor people. These radically different economically sustainable business models for making positive impacts on the lives of very poor people will need to incorporate the basic principles below.

a. First priority goes to models that effectively serve customers who live on less than a dollar a day.
b. Products and services are designed to reach price points affordable to people who earn less than a dollar a day, when sold at an unsubsidized fair market price.
c. First priority goes to the design and marketplace delivery of income-generating tools and strategies capable of at least paying for themselves in the first year.
d. The business model expressed in a viable business plan will be capable of reaching bottom-line profitability within a time frame acceptable to investors who fund the business.
e. Measurable positive impacts on poverty are an essential component of a viable business plan.
f. Capacity for scaling up the business to reach millions of poor customers is an essential component of a viable business plan.

People who survive on less than a dollar a day have the lowest labor wage rates in the world—about one sixtieth of the minimum wage rate in the USA. In a global economy where the typing of medical records in American and European hospitals is outsourced to India and designer jeans sold in Europe are produced in China, the challenge for big business is to find ways to harness the five-cent-an-hour labor rates of dollar-a-day people and make a profit doing it. There already are successful models for doing this.

The *Gujarat Cooperative Milk Marketing Federation* (GCMMF) has grown rapidly to become India's largest food-products marketing organization. In 2005–2006, its sales turnover was US$ 850 million handling 9.91 million liters of milk a day from 2.5 million small-farm milk producers, most of who started out earning less than a dollar a day. Also known as *Amul*, this creative organization found a way to collect milk from farmers with one to three buffaloes, cool it, and process it into products such as fresh milk, butter, cheese, and ice cream, sold to people who can afford to buy them. There are 800 million dollar-a-day rural people, just like the small-acreage farmers who are member producers of *Amul*, who can harness their radically low labor costs to produce labor-intensive high-cost off-season fruits and vegetables, herbs, and the key essential oil ingredients for luxury cosmetics and Channel No. 5 perfume, if big business can find ways of collecting them and marketing them to high-end markets like *Amul* does.

3 SMALL FARMS ARE VERY BIG!

Small farms play a much bigger role in global agriculture than most people realize. Of the 525 million farms in the world, 445 million, some 85%, are smaller than five acres (2 ha) (Nagayets, 2005). Farms less than five acres (2 ha) represent 95% of the farms and 69% of the total cultivated area in Bangladesh, and they represent 87% of farms and 60% of total cultivated area in Ethiopia. In China, 98% of all the farms are smaller than five acres.

The average farm size in both Asia and Africa is now 3.75 acres (1.5 ha) (Nagayets, 2005). The farms cultivated by dollar-a-day families are much smaller than the average. In spite of the predictions of economists, average farm size in developing countries steadily decreased, probably because of rapid population growth. Average farm size in the USA and in just about every country in Europe, where much of the leadership of global agricultural research institutions originates however, is steadily increasing, just as the economists predict.

Farms under five acres (2 ha) contributed 40% of food grain production and dominated the dairy sector in India in 1990/91; they made up 49% of total agricultural production in Kenya in 1985. Small farmers contribute 85% of total agricultural production in Malawi, and 97% of national milk production in Ethiopia. In Russia in 2001, farms under five acres (2 ha) produced 51% of the milk, 57% of the meat, 80% of the vegetables, 93% of the potatoes, and 28% of the eggs (Nagayets, 2005). If there are 445 million small farms, and a family of five lives on each of them, then 2,200 million of the 6,200 million people in the world live and work on small farms. Three quarters of the people in the world who survive on less than a dollar a day earn their livelihood from small farms, representing 800 million of the total 2,200 million who live on farms less than

five acres (2 ha) in size. The farms where these dollar-a-day farmers live and work are more typically one acre in size, divided into four or five scattered quarter acre plots (Polak, 2007).

4 FOOD SECURITY OPTIONS FOR SMALL FARMS

4.1 *Adopt green revolution strategies*

The green revolution has transformed world agriculture. Fifty years ago, millions of people starved to death in India and China on a regular basis. The green revolution put a stop to this by dramatically increasing food supply, and China and India are now net grain exporters. But the green revolution failed to put an end to poverty and hunger, much to the dismay of optimistic green revolution planners. 300 million people in India and 200 million people in China remain very poor, and most of them still go hungry. Increasing the world's food supply simply eliminates one important factor contributing to hunger. But poverty and hunger will end only when the poor people who live and work on small-farm and grassroots enterprises find ways to earn enough money to buy the food they need. Then the market will find ways to bring it to them. When instead, poor, hungry people are placed in a position of long-term reliance on disaster relief, donated food, and government food-distribution systems, their hunger persists.

The supply-driven strategies of the Green Revolution, however, may not help subsistence farmers, who must play to their strengths to compete in the global marketplace. The average size of a family farm is less than 4 acres (1.6 ha) in India, 1.8 acres (0.7 ha) in Bangladesh and about half an acre (0.2 ha) in China. Combines and other modern farming tools are too expensive to be used on such small areas. An Indian farmer selling surplus wheat grown on his one-acre plot could not possibly compete with the highly efficient and subsidized Canadian wheat farms that typically stretch over thousands of acres. Instead subsistence farmers should exploit the fact that their labor costs are the lowest in the world, giving them a comparative advantage in growing and selling high-value, and intensely farmed crops.

4.2 *Adopt low cost strategies to increase yields (deep urea granules, SRI)*

Strategies like implanted sustained release urea capsules, which IDE has field tested and marketed successfully with small farmers in the Central hills of Vietnam, Nepal, and Bangladesh, usually cost little more than traditional urea broadcasting, lower risk of loss from runoff in heavy rains, and increase yields by 20% or more. If a family produces 700 kg of the 900 kg they need to keep food on the table, and can increase the yield to 850 kg, they only have to find the money to buy 50 kg instead of 200.

The *System for Rice Intensification* (SRI), a low cost, more labor-intensive way to increase rice yields, is spreading rapidly among small farmers although it has generated considerable controversy. Most rice is grown underwater in rice paddies. This keeps rice plants continuously supplied with water and suppresses weeds. Since few dollar-a-day farmers have access to formal irrigation, they depend on monsoon rainfall to provide water to their rice crop. Travelers going south from Kathmandu to the Terai plains of Nepal behold miles and miles of terraces on slopes so steep they would challenge a mountain goat. Many of these terraces were built several generations ago with hand tools assisted by animal power. Each terrace collects monsoon rainwater, floods a small terrace planted with rice, and passes it on to the terrace below, all the way down to the bottom of the mountain.

In contrast to the usual practice of growing rice underwater, the SRI approach plants rice seedlings further apart like most people grow tomatoes, keeping their roots wet with periodic irrigation. Many tests of this approach report that rice plants grown this way are sturdier and have a healthier root system, partly because the soil is aerated (Polak, 2007). Yields increase as much as double that achieved with the conventional flood method. This gives small farmers the attractive option of increasing their rice yields without changing from their traditional varieties and without

risking a big investment in inputs. IDE's initial trials of SRI in Vietnam, Cambodia and India have produced encouraging results. SRI opens up the possibility of irrigating small rice fields with low cost sprinkler and drip systems, using much more modest water sources. The first field tests in India combining SRI with a low cost drip irrigation systems has produced promising increases in yield and quality (Polak, 2007).

4.3 *Grow high value cash crops and buy food*

The third approach to keeping the small farm family fed holds the most promise in the long run, but often appears too risky to small farmers at first. They can earn an additional net cash income of US$ 500 a year by growing a quarter acre of irrigated high value cash crops during the dry season, and use the cash from fruits and vegetables to buy the rice, wheat or corn needed to cover whatever shortfall remains after they have adopted low-cost, low-risk approaches to increasing their yields of staple crops. Millions of farmers have already taken advantage of this entrepreneurial approach.

Small farms in developing countries have the lowest labor rates in the world—between US$ 0.05 and 0.10 an hour. On a level playing field, small farms using family labor consistently outperform big farms using hired labor. The first step that will lead to prosperity for small farms is to identify four or five high value off-season fruits or vegetables for each agro-climatic zone that are likely to have sustainable market demand and can be grown successfully on quarter acre intensively cultivated irrigated plots. Then, for each agro-climatic zone, practical steps are taken to stimulate private sector networks that open smallholder access to the affordable irrigation, inputs and skills required to grow these crops, and the transport and trading networks required to sell them at a profit. IDE has already helped more than 2.5 million small farm families dramatically increase their income using this approach.

But to make it available to 800 million dollar-a-day rural people requires a bold new agricultural initiative centered on one-acre farms, an initiative comparable in size to the green revolution itself.

5 A REVOLUTION IN WATER

Conventional western water pumping, storage, and conveyance technologies are too expensive to be affordable for most smallholders in developing countries and difficult to scale down to fit the needs of their small plots. The design and mass dissemination of a whole new generation of affordable small plot irrigation technology will have a more dramatic positive impact on the lives of the rural poor than the introduction of personal computers created in the west. But to fill this huge market gap, radically different new approaches to the design and dissemination of irrigation technology are required.

5.1 *Key existing constraints in access to irrigation for smallholders*

Top down or bottom up irrigation? The rapid expansion of irrigation contributed as much as the adoption of high yielding varieties of seeds to the success of the green revolution. But these were based on the adoption of large-scale western irrigation technologies in developing countries. The operation and maintenance problems of large canal systems were addressed by a second irrigation revolution advocating farmer-managed systems. The extensive leakage of many canal systems provides lower cost access to groundwater irrigation through farmer investments in tube wells, but even the cost of a shallow diesel tube well in Bangladesh in the 1980s started at US$ 500, far too expensive for dollar-a-day farmers. Rather than starting with large expensive western technology, and assuming that it can be used effectively by smallholders, the affordable irrigation revolution starts with defining the irrigation needs on individual small farms, and then designing

irrigation technology cheap enough to be affordable on dollar-a-day incomes, small enough to fit existing plot sizes, and attractive enough to reach at least a million small customers through private sector marketing at an affordable price.

5.1.1 *Affordability*

At US$ 1,800 a hectare (US$ 0.18 per m^2) for vegetable crops in India and much more in Sub-Saharan Africa, the commercially promoted drip irrigation systems are much too expensive to be affordable for smallholders. The same can be said for conventional water pumping and water storage technologies. Treadle pumps brought the entry level price for efficient pumping in Bangladesh down to US$ 25 from US$ 500 for a five horse diesel pump set, and low-cost drip irrigation is now available for US$ 0.04 a m^2 in India, down from US$ 0.20 a m^2 for conventional systems. Field experience in South Asia and Sub-Saharan Africa suggests that the tipping point for market take-off requires reducing the cost of conventional irrigation technology by roughly 80%.

5.1.2 *Divisibility*

A 40 kg bag of fertilizer or a 20 kg bag of seeds can be divided easily to any size that fits the customer's needs, but most mechanical technologies, like tractors or drip irrigation systems, are *lumpy* inputs because they cannot easily be divided into smaller pieces. Radical changes in the design process for irrigation technology are required to bring the effective size down to the scale of 1,000 m^2 and smaller plots. For example, a variety of low-cost IDE drip systems are now available that start at a 20 m^2 kitchen garden sized system, at an entry level price of as low as one dollar.

5.1.3 *Expandability*

To be attractive to small farm customer, small plot irrigation systems not only must be available at an entry level cost that fits the farmer's pocketbook and size that fits small plots, but also each technology should ideally be infinitely expandable as farm income increases. A small farmer in India who invests US$ 8 in a new 200 m^2 IDE drip system that generates US$ 100 in new net income can seamlessly double or triples its size for the second season of use by investing some of the US$ 100 in new net income it generates.

5.1.4 *Profitability and market attractiveness*

Because of the vast unmet need in the marketplace, a practical threshold rule of thumb for new small farm irrigation technology is that it must show a net return of at least 100% on its purchase price (300% is more common) in one growing season and command a market for the sale of at least one million units at an unsubsidized fair market price. A compelling reason for marketplace adoption is that shifting from rain fed crops to affordable irrigation significantly reduces risk for dollar-a-day farmers.

5.2 *Access to water*

There are many other big untapped opportunities for small farmers to gain access to a source of water for irrigation. There are, in fact, practical ways to address the problem of small farm access to water.

From the largest to the smallest, irrigation tools can be classified as water lifting, water storage and water distribution technologies.

5.2.1 *Water lifting*

Buckets, counterbalanced buckets, sprinkling cans, and swing baskets are very cheap, but require a lot of muscle power. Of course, this is a renewable form of energy.

Until the design and mass marketing of treadle pumps, there were very few tools for small farmers to use to lift water between the extremes: at one end, a bucket, which is very cheap and too small, and at the other end, a five horsepower (HP) diesel pump, which is very expensive and too big. It takes a healthy man a day to lift enough water with a rope and bucket to irrigate an eighth of an acre of vegetables, and another two days to carry it to his crops in sprinkling cans. If he has enough money to pay US$ 500 for a five HP diesel pump and US$ 200 a year for buying diesel fuel and repairs to keep it running, he can keep 5 acres (2 ha) of vegetables watered without two much trouble. But this is hard to do on a total income of US$ 300 a year.

5.2.2 *Treadle pumps*

In the 1980s, Gunnar Barnes, a Norwegian engineer working for *Ranjpur Dinajpur Rural Service* (RDRS), a rural development organization in northern Bangladesh sponsored by *Lutheran World Service*, designed a human powered water lifting device that a small farmer could buy with a sack of rice. The treadle pump, operated by walking on two bamboo treadles, each activating a 2.5 inch[2] cylinder which sucked water up from a depth of 6–25 feet[3] (1.8–7.6 m) in a tube well. Since groundwater over most of Bangladesh is shallow, treadle pumps could be used to lift water in the dry winter season over most of Bangladesh. The pump itself retails for US$ 8, and the total cost of a pump installed on a tube well by a village well-driller is US$ 25. With this investment and two to six hours of labor a day, a family can irrigate a half acre of vegetables during the dry season, earning an average of at least US$ 100 a year after expenses. Best of all, the one-fifth or so of small farmers who were more market-savvy regularly earned new net income of more than US$ 500 a year.

These 2.25 million treadle pumps are generating more than US$ 200 million new net annual income for dollar-a-day small farmers. There is an additional multiplier impact on village economies in the range of US$ 600 million per year. In parts of Bangladesh and India, the influx of new income coupled with a drop in the price of diesel pumps imported from China to below US$ 200 has created a rapid uptake of low cost diesel pumps, and the creation of efficient water markets as diesel pump owners sell surplus irrigation water in the marketplace. Happily, these affordable water markets are now providing effective competition with treadle pumps to bring affordable irrigation water to small farmers in Bangladesh and India.

5.2.3 *Rope and washer pumps*

Adding a component to treadle pumps that pushes water to the suction component creates a pressure treadle pump that can pump up to 60 feet (18 m), but costs twice as much as the suction pump, and pumps less water because it takes more work to pump from depth. The rope and washer pump, developed in Nicaragua can lift water as much as 100 feet (30 m). This is a pump based on running a rope upwards through a pipe, with washers attached to the rope. As an operator on the surface turns a crank, a rope with washers attached to it is drawn up through a pipe in the well carrying water to the top. Some 60,000 *Rope and Washer* pumps have been sold in Nicaragua primarily for household water. *Rope and Washer* pumps are now being tested in conjunction with low cost drip systems to make the comparatively small amount of water that can be lifted from depth with human power irrigate enough plants to be economically attractive.

5.2.4 *Micro-diesel pumps*

When it comes to non-electric motorized pumps, diesel pumps have some advantages over gasoline engine powered pumps because they last longer and use less fuel. The ideal size of a diesel pump that would fit a one acre farm is about three quarters of a horsepower (HP), but until now,

[2] 1 inch = 2.54 cm.
[3] 1 feet = 0.3048 m.

the smallest diesel pump was 2 HP commercially available from China. At the same time, right after the Second World War, a 3/4 HP air cooled micro diesel operating through a friction wheel on the front tire of bicycles was used to boost bicycle power in Europe. IDE and Practica, a Dutch development organization, are now working on prototypes of the 3/4 HP bicycle powering micro diesels modified to drive a water pump. If this proves effective, there is a probable global market demand for several million micro diesels by one-acre farmers who have earned enough income to invest in mechanized water-lifting tools.

5.2.5 *Water storage*

In most places in the world, even the very dry ones, most of the year's rain falls during the two to four months of what people call the monsoon season. In the hot dry climate of the state of Maharashtra in India, for example, small farmers' fields become quagmires in the late summer. After that, it becomes, hotter and drier until before the monsoon, when temperatures rise to 112 degrees Fahrenheit (44°C) in the shade. This is when market prices for fruits and vegetables reach their highest levels but there is no hope of producing a crop without irrigation.

IDE is now designing a US$ 400 plastic lined pond with a low cost plastic cover 35 feet (10 m) in length and width and 7 feet (2 m) deep. This low cost small farm water storage system will hold 200,000 liters of monsoon rainwater on a small farm, enough to drip irrigate a quarter acre of high value vegetables in the driest time of the year for 100 days and generate at US$ 500 in new net income.

Farmers who lack access to either a stream or shallow groundwater may need to trap monsoon rainwater and store it for six months until the hottest, driest time of year when crop prices are at their peak. For them, the critical question is this:

"How much water do I need to store to earn US$ 500?"

The answer is pretty straightforward. You can just about always make US$ 500 from a quarter acre (1,000 m^2) of fruits and vegetables during the hottest and driest time of year, and in most places, small farmers would need to store 200,000 liters or so in an enclosed tank to drip irrigate a quarter acre of vegetables for a hundred days during the dry season.

At IDE we believe a US$ 400 plastic lined enclosed storage system will be purchased by millions of small farmers around the world.

The other options for one-acre farmers without access to wells lakes or streams are:

1. *Store Water Underground*: The best storage reservoir may be in underground sand layers called aquifers. In the 1980s, a Hindu religious movement called *Swadhyaya Parivar* led thousands of farmers in Gujarat to build waterways that direct monsoon runoff into large open wells. This collective action restored groundwater aquifers and made the stored water available for pumping during the dry season when crop prices are at their peak (Polak, 2007). There is a huge untapped potential for directing monsoon rainwater into underground aquifers, where it can be stored without any loss to evaporation and pumped out again during the time of year when prices for fruits and vegetables are at their peak.
2. *Store Water Above Ground*: *Build a Pond*. Any self respecting small farmer knows how to build a 100 m^2 pond that is two meters deep. The key to making it effective and affordable is to line it with plastic that prevents leaks and lasts at least two or three years. If the water is stored for several months, farmers need to find ways to eliminate or cut down evaporation. Shade provided by bamboo poles covered with banana leaves or trees beside the pond helps, and IDE is now designing a low cost plastic cover to eliminate evaporation.
3. *Create a Low Cost Water Tank*: *The Giant Condom Solution*. To prevent evaporation, the ideal form of storage is an enclosed tank. But the cheapest ferro-cement tank costs US$ 0.02 a liter in India. To lower this cost, IDE in India has designed and field tested a ten-meter long, one-meter diameter, double-walled plastic tube in an earthen trench. The tube costs US$ 40 and stores 10,000 liters of water. This is enough to provide drinking water for a family of five for a year, and have some left over for a small drip irrigated kitchen garden. Initial market tests for the enclosed plastic tube will take place in India in 2007.

5.2.6 *The wading pool solution*

A creative student design team at Stanford came up with an even simpler solution for a low cost above ground enclosed water storage system. They took the design of a simple plastic wading pool as a starting point. This is a plastic container shaped a little bit like an upside down bowler hat. As it is filled with water, the water pressure pushes against the side walls and gives shape to the storage container. Since the mechanical forces against the side walls are a function of the depth, there should be no limitation in size.

A farmer running a gravity pipe from a stream can roll up the plastic wading pool like a bed roll, and carry it to the part of the field he or she wants to irrigate. If he has a 1,000 liter wading pool, all he has to do is fill it up with a pipe from the stream, and run another pipe from the pool to the low cost drip irrigation system.

It is too early to tell how well this wading poor type storage system. The student team and IDE Myanmar are still testing it in the field.

5.2.7 *Water distribution*

Since 70% of the water diverted for human use in the world goes to irrigation, the astonishing fact is that some 90% of irrigation water is applied to fields and crops using inefficient surface methods that have been unchanged over the past 800 years. In most canal systems, there are huge water losses through seepage between the source and the field. An unintended positive consequence is that the leakage restores shallow water aquifers, allowing many small farmers to install shallow wells and pumps delivering irrigation water on demand. But when it comes to delivering this water to their crops, farmers usually apply the same inefficient surface methods used by everyone else.

But after a small farmer has painstakingly collected and stored water in a 200 m^3 pond, he needs a much more efficient water-distribution system to get the water to his crops without using it all up in the first day's irrigation. He needs low cost drip irrigation systems which ensure that 80 or 90% of the precious stored water goes right to the roots of the plants or something equally efficient. For other crops, low cost low pressure sprinkler systems, while not quite as efficient as drip systems, are much more efficient than conventional surface irrigation. But conventional drip and sprinkler systems simply are not available at a price a dollar a day farmer can afford, and at a size that fits their typical quarter acre plots.

5.2.8 *Low cost sprinkler systems*

Small farmers use low cost low pressure sprinklers instead of low cost drip systems for plants that are not in rows or very closely spaced, for hilly fields, and for water loaded with minerals that clogs up drip irrigation systems. When Jack Keller started working on the design of small plot low cost sprinkler systems, his first step was finding sprinkler heads capable of distributing water uniformly at 5 meters of pressure that was generated by running water from a tank 5 meters above the ground. At that time, the standard pressure head needed for conventional sprinkler systems was 20 meters. These IDE low cost sprinkler systems are just emerging from field testing in India, and will cost about of US$ 80 for a half acre system.

6 WHAT DESIGNERS CAN DO: DESIGN FOR THE OTHER 90%

If all the creative problem-solvers in the field of design now only address the problems of the richest 10% of the world's customers, a revolution in design is needed to incorporate the needs of the other 90%. This requires radical changes in the way design is taught both in rich and in developing countries and building a platform so that at least 10,000 of the world's best designers focus their attention on products and services that meet the needs of the other 90% of the world's population.

A few years ago, we believed that professors teaching irrigation in universities simply showed a callous disregard for addressing village irrigation problems. Then Jack Keller, a retired professor of civil engineering at Utah State who is a world expert on irrigation, invited the first

author of the present chapter to participate in a brainstorming discussion with irrigation academics at their annual meeting. They were fascinated by the possibility of applying what they knew about one-hundred-sixty-acre (65 ha) center-pivot sprinkler systems to designing a low-pressure, low-cost, half-acre sprinkler system for a small farm, and they were ready to step up and help.

Enter the new organization that was started in 2007, called D-Rev: *Design for the Other Ninety Percent* (D-Rev, of course, stands for *Design Revolution*.) The mission of this new organization is to make the design revolution a reality.

6.1 *The poor customer rules the design process*

Thinking of poor people as customers instead of as recipients of charity radically changes the design process. Poor persons won't invest in a product or service unless the designer knows enough about the preferences of poor people to create something they value. The process of affordable design starts by learning everything there is to learn about poor people as customers, along with what they are able and willing to pay for something that meets their needs. When in doubt, we at D-Rev resort to the *Don't bother* trilogy.

6.2 *Adopt the don't bother trilogy*

1. If you haven't had good conversations, with your eyes open, with at least 25 poor people before you start designing, *don't bother*.
2. If what you design won't at least pay for itself in the first year, *don't bother*.
3. If you don't think you can sell at least a million units at an unsubsidized price to poor customers after the design process is over, *don't bother*.

7 CONCLUSION

Over the past three decades, we have spoken with thousands of small farmers in the developing world and walked with them through their fields. They have consistently told us they can increase their earnings by as much as US$ 500 a year by intensively farming 1,000 m^2 (quarter-acre) plots of fruits and vegetables, but they need better cultivation methods, affordable irrigation and access to markets for their crops. Their struggle is part of a global challenge: by 2050 the world's farmers must feed 9,000 million people—3,000 million more than the current population—without much expansion in the amount of land and water devoted to agriculture.

If a small organization such as IDE, with an annual budget of US$ 10 million and a staff of 600, can bring nearly one million people out of poverty every year, then surely the combined efforts of the wealthy nations can do much more. But development agencies must be willing to start at the bottom—at the level of the small farmer walking quietly on his treadle pump—and work their way up.

These dollar-a-day farms may be small, but the market strength is found in the mass. One-acre dollar-a-day farmers and their urban brothers and sisters are already hard-nosed, stubborn survivalist entrepreneurs ready to take advantage of marketplace opportunities if the price is right, the return is high, and the risk is low. But they need private-sector supply chains to furnish them with the tools, materials, and information required to create high-value products, and private-sector value chains that sell what they produce at an attractive profit. As their incomes increase, they become customers for products like affordable eyeglasses, houses, solar lighting, health care, and education. New markets that serve poor customers will provide opportunities for hundreds of millions of dollar-a-day people to move out of poverty. A revolution in design is needed to create the range of new income-generating tools that will make this move possible.

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V
Ethics of groundwater use

CHAPTER 12

Specific aspects of groundwater use in water ethics

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ABSTRACT: Groundwater use has spectacularly increased during the last five or six decades. It is estimated that this use has increased in half century from 100–150 km^3/year to 900–1,000 km^3/year today. This intensive use has been described as a *silent revolution* performed by millions of farmers with scarce planning and control by the conventional governmental water agencies. Although the accuracy of most water data is generally illusory, it seems that today half of mankind drinks groundwater and more than 50% of the economic value of the irrigated agriculture is obtained with groundwater irrigation.

This *revolution* has produced great benefits in providing drinking water and decreasing malnourishment to the poor. But it has also produced different problems in some regions. These problems have been frequently exaggerated because of ignorance, inertia or corruption of some high-level water decision-makers. A series of *hydromyths* or wrong paradigms are pervasively found in many places and are discussed in this chapter.

Keywords: Groundwater (GW) intensive use; Silent revolution; Hydromyths; GW sustainability; GW economics; GW management institutions; Corruption

1 INTRODUCTION

This chapter aims to discuss how recent groundwater development and new concepts can shift our perceptions on the *looming water crisis* repeatedly forecasted in the media and in academic circles.

The current crisis is less due to water scarcity than to a crisis in water governance. The solutions, thus, have to be found elsewhere. This chapter proposes a shift away from pure technological fixes based on surface water infrastructures, predominant in the past, or so called the *hard path*, towards a *soft path* in water governance (Gleick, 2003). The *UN Reports on Human Development* clearly state this point of view (UNDP, 2006).

From the ethical point of view, it is important not to mix two connected and relevant issues: a) the ethical obligation of providing drinking water to the poor (the right to water or social ethics); and b) the ethical obligation of avoiding ecological disasters in aquatic ecosystems (*saving the planet* or environmental ethics).

The chapter focuses mainly on the agricultural sector, since the *lion's share* of the *blue water* consumptive use corresponds to irrigation, which is about 80%. This proportion can be higher than 90% in arid and semiarid regions. Any advances made in irrigation will translate in gains by other sectors—which often have higher economic returns or added value, such as industry, public water supply and sanitation, or environmental services.

First civilizations, known as *hydraulic civilizations* (Wittfogel, 1957), were born in the valleys of arid areas about 50 or 60 centuries ago. In these valleys, hunter and gathering societies settled into the land thanks to small irrigation infrastructures that could guarantee the regularity of crops. This required a collective effort, which facilitated the settlement of tribes, and led to the creation of *civic*

or small urban centers. These so called *hydraulic societies* relied heavily on *hard infrastructure* and often economies of scale to re-organize land use planning, whilst facilitating the strengthening of the central state as founder and coordinator of infrastructure. With few exceptions, most of the large water infrastructure built in the last 100 years has been due to collective action on the part of the state, funded and controlled by the state administration.

Intensive use of groundwater is a recent phenomenon, less than half a century old in most places. This situation has occurred mainly in arid and semiarid countries, in some coastal zones and near to a few megacities. This groundwater development has produced great socio-economic benefits, mainly in developing countries. It has provided cheap drinking water that has helped to improve public health. The new irrigated lands have contributed to eradicate, or at least mitigate, malnourishment among those living in poverty. Millions of modest farmers with scarce public or governmental planning, assessment, financing and control, have mainly performed this groundwater intense development. This intensive use has really been a kind of *silent revolution*. In most countries the corresponding public water or irrigation agencies have been mainly devoted to design, build and operate large surface water irrigation systems. The well-known American hydrologist Raymond Nace (1973), described as *Hydroschizophrenia* the attitude by some water decision-makers of strongly separating surface and groundwater projects, usually ignoring groundwater. This attitude has been commonplace in India, Mexico, Spain, and many other arid and semi-arid regions worldwide. As a consequence, certain adverse effects have ensued in some places. For instance, in South Asia the current situation concerning groundwater development has been frequently described as a *colossal anarchy*.

Most of the problems caused by this uncontrolled groundwater development could be avoided or mitigated if the corresponding government agencies had been more active in assessing and controlling groundwater use. On the other hand, surface water officials have frequently exaggerated such problems. This has created a pervasive *hydromyth* on the fragility or weakness of groundwater as a reliable resource.

Because of ignorance, vested interests, or more frequently because of the low credibility of the water official warnings about the potential threats, most farmers are not reducing their intensive groundwater abstraction. On the other hand, there are practically no documented cases where intensive groundwater abstraction from medium or large size aquifers has caused serious social or economic problems similar to those caused by soil waterlogging and salinization or by the people displaced or ousted by the construction of large dams.

2 A BRIEF CONSIDERATION ON WATER AND HUMAN DEVELOPMENT

Although this chapter is obviously not the most adequate place for a comment on the human development concept, it is nevertheless important to emphasize certain aspects of human development as much as they relate to groundwater. This topic is treated with more detail in Llamas (2001, 2005).

True human development cannot be equated with *having more*, but rather with *being more*. Cultural and spiritual values must always prime over purely materialistic or hedonistic goods. At the same time, it is universally accepted that in order for this to occur, a human being must have a minimum amount of material means such as food, drinking water, housing, education and an adequate level of public health care.

Those inhabitants of regions whose average annual rent per capita is lower than US$ 500 are considered to be living under extreme poverty. The estimate is that out of the 6,000 million inhabitants of the planet, about 1,000 million live under this poverty threshold. On the other hand, there are approximately another 1,000 million people, mainly living in developed countries, whose average rent per year is over US$ 10,000 (this is about 20 times higher than people living in poorer conditions). Since this comparison, based exclusively on per capita rent, is somewhat simplistic, the UN have been now for years using a more complex criteria which takes into account factors such as education and life expectancy (UNDP, 2005).

It would be reasonable for the onlooker to question why the *rich* should take an interest in raising the level of the *poor*. There are at least two commonly acknowledged ethical reasons not to accept this argument. First, the intrinsic dignity of all human beings; and second, the sense of fraternity—or solidarity—existing among all people. In addition, other practical (or even selfish) considerations point out that it is not possible to implement a global sustainable development while poverty exists. Thus the 2002 *World Trade Organisation* meeting in Doha concluded that it was necessary to reduce the tax barrier on farming products in a clear attempt to help poorer countries. Another reason, which has become more prominent after September 11, 2001, is the fact that poverty constitutes an ideal culture for future terrorists.

The role water plays in the eradication of poverty is essentially twofold. Firstly, it is necessary to provide drinking water, sanitation and hygienic education to less-developed countries in order to reduce the mortality and morbidity rate. Secondly is the need to implement small-scale irrigation systems so as to help provide enough food for those regions whose inhabitants suffer from chronic malnutrition or find themselves exposed to famine whenever prolonged drought periods occur (Polak, 2005).

In the year 2000, the United Nations released the *Millennium Declaration*. Such declaration consisted of an analysis of the general state of affairs in the planet, together with a series of action plans for the future. Two of these specific actions or goals aim to halve by the year 2015 the proportion of the Earth's population that does not have ready access to drinkable water or suffers from malnutrition. Other chapters in this book deal with the *Millennium Development Goals* (MDG) in more detail, e.g. Jimenez *et al*. (this volume).

International conferences, such as *Bonn's International Congress on Freshwater* (December 2001) or the four preparatory sessions for the *World Conference on Sustainable Development* also known as *Rio+10* (Johannesburg, August 2002), have upheld the conclusions of the aforementioned MDG.

The *International Conference in Bonn* (German Federal Government, 2001) pointed out that the necessary investment in order to provide a basic water supply and water treatment systems in developing countries (about 1,000 million people) would amount to about US$ 20,000 million in the next ten years. Developing countries are to contribute half of this quantity, while soft loans and donations should complete the total amount. The so called *Camdessus Report* (Camdessus, 2003) substantially increases the amount of investment necessary but it deals with all the hydraulic infrastructures.

This overall figure, which might appear high, adds up to merely US$ 10 per person each year for the 1,000 million persons living in the rich countries whose yearly rent per capita is over US$ 10,000. In other words, if each of these people in developed countries were able to donate US$ 10 a year, the problem would be solved in just one decade. This yearly donation would constitute less than 1‰ (one per thousand) the average income, less than the amount people in these countries spend, for instance, on domestic animal food or ice cream.

These data only show the tip of the iceberg of the serious problem that unsustainable consumption constitutes in developed countries. Catastrophist *neomalthusian* theorists, who prefer to emphasize the problems, real or fictitious, associated with the increase in the world's population, hardly ever mention this. It is also often forgotten that most developed countries are still far from fulfilling UN's proposal to contribute 0.7% of their *Gross National Product* to help developing countries.

Thus, it is noticeable that solving the problem of poverty for millions of people does not imply an extraordinary effort on the part of rich countries. The need for an adequate management of these investments, however, adds an extra complexity to the problem, since donations are meant to be catalysts to improve the institutional and organisational capabilities of developing countries, rather than being mere alms to the poor. On the other hand, it is a well-known fact that the final destiny of some of these donations has been the purchase of weapons or the personal profit of some politicians of certain governments.

In recent years, a good number of declarations of statements in favor of the right to water of the poor have been proposed. For example, on occasion of the 2007 *World Day of Water*, Cardinal Bertone on behalf of the leader of the Roman Catholics made a declaration reminding the no. 485 of

the *Compendium of the Social Doctrine of the Catholic Church* [www.vatican.va], which tells: "By its very nature water cannot be treated as just another commodity among many, and it must be used rationally and in solidarity with others. The distribution of water is traditionally among the responsibilities that fall to public agencies, since water is considered a public good. If water distribution is entrusted to the private sector it should still be considered a public good. The right to water, as all human rights, finds its basis in human dignity and not in any kind of merely quantitative assessment that considers water as a merely economic good. Without water, life is threatened" (Bertone, 2007).

3 WATER AND GROUNDWATER USE IN THE WORLD

Before describing the current situation of groundwater it seems useful to summarize the basic data on the hydrological cycle and the relatively new concepts of *blue water* and *green water*. Neither the *virtual water* concepts nor the role of *desalinisation* are dealt with in this chapter. Readers interested in these topics are referred to Allan (2006), Cooley *et al*. (2006) or Llamas & López-Gunn (2007).

The basic functioning of the hydrological cycle is well known, and its quantitative evaluation calculated about 40 years ago. In summary, total rainfall on land is calculated at 115,000 Mm^3/year, of which 45,000 Mm^3 make up the flow of rivers and aquifers, and 70,000 Mm^3 evaporate from soil or evapotranspirate from vegetation (UN/WWAP, 2003: 77, 84).

Blue water is the surface- and ground-water in the hydrological cycle. It is also the part of the hydrological cycle that humans have used beneficially for their own use through the construction of water infrastructures, like canals and reservoirs. More recently, *blue water* has also included the spectacular rise in the use of groundwater.

Green Water is a term that started to be used two decades ago. *Green water* is the rainwater stored in the soil as soil moisture, also called soil water. It is the water in the soil that allows the growth and development of natural vegetation (forests, pasture lands, tundra, bush land, and others) as well as rain-fed agriculture. This water evaporates directly from the soil or through evapotranspiration from vegetation. Soil water has only recently started to be taken into account quantitatively. Its measurement and monetary valuation is still highly complex. It is calculated to be 70,000 Mm^3/year, of which about 3,000 to 4,000 Mm^3 are used by rain-fed agriculture. In most water and agricultural statistics *green water* is not included. This is the case of the FAO-AQUASTAT (FAO, 2003), which only refers to *blue water*, even when in many countries—particularly in the developing world—most crops are rain-fed.

Shah (2007) presents a recent review of the situation at global scale, although with a greater emphasis on the problems in the developing countries. One interesting aspect of his work is the warning about the accuracy of the global data. This author estimates that the values of the groundwater withdrawn might be between 25% and 40% higher that the number given by FAO-AQUASTAT. This is a frequent problem in water resources data, where most data have only an *illusory accuracy*.

A confirmation of this small reliability of FAO's data is shown in Shah's document (2007: Table 10.2) where Spain is not included in the list of the 20 countries using more groundwater. In many official documents the amount of groundwater used in Spain is over 6,000 Mm^3/year. This means that in that list Spain should be placed in the position 9th, ahead of Italy and Turkey.

In any case the key message of Shah (2007), as in other recent statements (Llamas & Martínez-Santos, 2005; Ragone & Llamas, 2006; Llamas *et al*., 2007), is that the increase in groundwater use during the last half century has been spectacular, from 100–150 km^3 in 1950 to 950–1,000 km^3/year in 2000. And in a good number of countries this increase continues.

4 WRONG OR OBSOLETE PARADIGMS (*HYDROMYTHS*) ON GROUNDWATER SUSTAINABILITY

The concept *sustainable development* was first coined in the 1980s, and has been expressed in a variety of ways over the years. Perhaps the better-known (and widely contested) definition of

sustainability was established in the *Brundtland Report* by the *World Commission on Environment and Development* (WCED, 1987): "to satisfy current needs without compromising the needs of future generations". In a more recent book, Rogers *et al*. (2006) present a thorough study on the general concepts of sustainable development.

Sustainability means different things to different people probably due to the multi-dimensional nature of the concept. There may be as many as ten different aspects to be considered in assessing whether a given development can be labelled sustainable (Shamir, 2000). Even if all these are taken into account, it may not be so easy to reach an univocal conclusion. That is, the different dimensions of sustainable development may at times clash.

Let us take a look at an example. At a given aquifer, pumping rates for irrigation may prove *sustainable* from the hydrological viewpoint (provided that storage and/or average recharge are large enough). However, water table drawdown may induce degradation of valuable groundwater-dependent ecosystems such as wetlands, which may be considered unsustainable from the ecological point of view. Would a restrain from pumping be the most *sustainable* course of action? The answer to this question is difficult. If farmer livelihoods rely heavily on groundwater resources, a ruthless push towards wetland restoration may not be the most sensible solution to the problem. In that case, like in many real life situations, the social and economic aspects of sustainability come into play, and may eventually offset environmental conscience.

Llamas *et al*. (2007) provide a succinct overview of nine different aspects of groundwater sustainability: hydrological, ecological, economic, social, legal, institutional, inter- and intra-generational and political. Throughout that text, a distinction is often made between developed and developing regions. This is because perceptions as to what is sustainable vary across geographical boundaries, and are often rooted on cultural, political aspects and socio-economic situations. In this regard, the *Hydrogeology Journal* theme issue of March 2006 presents the socio-economic analyses of a dozen of case studies from all over the world. Perhaps the paper by Shah *et al*. (2006) about the main countries of South Asia is the most relevant for our analysis.

Whenever adverse effects of groundwater development begin to be felt, it is common to hear about *overexploitation*, a term usually equated to pumping in excess of the recharge. While this practice is often dismissed as *unsustainable*, the concept of *overexploitation* is conceptually complex. This is the reason why a significant number of authors consider it simplistic and potentially misleading (Selborne, 2001; Delli Priscoli *et al*., 2004; Llamas, 2004). Probably the most complete analysis is the one by Custodio (2002). As a consequence more and more authors are changing to the expression *intensive use of groundwater* instead of using *groundwater overexploitation*. Intensive groundwater use denotes significant changes on natural aquifer dynamics (Custodio & Llamas, 2003). In contrast with *aquifer overexploitation*, *intensive groundwater use* does not convey a positive or negative connotation. It merely refers to a change in flow patterns, groundwater quality or interrelations with surface water bodies.

5 THE GROUNDWATER INTENSIVE USE *SILENT REVOLUTION*

To the best of our knowledge, this *silent revolution* concept applied to describe the spectacular increase of groundwater use was firstly utilized in 2003 in the *Third World Water Forum* (Llamas & Custodio, 2003; Fornés *et al*., 2005; Llamas & Martínez-Santos, 2005). From then, this concept has been used by other authors such as Briscoe (2005) and by several experts from the *International Water Management Institute* (IWMI) (Giordano & Villholth, 2007).

The spectacular increase in groundwater development for irrigation has taken place during the last half-century in most arid and semiarid countries: a kind of *silent revolution*, carried out mostly by the personal initiative of millions of modest farmers in pursuit of the significant short-term benefits groundwater usually triggers or by a subsistence livelihood economy in the poorest countries.

Science and technology have played a key role in the *silent revolution*, since the advances in hydrogeology and well-drilling techniques, and the popularization of the submersible pump, have significantly reduced abstraction costs over time. The total direct cost of groundwater abstraction

today—not taking into account externalities—is in many cases only a small fraction of the economic value of the guaranteed crop. Thus, the *silent revolution* is largely a market-driven phenomenon, except in those very poor regions where the drilling technology is still low and subsistence livelihood economy predominates.

Different authors consider that the driving forces of this silent revolution may be different according to the circumstances. But they can be reduced to two main causes: a) a subsistence economy in the poorest countries; and b) the market in most countries that are not under threshold of poverty.

Llamas & Martínez-Santos (2005) presented a qualitative overview of five water policy stages brought on by intensive groundwater use in arid and semiarid countries. Each of the five stages is roughly equivalent to one-generation or about 20–30 years. While the beginning of these can be traced back to the moment when intensive groundwater development begins, their end point might not be so easily identified. Thus some overlapping between stages may occur: take, for instance, *hydroschizophrenic* attitudes, which may still persist in many countries.

For example, in the USA, the *Western Water Policy Review Advisory Commission* (U.S. Government, 1998), appointed by the USA President reminded that state laws should recognize and take into account the substantial interrelations of surface- and ground-water, and that these resources should be administered and managed conjunctively. Nevertheless, this has not yet been achieved in the two main groundwater user states, California and Texas (Kretsinger & Narasimhan, 2006; Peck, 2007). The legal situation is similar in many other arid and semiarid regions worldwide.

Surface water is heavily subsidized in most countries and therefore its price for irrigation is generally cheaper than groundwater's. Yet, many farmers prefer groundwater. Several motives exist for this seemingly suboptimal choice: one is that groundwater can be obtained individually, thus bypassing negotiations with other farmers and government officers, often an arduous task, and reducing transaction costs. A second and more important motive is the resilience of aquifers to dry periods. In this regard, most farmers resort to conjunctive use when possible, using subsidized surface water whenever available and groundwater whenever surface water supplies fail. Many irrigated cash crops, which usually require large investments from farmers, depend today on groundwater, either totally or on conjunctive use with surface water.

Another important and seldom-mentioned benefit of the *silent revolution* is its positive effect on the social and economic transition of many farmers. Relatively low pumping costs, and the protection groundwater provides against drought, have allowed poor farmers to gradually progress into a middle class status, enabling them to provide a better education for their children. After one or two generations, those children have been trained as teachers, technicians, and so forth, thus contributing to the overall progress of society. At the same time, those who choose to continue as farmers are in a position to use better agricultural technologies to grow cash crops that demand less water.

Perhaps one of the most significant aspects of the *silent revolution* is the way in which farmers, as they become richer and more educated, move from low-value crops to cash crops. This is due mainly to the intrinsic reliability of groundwater: encouraged by the expectation of enhanced revenues, farmers invest in better technology, both from the agricultural (selective seeds, agrochemicals) and the technical point of view (drip irrigation), and in turn, shift to higher-value crops. As crop value is related to crop type, climatic and other natural and social variables of each site, and subject to trade constraints, it ranges widely: in Europe, for instance, between US$ 600 per hectare for cereals and more than US$ 60,000 per hectare for tomatoes, cucumber, and other greenhouse crops. Frequently the ratio between crop value and groundwater irrigation cost is greater than 20 (Llamas & Custodio, 2003; Albiac *et al*., 2006).

However, in aquifers with low permeability and storativity, located in densely populated areas, this ratio can be substantially smaller even if energy is heavily subsidized. This appears to be the case in the hardrock groundwater development in Tamil Nadu and other states of India. In these cases, the economic performance of these developments is very poor and they will probably disappear if the fast economic growth of India continues. The rural population of these groundwater poor areas will migrate to cities or change jobs.

A number of reasons suggest that newly implemented drinking water supplies and irrigation systems must be mainly based upon groundwater resources. Firstly, groundwater infrastructures are often cheaper than the equivalent surface water infrastructures. Secondly, groundwater related investments can be more easily scaled in time while yielding results almost from the beginning; instead, hydraulic works based on surface water resources rarely take less than 20 or 30 years to be fully-functional. Thirdly, groundwater-based supply and irrigation systems are usually smaller, thus allowing for a more progressive participation from potential beneficiaries. Past experience shows that in many countries, taking India as the most spectacular example, the government began building a modest quantity of irrigation wells about 20 or 30 years ago. However, the new technology was soon learned by local farmers, who developed new wells at their own expense and at a much faster pace than the government. It must be noted, though, that this higher rate can at times be excessive, and must be regulated by the government in order to ensure a sustainable and equal exploitation of groundwater resources.

In this regard, it is pertinent to note that groundwater development is less prone to corruption than traditional surface water irrigation systems, due to the aforementioned smaller investment and shorter time frame required for the implementation of equivalent groundwater supplies. In many cases, the issue might be more of an ethical nature, related to the lack of political willingness to fight ignorance, arrogance, institutional inertia, or corruption (Llamas, 2005; Ragone & Llamas, 2006).

However, intensive groundwater use is not a panacea that will necessarily solve the world's water problems (Mukherji, 2006). In fact, should the prevailing anarchy continue, problems may appear in the mid- or long-term (two to three generations). Some are already documented, although at a lesser scale, and are usually related to water table depletion, groundwater quality degradation, land subsidence or ecological impacts on aquatic ecosystems (Section 6).

6 HYDROLOGICAL AND ECOLOGICAL IMPACTS OF GROUNDWATER DEVELOPMENT

Here we summarize five indicators of typical problems of intensively used aquifers, but it is important to mention that they are sometimes wrongly used. This is either because of the lack of hydrogeological knowledge or because certain lobbies may have an interest in expanding the *hydromyth* of the unreliability (or fragility) of groundwater development (López-Gunn & Llamas, 2000).

6.1 *Groundwater-level depletion*

It has been usual—like in the Spanish 1985 *Water Law*—to define *overexploitation* as the situation when groundwater withdrawal exceeds or is close to the natural recharge of an aquifer. The observation of a trend of continuous significant decline of the levels in water wells during several years is frequently considered as a clear indication of an unsustainable situation. This is a simplistic approach that might be a long way from the real situation. Many times it corresponds to a transient state of the aquifer until reaching a new equilibrium situation.

Intensive groundwater use frequently depletes the water table. Depletions of the order of 0.5 m/year are frequent, although rates up to 5–10 m/year have been reported (Llamas & Custodio, 2003; Garrido *et al*., 2006). Farmers are seldom concerned with this issue, except in the case of shallow aquifers. The increase in pumping costs is usually a small problem in comparison with potential groundwater quality degradation or *equity issues* such as the drying up of shallow wells or *khanats* (infiltration galleries), owned by the less resourceful farmers and located in the area of influence of the deep wells. This may cause social equity problems in regions where many farmers cannot afford to drill new wells or the water authorities are not able to demand the just compensation in water or money to poor farmers. Nevertheless, some Indian researchers, such as Mukherji (2006), consider that the real situation is different because there exists *de facto* a trade of groundwater between the farmers that allows a good irrigation system.

The opposite phenomenon (rise of the water table due to surface water over-irrigation) is also a problem for example in Punjab, India and Pakistan or in San Joaquin Valley in California. Rising of the water table often results in significant social and economic troubles due to soil water-logging and/or salinization.

6.2 *Degradation of groundwater quality*

Groundwater abstraction can cause, directly or indirectly, changes in groundwater quality. The intrusion into a freshwater aquifer of low quality surface water or groundwater because of the change in the hydraulic gradient due to groundwater abstraction is a frequent cause of quality degradation.

This degradation of groundwater quality may not be related at all to excessive abstraction of groundwater in relation to average natural recharge. Other causes may be responsible, such as return flow from surface water irrigation, leakage from urban sewers, infiltration ponds for wastewater, septic tanks, urban solid waste landfills, abandoned wells, mine tailings, and many other activities not related to groundwater development. For instance, the groundwater quality degradation in many Central and Northern European countries is related to intensive rain-fed agriculture.

Saline intrusion may be an important concern for the development of aquifers adjacent to saline water bodies. This is a typical problem in many coastal regions of semiarid or arid areas. Also in this case, the relevance of the saline water intrusion not only depends on the amount of the abstraction in relation to the natural groundwater recharge, but also on the well field location and design, and on the geometry and hydrogeological parameters of the pumped aquifer. In most cases, the existing problems are due to uncontrolled and unplanned groundwater development and not to excessive pumping. As a matter of fact since half a century ago, the seawater intrusion is well controlled in the coastal plains of Orange County (California) and Israel.

6.3 *Susceptibility to subsidence*

When an aquifer is pumped, the water pore pressure decreases and the aquifer solid matrix undergoes a greater mechanical stress. This greater stress may produce compaction of the existing fine-grained sediments (aquitards) if the stress due to the decrease in water pore pressure is greater than the so-called *preconsolidation stress*. This situation has occurred in some aquifers formed by young sediments, such as those in Mexico City, Venice, Bangkok and others.

Caves and other types of empty spaces may exist under the water table in karstic aquifers. When the water table is naturally depleted the mechanical stability of the roof of such empty spaces may be lost and the roof of the cave collapses. This is a natural process that gives rise to the classical dolines and poljes in karstic landscapes. When the water table depletion or oscillation increases due to groundwater abstraction, the frequency of karstic collapses can also increase.

In both cases, the amount of subsidence or the probability of collapses is related to the decrease in pore water pressure, which is related to the amount of groundwater withdrawal. Nevertheless, the influence of other geotechnical factors may be more relevant than the amount of water abstracted in relation to the renewable groundwater resources of the aquifer.

6.4 *Interference with surface water*

Some anthropogenic activities may have a significant impact on the catchment hydrologic cycle. For instance, the intensive use of groundwater for irrigation in the Upper Guadiana basin (Spain), has resulted in a serious water table depletion (about 30–40 m). The most alarming consequences of the water level drops were the changes in the groundwater flow patterns and in the form, function and quality of many wetlands. Areas that had received the natural discharge from the aquifer became natural recharge zones (Hernández Mora *et al*., 2003). This has produced a spectacular decrease in total evapotranspiration from the water table and wetlands, evaluated between 100 and 200 Mm^3/year (Martínez-Cortina, 2001). From the point of view of the water budget

there is an important increase (almost 50%) of the annual renewable resources, understood as the water that can be abstracted from the aquifer maintaining the water level as in the previous year, and calculated as the difference between aquifer recharge from precipitation and losses from evapotranspiration.

This artificial depletion of the water table can also change dramatically aquifer-streams relationship, as in the previous example. Gaining rivers fed by aquifers may become dry except during storms or humid periods when they may become losing rivers, an important source of recharge to the aquifer. Nevertheless, this new water budget may present legal problems if the downstream water users have previous water rights.

6.5 *Ecological impacts*

The ecological impacts, mainly caused by water table depletion as it has been showed in the Upper Guadiana basin case, are becoming an important new constraint in groundwater development in some countries. Decreasing or drying up of springs and wetlands, low flow of streams, disappearance of riparian vegetation because of decreased soil moisture, alteration of natural hydraulic river regimes, changes in microclimates because of the decrease in evapotranspiration, can all be used as indicators of ecological impact. Reliable data on the ecological consequences of these changes are not always available, and the social perception of such impacts varies in response to the cultural and economic situation of each region. The lack of adequate scientific data to evaluate the impacts of groundwater abstraction on the hydrologic regime of surface water bodies makes the design of adequate restoration plans difficult. For instance, wetland restoration programmes often ignore the need to simulate the natural hydrologic regime of the wetlands, i.e. not only restore its form but also its hydrological function. Similar problems result in trying to restore minimum low flows to rivers and streams. Oftentimes minimum stream flows are determined as a percentage of average flows, without emulating natural seasonal and year-to-year fluctuations to which native organisms are adapted (Llamas & Garrido, 2007).

7 SPECIAL ETHICAL ASPECTS OF THE ABSTRACTION OF FOSSIL GROUNDWATER

This section is taken mainly from Llamas (2004) and Delli Priscolli *et al*. (2004).

In most countries it is considered that groundwater abstraction should not exceed the renewable resources. In other countries—mainly in the most arid ones—it might be considered that groundwater mining is an acceptable policy, as long as available data assure that the groundwater development can be economically maintained for a long time, for example, more than 50 years and that the potential ecological costs and socio-economic benefits have been adequately evaluated. Nevertheless, some authors consider this option as unsustainable development or an unethical attitude with respect to future generations.

In contrast, few authors speak of the frequent unsustainability of most dams in arid regions. Some authors consider that the *useful life* of most dams in the North African Mediterranean countries is between 40 and 200 years because of their silting.

It has been stated that the frequently encountered view that the water policy of arid countries should be developed in relation to renewable water resources is unrealistic and fallacious. Ethics of long-term water resources sustainability must be considered with ever improving technology. With careful management many arid countries will be able to utilise resources beyond the foreseeable future without major restructuring.

In Saudi Arabia the main aquifers (within the first 300 m of depth) contain huge amount—a minimum of 2,000 km^3—of fresh fossil water, that is 10,000 to 30,000 years old. It is considered that these fossil aquifers can supply useful water for a minimum period of 150 years. Current abstraction seems to be around 15–20 km^3/year. During a couple of decades the Saudi government has pumped several km^3/year of non-renewable groundwater to grow low cost crops (mainly cereals), which were also heavily subsidised. The official aim of such activity was to help to transform

nomadic groups into farmers. Apparently such *overdraft* has been a success. Now the amount of groundwater abstraction has been dramatically reduced and the farmer nomads have become high-tech farmers growing cash crops. Another example is the situation of the Nubian sandstone aquifer located below the Western desert of Egypt, where the fresh groundwater reserves are higher than 200 km^3 and the maximum pumping projected is lower than 1 km^3/year. Probably similar situations do exist in Libya and Algeria. Other examples of mining groundwater can be found in Llamas & Custodio (2003).

It is not easy to achieve a virtuous middle way. As Collin & Margat (1993) stated: "we move rapidly from one extreme to the other, and the tempting solutions put forward by zealots calling for Malthusian underexploitation of groundwater could prove just as damaging to the development of society as certain types of *excessive pumping*".

8 ECONOMIC ASPECTS IN GROUNDWATER DEVELOPMENT

Groundwater unit volume cost increases with groundwater depth, as more energy is required for pumping and deeper wells might be needed. In our experience, these costs usually range between US\$ 0.02/m^3 and US\$ 0.20/m^3 depending on the country and the aquifer. However, according to Shah (2007) the economic cost (value) of groundwater is about US\$ 0.20 to 0.30 per m^3. It would be worthwhile to study this aspect in more detail and worldwide. These values seem to us very high in comparison to the general economic situation of Southeast Asia. One possible cause is the low technology used in the drilling of the wells and in the performance of the pumping devices.

Groundwater irrigation cost per hectare also increases with time, albeit at a lower rate. This is because farmers begin to use a more efficient technology and switch (if soil and climate allow it) to less water consuming crops: from maize or rice to grapes or olive trees, for instance. It is estimated that groundwater irrigation cost in Spain generally ranges between US\$ 20 to 1,000 per hectare and year.

Despite the illusory accuracy of global irrigation data and the variability of the existing estimates, rough calculations yield the following conclusion: groundwater-based irrigation seems to be twice as efficient as surface water irrigation in hydrological terms (m^3/ha), a ratio that increases to between three and ten times from the social and economic points of view (US\$/m^3 and jobs/m^3). Regional scale analyses carried out in Spain seem to confirm these figures (Hernández-Mora *et al*., 2001, 2007). Thus, it appears relevant and urgent to assess the comparative hydrological and socio-economic efficiency of surface- and ground-water irrigation at a global scale, carrying out similar studies in other regions of the world. Assessing the implications of this *silent revolution* should constitute a valuable contribution to the debate about global irrigation needs as perceived by many water experts. The required investment to assess the value and efficiency of groundwater irrigation versus surface water irrigation can be afforded by most governments.

The *more crops and jobs per drop* motto has been considered crucial in order to avoid a *looming water crisis*. This is because of the large share of irrigation in global water use, and irrigation's often low efficiency. However, few water experts or decision-makers are aware that the goal behind such a motto is often achieved by groundwater irrigation. Actually, in arid and semiarid regions in industrialized or rich countries the new motto is *more cash and nature per drop* (Llamas & López-Gunn, 2007).

Therefore, any study on economic sustainability of groundwater use should take into account the specific regional settings. The following circumstances may serve as a first attempt to establish a classification:

– Developing countries where easily-accessible unconfined shallow aquifers exist: Devices such as the treadle pump to access shallow water tables may constitute a catalyst for irrigation development (Polak, 2005, this volume), while environmental concerns are generally subordinated to human development. This is the case of many small African villages.

- Developing (or semi-developing or emerging) arid and semiarid regions, like India or regions of East Asia: Groundwater irrigation has experienced a spectacular development in recent years (Deb Roy & Shah, 2003). Such large regions may present a wide variety of conditions: from subsistence livelihoods to market economies, and from large alluvial aquifer systems (which may sustain long-term development) to hardrock aquifers (where small communities may rely on scarce resources and pumping may result too expensive).
- Developed arid regions endowed with good aquifers: This may correspond to countries such as Saudi Arabia or Libya, where groundwater mining is commonplace (see Section 7). Reliance on non-renewable resources, however, does not seem to render these economies unsustainable. Contrary to the perception of some environmental organizations, a good number of authors and the *UNESCO World Commission on the Ethics of Science and Technology* (COMEST) consider this practice to be acceptable under certain circumstances (Selborne, 2001; Delli Priscolli *et al*., 2004).
- Arid and semiarid regions of industrialized countries (e.g. California, Texas, Spain): Intensive groundwater withdrawals for irrigation are a well-established practice in these areas. Development is essentially market-driven, as the cost of obtaining groundwater generally amounts to a very small fraction of crop value. Some authors argue that the depletion of groundwater levels results in an increase of pumping costs, and may ultimately yield these developments economically unsustainable. However, empirical evidence in some areas seems to show the opposite. Farmers are undeterred from pumping despite depths in excess of 400 m (Garrido *et al*., 2006). This is because switching to higher value water-efficient crops may offset the increase of pumping costs, provided that groundwater quality does not worsen (Llamas & Martínez-Santos, 2005; Fornés *et al*., 2005).

9 SOCIO-POLITICAL AND INSTITUTIONAL ASPECTS OF GROUNDWATER DEVELOPMENT

In the preface of the last *Hydrogeology Journal* theme issue, Llamas *et al*. (2006) warn about the scarcity of analyses on the social science aspects about groundwater role in the general water resources policy. As a matter of fact, that theme issue tries to set the pace to increase these type of studies. This section has been mainly taken from Llamas *et al*. (2008).

9.1 *Social sustainability*

Most aquifers present a large storage volume of groundwater in relation to their renewable resources (often two or three orders of magnitude higher). A practical consequence is that the potential problems do not usually become serious in the short term (within one or two generations). By that time, farmers may have experienced a positive *social transition*.

Groundwater irrigation has proven an excellent catalyst for this *social transition* of farmers in arid and semiarid regions worldwide, as was explained in Section 5. Increased revenues result, and allow for a greater degree of social welfare. In addition, farmers become able to provide a better education for their children, who may either move on to other economic sectors (generally more productive), or return to agriculture with a more productive outlook. So, this transition means a reduction of global poverty (Llamas & López-Gunn, 2007).

This *social transition* triggered by groundwater together with the implementation of more efficient irrigation technologies can often result in a sustainable use in the mid-term. However, adequate groundwater management and governance remains an important challenge to ensure long-term sustainability.

Aquifers constitute an example of *common pool resources*, as in the majority of cases all actors have direct access (legal or illegal) to groundwater. Therefore, aquifers should typically follow the widely voiced *tragedy of the commons* pattern (Hardin, 1968). Nevertheless, after half a century of intensive groundwater use, the authors of this chapter do not know any cases of medium-sized or

large *good* aquifers (those with a surface larger than 500 km^2, and medium to high transmisivity and storage capacity values) where the tragic outcomes outlined by Hardin may have taken place causing social or economic disturbances; at least not in the degree of magnitude of those caused by soil water-logging and salinization (India, Pakistan or California) or the serious social conflicts in relation to people displaced or ousted by the construction of large dams (Briscoe, 2005; Shah *et al*., 2006).

The situation may be different in small or poor aquifers, where storage is not large enough to sustain development for over two or three generations. Though still uncommon, cases of small communities that have *run out of groundwater* have been reported.

The reality is that even some poor aquifers, such as the Indian *hardrock aquifers*, have played a key role in increasing food production. In India groundwater irrigated surface has increased in more than 40 million hectares during the last decades (Shah *et al*., 2006; Shah, 2007). As a consequence, India, despite an almost 100% increase of its population in the last 50 years, has not only achieved food security in practice, but also become an important grain exporter. However, uncontrolled aquifer development in arid and semiarid regions worldwide raises sustainability concerns, particularly whenever the natural rate of recharge is low.

It might be appropriate to point out the situation of some large aquifers that have undergone *overdrafting* or groundwater mining for many decades. In many of such areas, pumping data are hardly reliable. Take for instance California's aquifers, where overdraft estimates range nothing less that between 1,200 and 2,400 Mm^3/year. Recent information tells that the overdraft in California aquifers has not been adequately analysed since the 1980s (Kretsinger & Narasimhan, 2006). It is perhaps the lack of willingness to monitor, rather than overdraft *per se* that may constitute the greatest intergenerational threat for groundwater resources.

9.2 *Institutional issues*

A bottom-up approach seems to be the best way to achieve participatory management. Surface water irrigation communities constitute a good example. 7,000 of such communities (some of them centuries old) currently exist in Spain (Murcia, Valencia and Alicante being the better known ones).

However, there is an essential difference between surface water and groundwater. A gatekeeper may ultimately control surface water, while groundwater is usually subject to the individual decisions of hundreds (perhaps thousands) of independent users with direct access to the resource. Thus, top-down control has proven insufficient in most places due to this intrinsic complexity of groundwater governance. This is the reason why user communities are often advocated as the most plausible solution to ensure adequate groundwater resources management.

Groundwater user associations are still fairly scarce. Under Spain's 1985 *Water Act*, an attempt was made to impose these communities in *overexploited* aquifers, although this initiative has been far from successful in most places. Water agencies in Texas and California are currently trying to organize these communities, albeit by means of economic incentives rather than by compulsion.

The few examples of groundwater user associations that have become effective resource managers have two things in common: they have successfully articulated common goals and objectives, and they have established mutually accepted rules regarding resource access and use, in order to guarantee the long-term sustainability of the resource and dependant uses. The variety of circumstances under which these user associations operate, their ability to bring together thousands of independent users and sometimes manage large and complex aquifer systems, or the way in which some are working cooperatively with water authorities to establish sustainable management regimes, are all promising developments (Hernández-Mora *et al*., 2003).

In any case, since groundwater user associations are a relatively new feature, their ultimate implications on groundwater sustainability are yet to be seen.

9.3 *Legal issues*

From the legal viewpoint, legislation on aquifers presents two main issues of concern. The first one relates to whether groundwater resources should be public or private property. For instance,

in Texas groundwater from the Ogallala aquifer is mainly private (Peck, 2007). The second refers to the way groundwater rights should be inventoried and to whether the possibility to trade with them should be allowed. This second aspect, usually equated with *water banks* is perhaps subordinated to the first in terms of importance, even if significant informal markets already exist in some places (Mukherji, 2006).

In relation to property rights, groundwater is usually public and can be accessed by means of governmental permits (sometimes called *concessions*). This is the case of Israel, a number of states of the USA, Mexico and many other countries. In other places, such as California, Chile, India or Texas, groundwater is under private ownership.

Spain is a particularly interesting example of a mixed system. Wells drilled after January 1st, 1986, require governmental permission, while those operational before 1986 remain private. Private groundwater may remain so for 50 years (provided that the well-owners reach an agreement with the government in exchange for *administrative protection*) or perpetually (if the owner wishes to preserve his/her rights under the 1879 *Water Act*).

In any case, the Spanish situation is far more complex due to the lack of a reliable registry of groundwater rights. While the government is currently carrying out a series of remedial initiatives, these are insufficient in the eyes of some authors. Fornés *et al*. (2005), for instance, point out that these ignore a significant share of existing wells, and that the registry or inventory is therefore incomplete.

While some voices seem to disagree the current situation may be considered unsustainable in the long run, particularly if a strong political willingness to apply the laws is lacking. It seems clear that a reliable inventory of groundwater rights is desirable in order to ensure adequate management, whether it is transboundary or not.

9.4 *Political issues*

Politics has at times been defined as *the art of the possible* (rather than *the art of the reasonable*). Although in modern democratic societies decision-making is ultimately restricted to politicians, more or less powerful lobbies often influence these. These usually defend the interests of large corporations or different sectors of the population (unions, NGOs and others).

The motivations behind political decisions are so difficult to take into account that they are generally overlooked. In addition, they depend very heavily on social and cultural constrains, which are very different from country to country. Therefore this section is restricted to three brief examples as to how politics may come into play in regard to groundwater sustainability.

The first example refers to the 2005 events of the Upper Guadiana basin, in Spain. The *Guadiana Water Authority* (dependent on Spain's central administration) issued an order to shut down a series of wells. While law-in-hand this seemed an appropriate course of action, a social uproar ensued, mostly fuelled by farmer unions. This led the regional government to oppose the central government's orders. Up to date, the central water authority has been unable to shut down the wells.

A second case is described by Mukherji (2006). In 2004, the ruling political party of Andhra Pradesh (central India) stated that they would gradually stop electricity subsidies for pumping. This led to a significant resistance on the part of farmers. Seemingly as a result, the opposition won the 2004 election largely on the strength of opposing this measure. Electricity remains mostly free to this day.

Finally, the third example refers to California. In 2002, after a long and arduous work, Professor Sacks (Berkeley) developed a law to replace the old water act. This effort was motivated by the fact that the old law was conceptually obsolete since, among other erroneous assumptions, it practically ignored the unity of the hydrological cycle and equated groundwater to underground rivers. However, frontal opposition on the part of farmers and urban water supply companies eventually caused the project to be rejected and the obsolete code to remain. However, the Government of California has moved away from the *command and control* approach while implementing a policy of education and economic incentives with encouraging results.

These three examples show how political constrains (namely voters) may lead to potentially unsustainable situations. Education of the general public is perhaps the only means to avoid these kinds of occurrences in the future. In the case of transboundary aquifers, this is a particularly relevant issue, since integrated political actions are required on both sides of the border (Eckstein, 2007).

10 ESSENTIAL ETHICAL ASPECTS

Finally we summarize some of the main ethical aspects of groundwater management, following Fornés *et al*. (2005). A more complete and sophisticated classification can be found in Selborne (2004).

10.1 *Perverse subsidies to surface water projects*

The hidden or open subsidies that have traditionally been a part of large hydraulic projects for surface water irrigation, are probably the main cause of the pervasive neglection of groundwater problems among water managers and decision-makers. Surface water for irrigation is usually given almost free to the farmers; and its wasteful use is the general rule.

It is usual that water supply companies, farmer unions, etc. lobby the State for the construction of surface water infrastructures that are primarily paid for with general revenues, instead of advocating a responsible use of groundwater resources. At times, this may lead to social conflicts—like the cases of the Tagus-Segura transfer or the overruled Ebro transfer, both in Spain—between water-importing and water-exporting basins.

Progressive application of the *user pays* or *full cost recovery* principle would probably make most of the large hydraulic projects economically unsound. As a result, a more comprehensive look at water planning and management would be necessary and adequate attention to groundwater planning, control and management would probably follow.

10.2 *Public, private, or common groundwater ownership*

Some authors consider that the legal declaration of groundwater as a public domain is a *conditio sine qua non* to perform a sustainable or acceptable groundwater management. This assumption is far from evident. For many decades groundwater has been a public domain in a good number of countries. Nevertheless, sustainable groundwater management continues to be a significant challenge in many of those countries. Highly centralised management of groundwater resources is not the solution to promote solidarity in groundwater use as a *common good*. Groundwater management should be in the hands of the stakeholders of the aquifer, under the supervision of the corresponding *Water Authority*. Stakeholders' participation has to be promoted bottom-up instead of top-down.

10.3 *Lack of hydrogeological knowledge and education*

The education of stakeholders and widespread presence of groundwater user associations is crucial for an adequate participatory bottom-up management approach. It has to be a continuous process in which technology and education improve solidarity and participation to the stakeholders and a more efficient use of the resource.

10.4 *Transparency in groundwater related data*

Good, symmetric and reliable information is crucial to facilitate cooperation among aquifer stakeholders, and a prerequisite to succeed in groundwater management. All stakeholders should have easy access to good and reliable data on abstractions, water quality, and aquifer water levels. Current information technology allows information to be made easily and economically available to an unlimited number of users. Nevertheless, in a good number of countries it will be necessary

to change the traditional attitude of water agencies of not facilitating the easy access to water data to the general public.

10.5 *The ethics of pumping non-renewable groundwater resources (groundwater mining)*

As was stated in Section 7, some arid regions have very small amounts of renewable water resources but huge amounts of fresh groundwater reserves, like for example the existing reserves under most of the Sahara desert. In such situations, groundwater mining may be a reasonable action if various conditions are met: 1) the amount of groundwater reserves can be estimated with acceptable accuracy; 2) the rate of reserves depletion can be guaranteed for a long period, e.g. from 50 to 100 years; 3) the environmental impacts of such groundwater withdrawals are properly assessed and considered clearly less significant than the socio-economic benefits from groundwater mining; and 4) solutions are envisaged for the time when the groundwater is fully depleted. Selborne (2001), former chairman of the *Water Resources Committee of the World Commission of the Ethics of Science and Technology* (COMEST), seems to agree with this approach.

11 THE WAY FORWARD

Suggestions to achieve a sustainable and ethical groundwater management were presented in the *Alicante Declaration* (Ragone & Llamas, 2006), and constitute a more comprehensive, if still general, call for action. We reproduce here the most relevant aspects.

- *First*: It is extremely difficult to provide a general guide to groundwater sustainability, as complying with all the different dimensions may not be possible in most cases. Emphasis on one or another is likely to depend on economic, social, cultural and political constraints.
- *Second*: Groundwater management requires a higher degree of user involvement than surface water developments. Experience shows that sustainable aquifer use cannot be solely achieved by means of top-down *control and command* measures.
- *Third*: User participation requires a degree of hydrogeological education which is still absent in most places. Steps should be taken to make the peculiarities of groundwater resources known to all, from politicians and water decision-makers to direct users and the general public. This should begin at the school level.
- *Fourth*: Appropriate groundwater management requires a significant degree of trust among stakeholders. This implies that groundwater data should be transparent and widely available (via Internet, for instance). In addition, the system should be able to punish those who act against the general interest.

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CHAPTER 13

Economics, ethics and politics of groundwater: Evidence from West Bengal, India

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ABSTRACT: This chapter deals with three different, yet related issues of groundwater use, *viz*. economics, ethics and politics. One of the most important ethical dilemmas of global groundwater use is that its positive impact on food security, incomes of the poor and poverty alleviation are relatively under-estimated while the negative externalities are often over-emphasized. This chapter deals with this very ethical dilemma by illustrating how the role of groundwater irrigation in sustaining high agricultural growth rates in West Bengal—an eastern state of India, has been over looked in academic discussions so far. Groundwater irrigation has conferred immense economic benefits in terms of increased access to irrigation, higher cropping intensity and productivity. Informal groundwater based irrigation services markets have played an important role in this regard. This chapter focuses on groundwater economics and the impact of groundwater supported private irrigation services markets. Finally, this chapter concentrates on groundwater politics. It shows that the dominant discourse in the field of groundwater studies in India has been that of depletion and scarcity so much so that the groundwater policies even in a well-endowed state such as West Bengal has been unduly influenced by this dominant discourse. The result has been that of a paradox: little groundwater regulation where resource conditions are precarious (e.g. Gujarat, Tamil Nadu) and strict regulation where little is needed (e.g. West Bengal).

Keywords: Groundwater; Groundwater economics; Groundwater markets; Groundwater politics; Groundwater ethics; West Bengal, Gujarat, India

1 INTRODUCTION

In this chapter, I will be argue that in a region with well endowed alluvial aquifer and abundant rainfall, groundwater irrigation is a source of potential wealth and welfare to the people rather than a threat as is often claimed in the context of other types of aquifers and hydrological regimes, for example, a hard rock aquifer in an arid and semi-arid region (Janakarajan & Moench, 2006; Janakarajan, 1990). Unfortunately, policy discourse on groundwater in India has been overwhelmingly dominated by issues of scarcity and depletion. Valid and important as these concerns are, they are relevant only for the arid and semi-arid parts of the country with hard rock or coastal aquifers, while there are significant parts of the country (with humid, sub-humid climate and alluvial aquifers) where groundwater irrigation has the potential to unleash agrarian boom. An apt example of this is the state of West Bengal, which emerged from a century long *agrarian impasse* (Boyce, 1987) due to intensive use of groundwater resources. However, policy makers very seldom differentiate between various types of aquifers and hydrological systems (i.e. scientific information) and are mostly influenced by the dominant discourse, irrespective of whether or not that discourse reflects the ecological reality of that particular region. This results in a situation where groundwater policies do not reflect resource conditions as I shall show in the last section of this chapter.

This chapter is primarily about economics of groundwater use, the ethical issues involved in neglecting the positive role of groundwater in agriculture and the politics behind it. In this chapter, I will first focus on the positive contribution of groundwater and groundwater supported irrigation

services market (also referred to as groundwater markets) to the agrarian economy of West Bengal. This chapter is divided into five sections. In the second section (after this Introduction), using secondary data, I will show that the changing pace of groundwater irrigation explains much of the agrarian growth in West Bengal. I will also show that West Bengal is well endowed with groundwater resources and there are no immediate concerns about resource *over-exploitation*. The third section will concentrate on the economics of groundwater markets and its role in spreading access to irrigation to the *have-nots*. This will be based on primary data collected from 294 well owners and 286 water buyers across 40 villages spread over 17 districts of West Bengal.[1] In the fourth part of the chapter, I will conclude by briefly highlighting some policies that have negatively affected the growth in groundwater irrigation in the state over the last few years. In doing so, I will compare and contrast the groundwater resource conditions and policy environments in water abundant West Bengal and water scarce Gujarat. In the final section I will conclude this chapter by noting the paradox of groundwater policies and politics in India.

2 THE ETHICAL DILEMMA: NEGLECT OF ROLE OF GROUNDWATER IN AGRARIAN TRANSFORMATION IN WEST BENGAL, INDIA

Agrarian growth in West Bengal and the reasons thereof have long captured the imagination of researchers. The story of this growth may be captured in three distinct phases—the first from 1900 to 1980 tells a sad tale of "hunger in a fertile land" (Boyce, 1987: 1), the second (1981—early 1990s) a triumphant account of a rate of foodgrain production that was "highest among 17 major states of the Indian union" (Saha & Swaminathan, 1994: A2) and the third of agricultural growth that "significantly slowed down in the 1990s" (Sarkar, 2006: 342).

Boyce in his seminal work captured the dynamics of the first phase when the proverbial *Sonar Bangla*[2] became the abode of some of the poorest people in the world. This paradox of hunger amidst plenty was explained by him and other scholars in terms regressive agrarian structure that resulted in high rural inequality (Bose, 1993; Mukherji & Sanyal, 1995; Palmer-Jones, 1999). In particular Boyce recognised water control as the key input and noted that development of private groundwater irrigation was hampered due to small and fragmented land holdings.

Just as Boyce's book was published in 1987, there were telltale signs of a quiet Green Revolution going on in rural Bengal. An unprecedented growth in the agricultural sector at the rate of 6.5% per annum was recorded during the period 1981 to 1991 (Saha & Swaminathan, 1994). A decade earlier, the then newly elected Communist government of West Bengal had implemented one of the most successful land reforms programme in the country.[3] At the same time, village *panchayats* (elected village councils) were reconstituted, empowered and regular democratic elections were held after every five years. The fact that phenomenal growth in agriculture took place just after these two effective reforms led most analysts to seek causal relationship between the two (GoWB, 1995–96, 2004). Dasgupta noted: "one of the major consequences of those institutional changes has been a high rate of agricultural growth in the state, after a social-psychological time lag of around six to seven years" (1995: 3) without offering either any data or elucidating the probable causal pathway linking the two. Indeed, very few studies have tried to quantitatively model the impact of land reforms and *panchayat* reforms on agricultural production in the state. Three such studies that attempt to capture the impact of agrarian and political reforms on agricultural productivity in the state are by Sen & Sengupta (1995), Ghatak (1995), and Banerjee *et al*. (2002) and they at best found mixed results.

[1] The questionnaire survey was conducted over a period of five months from August to December 2004.

[2] *Sonar Bangla* translates into *golden Bengal*. It refers to the once famed prosperity of Bengal in general and fields overflowing with golden ripe paddy in particular.

[3] While it is outside the scope of this chapter to go into details of this ambitious and largely successful land reforms programme, details can be found in Bandopadhyay (1981), Bhowmick (2001), and numerous others.

Table 1. Mean values of dependent and explanatory variables used in regression equations, 2000–03.

Indicator	Abbreviation	Unit	Mean (N = 18)
Production of food grains	PROD	'000 tonnes	842.8
Net cultivated area	NCA	'000 ha	289.9
Cropping intensity	CRPINT	Percentage	157.5
Gross cropped area	GCA	'000 ha	412.7
Fertilizer consumption	F	'000 tonnes	62.8
Gross groundwater irrigated area	GWI	'000 ha	78.5
Number of WEMs	WEM	Numbers	35,955
Level of groundwater development	GWDEV	Percentage	41.30
Gross surface water irrigated area	SWI	'000 ha	82.2
Surface irrigated area to gross irrigated area	SWI_GIA	Percentage	51.2
Actual monsoon rain	RAIN	Millimetres	1,284.9
Credit disbursed by commercial banks	CRDT	Million Rs	1,556.6
Agricultural labourers	LAB	'000 persons	408.6
Redistribution of vested land	VEST	Ha/100 ha of NCA	8.2
Registered bargadaars	BARGA	No./100 cultivators	28.1

Source: BAES (2002, 2003).

Amidst the general and often unquestioned consensus that agrarian growth in West Bengal was a result of agrarian and political reforms, Harriss (1993) and Palmer-Jones (1995, 1999) offered an alternative explanation that attributed high agricultural growth to development of groundwater irrigation rather than agrarian reforms.

2.1 *Determinants of inter-district variations in agricultural production in West Bengal*

In view of the above arguments, in this section I present the hypothesis that the inter-district variation in agricultural production is better explained in terms of variation in area under groundwater irrigation than the land reforms and other institutional variables. This will be tested with the help of district level cross sectional data for triennium ending 2002–03.[4] A production function is specified that takes two functional forms, one linear[5] and another Cobb-Douglas. Various alternative models are tested and results of all are summarised in Tables 2 and 3, while Table 1 gives the mean values of explanatory variables.

This analysis shows that district level variations in groundwater irrigation is instrumental in explaining inter-district variation in agricultural production and that it is a more significant explanatory variable than the land reforms variables included in the model. It also shows that groundwater irrigation related variables are more significant than surface water irrigation related variables. Such a statistical exercise is of course not enough to claim that "modest agrarian reforms" (Harriss, 2003: 17) undertaken by the Government of West Bengal (GoWB) has had very little impact on agricultural production, given that Nugent had pointed out, "... it is difficult to isolate the most relevant institutional change for hypothesis testing" (as quoted by Harriss, 2003). However, what this analysis does is to squarely bring into picture the impact of groundwater irrigation on agricultural

[4] While the data for all variables pertain to the years 2000–01 to 2002–03, for the districts of Bankura, Birbhum, Bardhaman and Paschim Medinipur, the corresponding years are 1999–2000 to 2001–02. This was because the latest district handbooks published by the BAES (of the year 2003) were not available for these four districts and consequently district handbooks for the year 2002 were used.

[5] Linear specification is not appropriate for modelling production function because of operation of law of diminishing marginal returns, which means that input use is not linearly related with output. Therefore, I also specify Cobb-Douglas function which is more appropriate.

Table 2. Determinants of food grains production in West Bengal, 2000–03: Results of a district level OLS regression.

Variables/ Standardised beta coefficients	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	−104.49	−264.23	−127.97	−43.63	−37.65	−86.56
	(−0.478)	(−1.142)	(−0.980)	(−0.405)	(−0.165)	(−0.408)
NCA	0.100	0.336**	–	–	0.100	0.214
	(0.510)	(2.382)			(0.486)	(1.739)
CI	–	0.152	–	–	–	–
		(1.501)				
GCA	–	–	0.332*	0.339*	–	–
			(3.311)	(3.351)		
FERT	−0.239	−0.176	−0.246	−0.228***	−0.320***	−0.188
	(−1.601)	(−1.439)	(−2.397)	(−2.222)	(−1.993)	(−1.446)
GWI	–	–	–	–	0.325*	–
					(3.443)	
WEM	0.341*	0.234**	0.278**	0.233**	–	0.318*
	(3.721)	(2.468)	(2.570)	(2.292)		(3.866)
SWI	0.340**	0.238**	–	–	0.286**	0.331**
	(3.117)	(2.042)			(2.583)	(3.125)
SWI_GIA	–	–	0.247**	0.231**	–	–
			(2.929)	(2.743)		
RAIN	0.101	–	–	–	0.121	–
	(0.757)				(0.868)	
LAB	0.487***	0.302***	0.534*	0.540*	0.516***	0.337**
	(1.962)	(2.171)	(5.518)	(5.519)	(1.996)	(2.303)
CRDT	0.339**	0.286***	0.324*	0.338*	0.367**	0.306**
	(2.669)	(2.596)	(3.430)	(3.560)	(2.739)	(2.628)
VEST	−0.142	−0.118	−0.249*	−0.280*	−0.153	−0.058
	(−0.971)	(−1.234)	(−3.373)	(−4.037)	(−1.002)	(0.624)
BARGA	0.074	0.076	0.078	–	0.049	0.084
	(0.779)	(0.875)	(1.117)		(0.500)	(0.910)
Adjusted R^2	0.935	0.945	0.952	0.951	0.928	0.938
N	18	18	18	18	18	18

Source: Author's calculations based on BAES (2002, 2003). Figures in parentheses denote t values. *, ** and *** indicate coefficients significant at 1%, 5% and 10% level of significance respectively for two tailed t-test.

production in the state. The positive impact of groundwater on agrarian transition of West Bengal so far has been either entirely ignored or under played, while the role of agrarian reforms has been emphasised time and again. Many scholars have also claimed that growth in groundwater irrigation in the state has been a direct consequence of agrarian and political reforms. I will examine if it has been indeed so in a later section of this chapter.

2.2 *Groundwater resources in West Bengal*

Just as the euphoria over unprecedented agrarian growth in the early 1990s was beginning to sink in, there came the realization that this growth had slowed down and even stagnated by early 1990s. Sarkar (2006) offered several reasons for this slowdown, *viz*. constraints in further expansion in *boro* (summer) paddy cultivation due to unavailability of water, lack of technological breakthrough

Table 3. Determinants of food grains production in West Bengal, 2000–03: Results of a district level Cobb-Douglas function.

Variables/Standardized beta coefficients	Model 1	Model 2	Model 3
Constant	0.257	−0.280	−1.001
	(0.284)	(−0.349)	(−1.520)
LnNCA	0.220***	0.182	0.321**
	(2.090)	(1.604)	(3.658)
LnFERT	−0.190	−0.177	−0.082
	(−1.282)	(−1.194)	(−0.682)
LnGWI	0.172***	–	–
	(1.841)		
LnWEM	–	0.199***	–
		(1.776)	
LnGWDEV	–	–	0.171***
			(2.931)
LnSWI	0.054	0.783	0.014
	(0.595)	(0.454)	(0.211)
LnLAB	0.610*	0.570*	0.605*
	(4.670)	(3.929)	(5.796)
LnCRDT	0.212	0.222	0.116
	(1.399)	(1.437)	(0.945)
LnVEST	−0.102	−0.110	−0.031
	(−1.298)	(−1.381)	(−0.450)
LnBARGA	0.022	0.076	0.119
	(0.251)	(0.950)	(1.804)
Adjusted R^2	0.943	0.941	0.960
N	18	18	18

Source: Author's calculations based on BAES (2002, 2003). Figures in parentheses denote t value. *, ** and *** indicate coefficients significant at 1%, 5% and 10% level of significance respectively for two tailed t-test.

in the form of better seeds, unfavourable input-output ratio in the post economic reforms era, etc. While one part of the argument pertaining to increased input costs and lower output price is indeed true, the other, *viz*. constraints in further expansion in *boro* cultivation due to unavailability of water is far from so. As I shall show in this section, West Bengal is very well endowed with groundwater and as such there is no physical water scarcity. However, regressive policies (such as restriction on new electricity connections, high electricity tariff, high diesel price, etc.) have created economic scarcity of groundwater in a state where 95% of all villages have water tables within 15 meters below ground level (WIDD, 2004).

The latest estimation of groundwater resources in the state of West Bengal (WIDD, 2004) shows that the state as a whole has 30,200 Mm^3 of replenishable groundwater of which some 11,300 Mm^3 is used annually. West Bengal is a part of the Ganga-Meghna-Brahmaputra (GMB) aquifer system which is one of the richest aquifers in the world.[6] Table 4 shows the per unit availability of groundwater resource in the major Indian states. It is seen that West Bengal ranks second among major Indian states in terms of gross replenishable groundwater per unit of net cultivated area and third in terms of the same per unit of geographical area. The level of groundwater development in the state varies from as high as 84.6% in Nadia district to as low as 5% in Jalpaiguri district,

[6] Out of the total replenishable groundwater resources in India estimated at 324.43 km^3, as much as 164 km^3 occur in the basins of Indus, Ganga, Brahmaputra and Meghna (CGWB, 2006).

Table 4. Total replenishable groundwater resources per unit of net cropped area and geographical area, May 2004.

State	Gross annual replenishable GW resource (Bm^3/year)	Net annual GW availability (Bm^3/year)	Annual GW draft (Bm^3/year)	Level of GW development (%)	Gross replenishable GW per unit of NCA (Mm^3/'000 ha)
Assam	27.23	24.89	5.44	22	9.03
West Bengal	30.36	27.46	11.65	42	5.55
Tamil Nadu	23.07	20.76	17.65	85	4.83
Uttar Pradesh[a]	78.62	72.28	50.17	69	4.78
Bihar[b]	34.77	32.67	11.83	34	4.53
Punjab	23.78	21.44	31.16	145	4.43
Kerala	6.84	6.23	2.92	47	3.51
Orissa	23.09	21.01	3.85	18	3.31
Andhra Pradesh	36.50	32.95	14.90	45	3.31
Madhya Pradesh[c]	52.12	49.01	19.32	39	2.68
Haryana	9.31	8.63	9.45	109	2.38
Maharashtra	32.96	31.21	15.09	48	2.13
Gujarat	15.81	15.02	11.49	76	2.13
Karnataka	15.93	15.30	10.71	70	1.56
Rajasthan	11.56	10.38	12.99	125	0.78

Source: Central Groundwater Board (data downloaded from website: [www.cgwb.in] on 1st March 2007).
[a] includes Uttar Pradesh and Uttaranchal; [b] includes Bihar and Jharkhand; [c] includes Madhya Pradesh and Chattisgarh.
Bm^3 = Billion m^3 = 1,000 Mm^3.

the average for the state being 41.3%. Thus, none of the 17 districts fall in the *over-exploited*[7] category. At the next administrative level, *viz*. the blocks, some 29% of the blocks are in the critical and semi-critical category in 2002–03 [as per *Groundwater Estimation Committee* (GEC)-1997, CGWB 1998] this figure was higher at 34% in 1993 (as per GEC-1984, CGWB 1995).

Within the state, there are spatial variations in intensity of groundwater use with the eastern districts of Nadia, Murshidabad and North 24 Parganas showing highest density of wells and tubewells. Is resource use in West Bengal then in sync with resource potential? In an earlier study, Deb Roy & Shah (2003) had shown that for India as a whole, there exists a mismatch between groundwater resource potential and resource use, because several low potential districts (in the states of Tamil Nadu, Andhra Pradesh, Maharashtra, Karnataka, Gujarat, etc.) record very high utilization of groundwater, thereby putting resource sustainability at risk. Is the same true for West Bengal? I have cross-tabulated tubewell density and groundwater potential per unit of net cultivable area (Table 5). The results show that a mismatch does exist between resource potential and utilisation, but it has more to do with under utilization than over exploitation. Thus, 43% of blocks have high resource potential but low tubewell density. In these blocks, there is further scope of groundwater development at least in the short and medium run, without jeopardising resource sustainability. These facts therefore refute Sarkar's (2006: 343) diagnoses that "... expansion in *boro* cultivation had to stop, being constrained by the unavailability of water".

Anantha & Sena (2007) based on well monitoring data of *State Water Investigation Directorate* (SWID) for last 28 years in Bhakuri-II gram *panchayat* of Murshidabad district found that even after continuous groundwater extraction in the last three decades, pre-monsoon water table is

[7] Methodology for groundwater estimation has changed from GEC-1984 to GEC-1997 methodology (CGWB, 1995, 1998).

Table 5. Net groundwater available for irrigation (Mm^3/1,000 ha of cultivable land) in 2000–01 *versus* density of tubewells (No. of tubewells/100 ha of net cultivable land) in 2000–01: A block level cross-tabulation.

Category	Number of blocks	Percentage to total
High groundwater potential–High tubewell density	68	26.0
High groundwater potential–Low tubewell density	113	43.1
Low groundwater potential–High tubewell density	3	1.1
Low groundwater potential–Low tubewell density	78	29.8
Total	**262**	**100.0**

Source: Author's calculation based on 3rd MI census (GOI, 2001).
High groundwater potential: >5 Mm^3 of net groundwater/1,000 ha of cultivable land.
Low groundwater potential: <5 Mm^3 of net groundwater/1,000 ha of cultivable land.
High tubewell density: >20 tubewells/100 ha of net cultivable land.
Low tubewell density: <20 tubewells/100 ha of net cultivable land.

still within 6 meters below ground level and the rate of decline is only 9 cm/year in the pre-monsoon season. Given the current precipitation, recharge and assuming higher rate of growth in water extraction mechanisms and population, they extrapolated the groundwater levels in their study area and found that water tables would remain within 1.8 to 2.5 m in pre-monsoon season for another 32 years, thereby implying that centrifugal pumps fitted on a shallow tubewell will suffice for *boro* paddy cultivation for at least another three decades. The same conditions hold in most of my study villages and much of West Bengal. This is because West Bengal receives very high average annual rainfall (1,500 mm to 2,500 mm), is underlain by unconfined alluvial aquifers with high recharge potential and lies on one of the most prolific river aquifer systems in the world, *viz*. the Ganga-Meghna-Brahmaputra (GMB) basin. All these three factors ensure that groundwater is amply recharged during the post monsoon season. Therefore, concerns of over-exploitation of groundwater while true in parts of arid and semi-arid India with hard rock aquifers is far from so in the humid and sub humid GMB basin with unconfined alluvial aquifers. Indeed, the recommendations made by *Reserve Bank of India* (1984) that utilisation of groundwater offers an important window of opportunity for poverty alleviation in eastern India still remains valid—an opportunity that is in the danger of being missed due to high diesel prices and low rates of rural electrification.

2.3 *Determinants of tubewell density*

What determines density of wells and tubewells in West Bengal? Proponents of the *agrarian structure* school have argued that land and *panchayat* reforms ushered in productivity enhancing technologies including that of shallow tubewells (Sen & Sengupta, 1995; Rawal & Swaminathan, 1998). It has been also claimed that *panchayat* support in form of public tubewells, bank loans and rural electrification has played an important role in spread of shallow tubewells in West Bengal.[8] On the other hand, some have modelled tubewell density as a demand and supply function of groundwater irrigation. In one such all India district level study Deb Roy & Shah (2003) showed that pump density in India was predominantly a function of demand pull where demand

[8] In a way, many scholars have indirectly attributed expansion in private groundwater irrigation to institutional and policy reforms undertaken by the Government of West Bengal, especially through its efforts in rural electrification, public tubewells and bank loans supported by the *panchayats*. However, this claim is doubtful, because only 12.2% of all WEMs are electric operated, only 5% of WEM owners report having availed of bank loans and subsidies, and only 2.5% of all WEMs in the state are owned by the government and 1.9% are owned by the panchayats. Indeed, West Bengal has one of the lowest proportions of electric pumps to total pumps among all major states of India. At an all India level, this figure is as high as 51%.

Table 6. Mean, year and source of data used for modelling determinants of tubewell density in various blocks of West Bengal.

Indicators with units of measurement	Abbreviation	Type of variable and expected sign of β coefficient	Mean	Year and source of data
No. of tubewells/ 100 ha of NCA	TWDEN	Dependent variable	15.27	No. of WEMs, 2001—3rd MI census (GOI, 2001) Net cultivable land – BAES (2002, 2003)
Net GW recharge (m^3)/ha of NCA	GWR	Supply side Positive	6,517.98	Net GW recharge, 2000/01—WIDD (2004)
% area under canal, tank and river lift irrigation to net irrigated area	SWI	Supply side Negative	50.8	BAES (2002, 2003)
Number of rural persons/ha of NCA	RPDEN	Demand side (demographic) Positive	14.23	Panchayat Chalchitra, GoWB based on Census 2001
% of cultivators to total rural workers	CULT	Demand side (demographic) Positive	28.92	Panchayat Chalchitra, GoWB based on Census 2001
% of villages with electricity for agricultural purposes	POWER	Demand side (infrastructure) Positive	32.94	Panchayat Chalchitra, GoWB based on Census 2001
Number of banks/100 villages	BANK	Demand side (infrastructure) Positive	10.56	BAES (2002, 2003)
Road length (km) per km^2 of block area	ROAD	Demand side (infrastructure cum institutional) Positive	1.90	BAES (2002, 2003)
Panchayats				
% of vested land distributed to NCA	VEST	Institutional No a priori expectation	7.47	Do
% of bargadaars and pattaholders to total rural population	BARGA	Institutional No a priori expectation	7.95	Do

Source: As mentioned in the last column of the table.

for groundwater was determined by population density, agricultural productivity and agricultural credit. Meinzen-Dick (1996) similarly modelled the determinants of tubewell density in different districts of Punjab and found demand side variables especially that of population density and dummy for rice zone were most significant in explaining tubewell density across various districts of Pakistan.

In this chapter, I have formulated a model to explain the variations in tubewell density in various blocks of West Bengal. For this, I have used block level data for 300 blocks in 17 districts of West Bengal.[9] Mean values of each of the independent variables (both demand side and supply side) along with year and source of data are given in Table 6. The result of linear regression model is given in Table 7.

[9] Darjiling district is excluded from this model due to unavailability of data.

Table 7. Determinants of pump density in West Bengal: A block level analysis.

Explanatory variables	Unstandardised coefficients β	Standardised coefficients β	t-value	Significance
Constant	−0.365	–	−0.110	0.913
GWR	0.001	0.416	10.252	0.000
SWI	−0.176	−0.322	−9.077	0.000
RPDEN	0.497	0.293	5.374	0.000
CULT	0.338	0.207	4.799	0.000
POWER	0.016	0.019	0.593	0.554
BANK	−0.093	−0.067	−1.857	0.064
ROAD	1.011	0.123	3.187	0.002
VEST	−0.026	−0.010	−0.258	0.796
BARGA	−0.436	−0.126	−3.081	0.002
N		300		
Adjusted R^2		0.708		
Durbin Watson		1.603		

Source: Author's calculation based on data obtained from sources mentioned in Table 6.

From Table 7, it is seen that these nine independent variables explain almost 71% of variations in tubewell density. GWR, RPDEN, CULT, ROAD and POWER have the highest positive impact on tubewell density and this confirms my *a priori* expectations. In West Bengal, supply of groundwater (GWR) plays a very important role, again reinforcing the fact that resource development in this state closely follows resource endowments. However, demand pull is also important as is brought out by the positive impact of RPDEN and CULT variables. Infrastructure variables too play a positive role thereby showing that well connected blocks are likely to have higher pump density. SWI, BARGA, BANK and VEST have negative impact on pump density. All the signs, except that of BANK fulfil my *a priori* expectations. That BANK variable is negatively related to pump density is counter-intuitive and may perhaps be explained by the fact that institutional finance has played very little role in diffusion of pumps in West Bengal.[10] The land reforms variables (VEST and BARGA) are negatively associated with pump density showing that if anything, success of land reforms in a block has had a negative impact on tubewell density. This evidence contradicts the notion that land reforms unleashed technological breakthrough including that of shallow tubewells, which in turn led to high level of agricultural growth in the state. In an earlier section, I had shown that area under groundwater irrigation was one of the most important determinants of agricultural production in the state and now I have shown that agrarian reforms have had no impact on spread of tubewells.

From these two pieces of evidence (i.e. determinants of agricultural production and determinants of pump density), it may be reasonably concluded that expansion of tubewell irrigation was in response to spread of green revolution technologies as it was elsewhere in India. As Repetto (1994) noted: "Green revolution has often been called a wheat revolution, it might also be called a tubewell revolution" (also see Dhawan, 1982, 1988). Thus, availability of groundwater resources coupled with affordability of pumping technologies and high demand for water control among farmers ushered in a *silent revolution* (Llamas & Martínez-Santos, 2006) in the Bengal countryside. A similar point is made by Palmer-Jones (1992) in the context of Bangladesh.

[10] As per the 3rd *Minor Irrigation Census* (Government of India, GOI, 2001), only 5% of WEMs in West Bengal were financed through bank loans.

3 THE ECONOMICS OF GROUNDWATER SUPPORTED IRRIGATION SERVICES MARKETS: EVIDENCE FROM 40 VILLAGES

In the previous section, I showed that groundwater irrigation has played a central role in agrarian transformation in West Bengal. The next question therefore is: "how do farmers access groundwater? Do all farming households own *Water Extraction Mechanisms* (WEMs), or does state provide irrigation through public tubewells?" The answer to both is negative. According to the 3rd *Minor Irrigation Census* (GOI, 2001), only 4.4% of all WEMs in the state are owned by the government and the *panchayats* put together—the rest are individually owned. But then not all farmers own WEMs. As per the 54th round of NSSO survey (NSSO, 1999), of the 6.1 million farming households in West Bengal, only 1.1 million reported owning WEMs, while 4.6 million farming households reported using irrigation. Some of them certainly fell within the canal command areas, but an overwhelming number of 3.1 million households (or 50.4% of all farming households) reported hiring of irrigation services from other farmers.[11]

3.1 *Participants of groundwater markets*

The participants in the water market are primarily the water sellers and the water buyers. Are the characteristics of WEM owners significantly different from the *pure*[12] water buyers? If it is so, then it may be hypothesized that there is an entry barrier to WEM ownership that precludes certain class of farmers from owning WEMs. The issue of ownership of pumps is also significant in the light of the fact that many scholars (Wood, 1995, 1999; Janakarajan, 1994) have claimed that WEMs are owned only by the large farmers who in turn are able to appropriate a large part of the net irrigation surplus through water sales or land lease and sharecropping contracts. Table 8 compares some of these characteristics of the WEM owners and *pure* water buyers.[13] This table shows that WEM owners significantly differ from the *pure* water buyers in land owning characteristics and type of residence. But, in all other respects, there is not much difference between the two categories—a finding somewhat at variance with what Meinzen-Dick (1996) and Bahadur (2004) found in the context of Pakistan and Nepal respectively.

While it is true that WEM owners own considerably more land than the non-WEM owners, it is not true that all WEM owners are large farmers. In fact, in the context of West Bengal, it is the small and marginal farmers who own the lion's share of irrigation assets. From Table 9 it is seen that 77% of all WEM owners are small and marginal farmers (with land holding ranging from 0–2 hectares), and an overwhelming 95% of water buyers belong to this category.

3.2 *Spread of groundwater market*

How important are water market transactions in the agrarian economy of West Bengal? For instance, what percentage of total irrigated area in the state comes under the ambit of water market and how many cultivating households report hiring in of irrigation services? There are two aspects of spread of water market. One is the horizontal spread, usually called the *breadth* of water market. The other is the vertical spread, also called the *depth* of the market.

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[11] This means that 1.1 million WEM owning households hired out their pumping equipment (or sold water directly) to another 3.1 million households.

[12] I define *pure* water buyers as those who do not own any means of irrigation and rely upon others to access irrigation.

[13] Note that WEM owners include the class of pump owners who neither buy nor sell water (PO), pump owners who only buy water (PB), pump owners who only sell water (WS), and pump owners who buy as well as sell water (SB), while pure water buyers (WB) are those who do not own WEMs.

Table 8. Landholding, demographic and occupational characteristics of WEM owners and pure water buyers: Result for 40 village survey in West Bengal.

Indicators	WEM owners	Pure water buyers	Is the difference in means statistically significant?
Average age of the head of household	49.9	46.9	No
Average years of education of head of household	7.8	6.2	No
Average number of adult family members	5.4	4.2	No
% living in concrete houses	67.7	46.2	Yes
% reporting agriculture as the main occupation	77.2	69.2	No
% reporting alternate sources of income	54.1	55.6	No
Average land owned (ha)	1.9	0.9	Yes
Average gross cropped area in 2003–04 (ha)	3.6	1.6	Yes
% reporting leasing or sharecropping in of land	15.0	14.7	No
% reporting leasing or sharecropping out of land	33.3	32.5	No
% of respondents who are landless	1.7	9.8	Yes
Sample size (numbers)	294	286	–

Source: Primary data collected during questionnaire survey, August to December 2004.

Table 9. Size class classification of WEM owners and water buyers in West Bengal.

Size class category	No. of WEM owners	No. of Pure water buyers
Sub-marginal (<0.5 ha)	56 (19.0%)	142 (49.7%)
Marginal (0.51–1.0 ha)	80 (27.2%)	85 (29.7%)
Small (1.01–2.0 ha)	90 (30.6%)	46 (16.1%)
Medium (2.01–4.0 ha)	56 (19.0%)	10 (3.5%)
Large (>4.01 ha)	12 (4.1%)	3 (1.0%)
All	**294 (100%)**	**286 (100 %)**

Source: Primary data collected during questionnaire survey, August to December 2004.

Table 10. Various measures of breadth of groundwater market in West Bengal.

Indicator of breadth of groundwater market	Pump owners	Water buyers
Percentage of gross irrigated area to gross cropped area	84.1	79.7
Percent. of gross irrigated area irrigated through purchased groundwater	14.2	94.9
Average number of water buyers served by each water seller	27.2	Not applicable
Sample size	294	286

Source: Primary data collected during questionnaire survey, August to December 2004.

There are various measures of breadth of groundwater market. For one, gross irrigated area as percentage of gross cropped area and the proportion of this gross irrigated area serviced through purchased water gives an indicator of the spread of groundwater market. The other indicators are: number of well owners who report selling water, extent to which well owners participate as buyers in the market and average number of buyers that a water seller services. My survey shows that 70.5% of all households reported buying water from private WEMs, 75% of pump owners sold water to other, 33% of all WEM owners also bought water from others and 92% of all respondents came within the ambit of groundwater market either as a seller or buyer or both. Table 10 summarises some of the indicators of breadth of water market. By all these measures, it is quite apparent that groundwater markets have considerable breadth in West Bengal.

Table 11. Various measures of depth of groundwater market in West Bengal.

Measures of depth of groundwater market	Values
Percentage of gross irrigated area per WEM belonging to water buyers	69.0
Percentage of total hours of water sold to total hours of water pumped	55.7
Average hours of water bought by a water buyer (hours/ha)	155.2
Percentage of gross household income derived from water selling by a pump owner	11.6
Percentage of gross household incomes derived from crops grown with purchased groundwater by water buyers	72.2

Depth denotes the importance of water transactions in the household economies of both buyers and sellers. Some commonly quoted measures of depth are: a) gross area irrigated by a WEM and the proportion of it belonging to water buyers; b) average hours of operation of WEM and the percentage of those hours sold to others; c) average hours of irrigation per unit of land bought by the water buyer; and d) contribution of sold/purchased irrigation to gross household incomes. Table 11 shows some of the measures of depth of water market in West Bengal. On the whole, it seems that water market in West Bengal has achieved considerable breadth and depth,[14] unlike water markets in eastern Uttar Pradesh—that has high breadth but low depth (Shah *et al*., 1997).

3.3 *Contracts in groundwater markets: An analysis of modes of payments, types of transactions and water prices*

In this section, I will try to understand the mode of functioning of water market, various contractual forms and their rationale. This analysis is based on 833 water buying transactions reported by 412 water buyers from 40 villages in West Bengal.[15] There are basically two modes of payment prevalent in water market transactions in West Bengal, *viz*. payment in cash and payment in kind. Each of these transactions have different implications for the terms and conditions of water sale, *viz*. on timing of payment, frequency of irrigation, risk sharing between the water buyer and the seller, responsibility of water distribution, etc. Table 12 shows the frequency distribution of various types of water selling contracts in West Bengal.

Hourly cash contract is the single most dominant type of contract in water market in West Bengal as seen from Table 12. Under this contract, an hourly water charge is fixed by the seller (irrespective of crop and season) and the buyers are expected to pay the water price on spot right after irrigation or within a week or two of the transaction. Fixed seasonal cash contract is the next important contract in water market and accounts for 47.5% of the total cash transactions in my sample. This type of contract is the predominant mode of water transaction in case of electric WEMs and for paddy crop, especially *boro* paddy. Only 7% of all transactions in water market were in kind, showing that this form of transaction is relatively rare in West Bengal. Kind contracts are forged for paddy

[14] There are quite obviously spatial variations in breadth and depth of groundwater markets in West Bengal. They tend to have both higher breadth as well as depth in the new and old alluvial districts of Nadia, Murshidabad, North 24 Parganas, Hugli and Bardhaman than in the drier western districts of Purulia and backward diesel WEM districts of North Bengal. The depth and breadth of groundwater market is also considerably lower in diesel WEM dominated villages as compared to electric WEM dominated villages.

[15] Every water buyer was asked to specify the details of his/her water buying activities for the agricultural year of 2003–04. They gave details of crops for which they bought water and the price they paid for it. I have used the data so generated in this section. I have similar set of 363 water selling transactions details as reported by the water sellers for the year 2003–04. Descriptive statistics such as mean value of water price, percentage of transactions under each type, etc., showed that water price and mode of transaction (for different crops and seasons) as reported by the water sellers was more or less the same as reported by the water buyers. Hence for this analysis, I chose the larger of the two samples.

Table 12. Frequency distribution of various modes of payment for water in West Bengal, 2003–04.

Mode of payment	Unit	No. transactions	% to total
Hourly cash	Rs/hour	390	46.8
Area based seasonal cash	Rs/ha/season	365	43.8
Area based one time irrigation fee	Rs/ha/irrigation	13	1.6
All cash transactions	–	**768**	**92.2**
Fixed kind	kilograms/ha	35	4.2
Sharecropping	Share of crop/ha	21	2.5
Others	Various	9	1.1
All kind contracts	–	**65**	**7.8**
Total	–	**833**	**100.0**

Source: Author's fieldwork in 40 villages in West Bengal, August 2004 to December 2004.

Table 13. Water prices for different crops as charged by electric and diesel WEM owners.

		Type of WEM and average water price		
Name of the crop	Mode of water pricing	DST	EST	ESB
Any crop	Rs/hour	46.3	25.2	31.9
Summer paddy (*boro*)	Rs/ha/season	10,700	4,774.5	3,835.9
Monsoon paddy (*aman*)	Rs/ha/season	3,915	2,761.5	1,235

Source: Author's fieldwork in 40 villages in West Bengal, August 2004 to December 2004. DST = Diesel centrifugal pumps; EST = electric centrifugal pumps; ESB = electric submersible pumps.

(aman and *boro*) crops only. Under fixed kind contract, the water seller takes upon himself to irrigate a given land (say hectare) sown with a specified crop (exclusively paddy) for a fixed amount of payment in kind (kg of paddy/hectare). Table 13 shows water prices for important crops as charged by electric and diesel WEM owners.

Another example of kind contract is sharecropping for water. Curiously, sharecropping for water is conspicuous by its near absence in West Bengal. I found evidence of sharecropping for water in only one out of my 40 study villages, while Moitra & Das (2005) did not find any evidence of it in over 500 villages they had surveyed. While sharecropping for water is a novel phenomenon in West Bengal,[16] it is not so in other parts of India. For instance, Dubash (2002: 201) found that in "the early years of water exchange, crop share was the only arrangement . . ." in his study region in north Gujarat—and this later gave way to fixed cash contract. However, in a recent study of groundwater market in north Gujarat, Prakash (2005) found that sharecropping contracts for land, labour and water have re-emerged as the "new face of water market" in response to rapid depletion of groundwater as well as demographic changes owing to international emigration in the region. Sharecropping for water is not limited to Gujarat alone—evidence of the same has been found in Pakistan (Strosser & Meinzen-Dick, 1994; Jacoby *et al*., 2001), Tamil Nadu (Janakarajan, 1994), Andhra Pradesh (Shah & Raju, 1988) and Madhya Pradesh (Kajisa, 1999). In this regard, West Bengal is an exception.[17]

[16] Sharecropping for water has never been important form of transaction in West Bengal right from the inception of water markets in early 1970s. In a recent work Moitra & Das (2005) too did not find any evidence of sharecropping for water in over 500 or so villages that they surveyed.

[17] The reason might be the prevalent attitude that sharecropping as an institution is *backward* and exploitative, especially when land reforms were in full force.

Table 14. Some indicators of impact of groundwater markets.

Indicator	Pump owners	Water buyers
Cropping intensity (%)	184.0	180.0
% area under water intensive *boro* paddy to GCA	24.1	22.8
% area under profitable potato crop to GCA	8.0	8.1
Productivity (kg/ha) of *boro* paddy	5,025	5,025
Productivity (kg/ha) of potato	16,200	18,000
Hired labour use (person days/ha) for *boro* paddy	128.3	111.8
Fertilizer use (kg/ha) for *boro* paddy	501.0	465.8
Gross income from crop cultivation (Rs/year/ha)	31,200	28,583
Sample size (Numbers)	294	286

Source: Author's fieldwork in 40 villages in West Bengal, August 2004 to December 2004.

Other variants of kind contracts (especially interlocking contracts) are also relatively rare in West Bengal. Various scholars, such as Wood (1995), Janakarajan (1990), Jacoby *et al*. (2001) and Prakash (2005) have documented the existence of interlocked contract for land, water and labour from Bihar, Tamil Nadu, Pakistan and Gujarat respectively. While Wood, Janakarajan and Prakash have shown that these interlocked contracts tend to work against the interest of the water buyers cum tenants, Jacoby *et al*. (2001) have shown that tenants of landlords who own tubewells tend to receive cheaper and better quality irrigation than non-tenants and other water buyers. Shah (1993) found that payment for water with labour days was common in some villages of Andhra Pradesh. However, in West Bengal I did not find much evidence of interlocked contracts or payment for water with labour days. Thus, on the whole, sharecropping for water, interlocked land and water transactions and *other* unspecified types of water selling contracts are relatively rare in rural West Bengal.

3.4 *Impact of groundwater market*

A review of literature (Mukherji, 2004) shows that impact of groundwater markets are manifested in terms of changes in cropping pattern, cropping intensity and crop productivity among the participants. Similar changes are also noted in agricultural labour employment (see Hussein, 2005, for a review of literature on impact of irrigation in South and South East Asia). Thus, one of the impacts of a well functioning groundwater market would be to narrow down the cropping intensity, cropping pattern, productivity and input use gaps between the owners and non-owners of WEMs (Shah, 1993; Shah & Ballabh, 1997). In Table 14, I have summarised some of the above mentioned indicators and how water buyers have performed *vis-à-vis* the water sellers in respect of these indicators. This shows that water buyers achieve similar cropping intensities, crop productivities as well as similar gross income from crop cultivation as pump owners do. Therefore, in rural Bengal, non-ownership of means of irrigation does not translate into poor access to irrigation as it does in many other parts of India such as Gujarat and Tamil Nadu.

4 POLITICS OF GROUNDWATER IN WEST BENGAL: ABUNDANT GROUNDWATER RESOURCES AND RESTRICTIVE POLICIES

In the preceding sections of this chapter, I showed that the state of West Bengal is well endowed with groundwater resources and that groundwater based private irrigation services markets function efficiently and equitably in the state. I also showed that West Bengal's spectacular growth in agricultural sector in the 1980s and 1990s may largely be attributed to expansion in groundwater irrigation. The situation in West Bengal is therefore in sharp contrast to many other states that face acute groundwater scarcity. What then is the groundwater story (or problem) in West Bengal?

Table 15. Cost of cultivation and net returns from *boro* paddy for diesel and electric pump owners and water buyers in West Bengal, 2003–04.

						Cost of cultivation (Rs/ha)		Net returns (Rs/ha)	
Crop	WEM type	Water transaction status	N	Yield (kg/ha)	Cost of irrigation (Rs/ha)	Cost of cultivation without including family labour	Cost of cultivation including family labour	Net returns without imputting labour	Net returns after imputting family labour
Boro	Diesel	PO	55	5,025	7,448	17,850	20,190	9,788	7,448
Boro	Diesel	WB	28	5,250	12,998	23,295	27,075	5,580	1,800
Boro	Electric	PO	64	5,475	1,665	12,383	14,970	17,730	15,143
Boro	Electric	WB	61	5,175	4,628	15,578	18,225	12,885	10,238

Source: Author's calculations based on fieldwork in 40 villages in West Bengal, August to December 2004.

The groundwater story in West Bengal is not of physical scarcity or depletion, but is of misplaced concerns and policies that have created *economic* scarcity of groundwater in a region endowed with world's best alluvial aquifer. There are at least three reasons that have given rise to economic scarcity[18] of groundwater in the state.

First, West Bengal has the lowest number of electric operated tubewells anywhere in India, even lower than the neighbouring state of Bihar. Only 7% to 12% of all pumps in West Bengal are electric operated as against the average of 50% for India as a whole. In addition, farmers in West Bengal are subject to one of the highest electricity tariff anywhere in India. For example, while farmers in Andhra Pradesh and Tamil Nadu are given electricity free of cost and those in Gujarat pay Rs. 850/horse power (HP)/year (US$ 21.25/HP/year),[19] farmers in West Bengal pay Rs. 1,760/HP/year (US$ 44/HP/year).

Procuring new electricity connection in West Bengal is a daunting task thanks to the rather stringent *State Water Investigation Directorate* (SWID) certification requirements. Added to this is the fact that since late 1990s subsidised rural electrification scheme that has been in force since early 1980s was withdrawn with the result that farmers now have to bear the full cost of pump electrification. These two factors, *viz*. SWID certification and withdrawal of subsidised electrification scheme have resulted in stagnation in the number of new electric connections in the state.

That most pumps in West Bengal are diesel operated did not matter so much in the 1980s and 1990s when diesel prices were very low.[20] However, since 2000, diesel prices have gone up sharply by 2.8 to 3.3 times thereby increasing costs of irrigation especially for water intensive crops such as *boro* paddy. Under the present situation when diesel price is in the range of Rs. 33 to 35 per litre (US$ 0.825 to 0.875 per litre), only electric WEM owners (and their water buyers) are able to cultivate *boro* paddy while diesel WEM owners and their water buyers have almost entirely stopped *boro* cultivation. Table 15 shows net profitability from *boro* cultivation for electric WEM owners, diesel WEM owners and their respective buyers. It shows the very low profit for the diesel WEM owners and even lesser profits for those who buy water from diesel WEM owners.

This assumes serious dimension when we take into account that over 90% of all WEMs in West Bengal are diesel driven and in most of these villages, *boro* paddy cultivation has been either discontinued and will be so in coming years. In 19 of my 40 study villages that were exclusively

[18] Economic scarcity refers to inability of farmers to extract and use groundwater due to prohibitively high costs of water extraction even when there is no physical scarcity of groundwater as such.
[19] 1 US$ = 40 Rs. (Indian Rupees), as in July 2008.
[20] Even in 1990, diesel price in Kolkata was only Rs. 10.18 per litre (US$ 0.25 at 2008 exchange rate).

dependent on diesel WEMs, *boro* paddy cultivation had almost entirely stopped and the farmers had reverted to low profit rainfed crops in winter season or profitable but risky vegetable crops in villages located near towns. Earlier several studies had shown that *boro* paddy cultivation had propelled West Bengal to high levels of agricultural growth in the 1980s and 1990s (Rogaly *et al.*, 1999) and decline in *boro* paddy cultivation will surely affect future agricultural growth in the state. Ghosh & Harriss-White (2002) too voiced this concern when they found a "deep crisis in rice economy"—a crisis that has since then deepened in intensity and severity.

In this situation of impending crisis in the agrarian economy (mostly due to unfavourable input-output ratios) and abundance of groundwater, one would have expected policies that stimulate groundwater use for agriculture. However, the government of West Bengal has adopted a conservationist stand *vis-à-vis* groundwater. This is amply reflected by their policies of stringent SWID certification and consequent slow down in rural electrification. This (i.e. precautionary principle) is in sharp contrast with other states of India such as Gujarat and Tamil Nadu, where groundwater situation is alarming and yet, governments succumb to popular electoral pressures and give concessions to farmers in form of subsidized electricity. This apparent paradox of restricting groundwater access in a place of relative abundance (as in West Bengal) and almost non-existent groundwater regulation in an area of relative scarcity (as in Gujarat) may be very well explained through the *political ecology* perspective.

4.1 *Political ecology perspective in understanding groundwater issues in India*[21]

Political ecology, as a discipline, looks at among other things into the political struggles over access to natural resources and how this struggle in turn is shaped by existing power relations among various actors. The origin of the term *political ecology* is traced back to a paper by Wolf (1972, quoted in Walker, 2005) who linked "human strategies to ecological success to cultural adaptation" (Walker, 2005: 74). To begin with, this field drew inspiration from biological and earth sciences. But by mid-1970s, through writings of Andre Gunder Frank (1969) and Wallerstein (1974) the focus had squarely shifted to the question of *unequal power relations* in a globalized capitalistic economy and the way this affected human interactions with the physical environment. Blaikie & Brookfield (1987: 17) insightfully summed up political ecology as a discipline that "... combines the concerns of ecology and a broadly defined political economy. Together this encompasses the constantly shifting dialectic between society and land-based resources and also within classes and groups within society itself".

Thus political ecology is concerned with power and the way unequal power relation among various actors affects their access to environmental resources. In this section of the chapter, I use the political ecology framework to understand how two states in India posed with entirely different geo-hydrological regimes (one of abundance and another of scarcity of groundwater) managed to arrive at entirely contradictory groundwater policies *viz*. that of restriction in water abundant West Bengal and almost no effective policy and hence *status quo* as far as groundwater extraction is concerned in water scarce Gujarat. Of the various ways of conceptualization of power (see Mullins, 2004; Bryant, 1992, 1998, for further discussion), two are relevant in this context, *viz*. *indirect discursive control through ideas* and *control over access to resources*. The former is manifested in the state of West Bengal where through the use of mass media, the government has been able to influence public opinion especially that of the influential urban intellectuals such that they believe that the state is faced with precarious groundwater situation that need immediate amelioration—while the reality, as I have already shown, is quite the contrary. On the other hand, quite another manifestation of power is seen in Gujarat, where the farmers who already have access to this dwindling resource are fighting hard to keep this control intact and through successful negotiation in the

[21] This part of the chapter largely draws from the author's earlier paper titled: *Political ecology of groundwater: The contrasting case of water abundant West Bengal and water scarce Gujarat, India*, published in the Hydrogeology Journal (Mukherji, 2006).

political space have been so far more or less able to do so—and a race to the bottom of the aquifer has begun—and at places, this race is now almost over, where aquifers have been pumped dry. Therefore, in view of this paradox, the central question that I will try to answer in this section is: "why is it that farmers organise themselves in Gujarat and successfully glean concessions from the state, while farmers in West Bengal do not?"

4.2 *Political ecology of groundwater in India: All politics and no ecology*

Thus far, in this chapter, I have argued that in West Bengal, with ample groundwater resources and low levels of resource development, the state government has assumed a strong regulatory posture. This has successfully slowed down the pace of resource development on the one hand and reduced farmer income on the other—and yet the peasants there have failed to put up effective resistance. In contrast, in Gujarat, where strict regulation is needed because the resource is extensively over-developed, the politicians as well as bureaucrats are steeped in a resource development mode and the farmers too offer strong resistance to any attempts to curb their access to groundwater. This throws up the question, *viz*. "Why do peasants organize around groundwater issues in Gujarat and not West Bengal?" This section tries to answer this question. There are a possible three sets of explanatory factors including:

a. Contextual (pertaining to specific context of the two states).
b. Perception of the urban intelligentsia, bureaucracy and politicians *vis-à-vis* groundwater issues.
c. The organizational and ideological imperatives of the main farmer organizations in these states, *viz*. *Krishak Sabha* (KS) in West Bengal and *Bharatiya Kisan Sabha* (BKS) in Gujarat.

Of the contextual issues, the first is the degree of dependence on groundwater for farming activities. In many parts of Gujarat, the dependence on groundwater is much more critical than in West Bengal. For example, in North Gujarat, agriculture would shrink drastically if use of groundwater was curtailed, while in West Bengal, regulation impedes further growth in agriculture; though due to abundant rainfall, farmers can still revert to rain-fed farming. So, it may be asserted that peasants in Gujarat are more likely to organize and agitate on groundwater issues than peasants in West Bengal. To add force to this argument is the fact that the number of large- and medium-scale landholding farmers (also called *bullock capitalists* by Rudolph & Rudolph, 1987) who spearhead the *new agrarian movements* are in majority in Gujarat but comprise only 2.1% of the total farmers in West Bengal. However, this explanation in itself is not entirely satisfactory. In reverting to rain-fed farming, as many Bengali farmers have already done due to lack of electricity connection and high diesel costs, farm incomes plummet drastically and this indeed gives rise to immense dissatisfaction among the farmers, as this author had the opportunity to experience during fieldwork in the state. However, this unrest among the farmers does not find expression in the form of farmers movements because of the lack of support from the only farmer organization in the state—the *Krishak Sabha*.

The second contextual reason is that of path dependency—i.e. the farmers in Gujarat have a long tradition of groundwater irrigation as compared to that of Bengal farmers. In Gujarat, 70–80% of irrigated areas were served by wells and pumps at the start of the 20th century (Dr. Tushaar Shah, *International Water Management Institute*, India, 2005, pers. comm.). In West Bengal, groundwater irrigation has become important only during the past 20 years. So around 1990, when discussion about the environmental threat of groundwater over exploitation began in a serious way, Gujarat already had an over-developed groundwater economy while West Bengal was still at the early stages of groundwater development. People in Gujarat were long accustomed to groundwater irrigation; it was far more difficult to wean them away from it, while it was much easier to apply the *precautionary regulation principle* in West Bengal and since this works, it might as well be justified. However, this explanation too is unsatisfactory because irrespective of when groundwater irrigation started, the farmers who become used to groundwater irrigation find it difficult to do without as indeed is the case in West Bengal. However, the fact that voices of dissent are scarcely heard does not mean that there is no dissent; it merely means that these voices do not find expression.

The third contextual reason could be the global notoriety generated by the arsenic problem which, whether justified or not, has also caused panic amongst West Bengal politicians and bureaucrats. However, the SWID certificate is not just limited to arsenic affected areas, but also extends to all seven districts where the officials believe (though data belies) that groundwater over-exploitation takes place. But then, global notoriety has been also generated by fluoride problem in much of Gujarat and yet, this does not figure in the policy making discourse in that state. Thus, none of the three specific reasons outlined in this paragraph are adequate to explain the lack of a farmer movement in West Bengal around groundwater issues.

The second factor that might partly explain this anomaly is the perception of the urban intelligentsia, politicians and bureaucrats regarding groundwater issues. In West Bengal, environmentally conscious urban middle class very often hear and read the inaccurate accounts of dwindling groundwater resources and arsenic contamination and are not aware of the beneficial impacts of groundwater use. Thus they tend to form a negative perception about groundwater use and hence have little sympathy for the farmers. Under such a situation of tacit support from the urban intelligentsia and no visible and active opposition from the peasant community, the GoWB was able to undertake and implement one of the most effective groundwater regulations in India. This is also precisely the reason why caste based politics has never found favour in West Bengal, while in most other states, including Gujarat, caste lobbies are quite common. Indeed, in Gujarat, the *Patel* (predominantly farmers) lobby is a force to reckon with. In West Bengal, "... the overall dominance of modes of culture and thought of urban intelligentsia ..." (Chatterjee, 1997: 82) have prevented both caste-based affiliations as well as sympathy for the newly emerged capitalist farmer who depends on markets for survival. The overall *left leaning* urban intelligentsia still rejoices in the *land to the tiller* slogan little realizing that rural realities have changed since the decade of the 1970s and that now all farmers, be it a sharecropper or a small farmer or a large-scale landholding farmer, are inextricably linked to the market, and that input cost (including that of groundwater) and output prices are their major concerns.

The nature and the political ideology of the state also matters. For example, the socialist-communist ideology of the GoWB has moulded its attitude towards groundwater use. After the independence of India in 1947, land distribution in the state of West Bengal was one of the most inequitable in the country. After independence, this system was abolished and land-reform initiatives were instituted which aimed at conferring ownership rights to the cultivator of the land on the one hand and distributing excess land seized from the very large landholder to the rural landless on the other. The *Communist Party of India* (Marxists)—CPI(M)—government which came to power in 1978, took up land reform in earnest and showcased one of the most successful land reforms in India (though most scholars echo this positive view, voices of dissent and criticism of land reforms in West Bengal can be found in Mallick, 1993). These poor farmers became the major support base of the CPI(M) and the richer peasants were looked upon as *class enemies*. However, given the democratic set up of India, and the pragmatism of the CPI(M), the party chose the path of reform rather than revolution and became a party of *middleness* which was careful not to antagonize the landed peasants beyond redemption (Bhattacharyya, 1999). However, certain prejudices remain; for example, there was still a tendency to look at pump owners as exploitative water lords (Adnan, 1999; Webster, 1999), not withstanding the fact that various studies had shown that informal groundwater markets were at the very heart of agrarian transformation in West Bengal (Palmer-Jones, 2001; Harriss, 1993). Thus, for instance in the context of the SWID certificate, the concern was not only of lowering the water table, which in any case was admitted to be a seasonal phenomena, rather it was the fact that many of the new structures were being made more for commercial purposes than for personal purposes. In Gujarat, on the other hand, many of the politicians and government officials have strong rural roots (a phenomenon mostly absent in West Bengal) and indeed take pride along caste lines, for example, a *Patel* would generally be proud of the fact he is a *Patel*, which is the epitome of the good farmer. Thus, officials of the electricity board and groundwater departments can and do empathize with the farmers' plight.

While both the context specific factors and the attitude of the decision makers are important, what matters most in terms of a farmer movement is the organizational set up of the farmers' union that

spearheads such agitation. This is clearly demonstrated by the contrast between the BKS in Gujarat and the KS in West Bengal. BKS is a farmers' organization recruiting its members from amongst farmers, and the leadership is also in the hands of the farmers. On the other hand, membership to KS is open to farmers (and sharecroppers), landless labourers as well as the so-called rural intelligentsia who are predominantly school teachers. For example, in one district of West Bengal, *viz*. Nadia, there are approximately 55,000 members of the KS, of which 50% are landless labourers, 30% are farmers, and the remaining 20% are not directly related to agriculture, *viz*. teachers and rural traders. The leadership of the KS is in the hands of the intelligentsia and not the farmers because they are thought to be educated enough to lead an ideologically motivated party like the CPI(M) and its related organizations (district leader of the KS, Nadia district, 2005, pers. comm.). Ironically, the interests of the farmers, the agriculture labourers as well as the intelligentsia are very different and at times even diametrically opposite. For instance, while the labourers bargain for a hike in wages, it is in the interest of the landowning farmer to keep wages low. Again, while the farmer would like to get higher prices for his produce, the labourer and the rural non-farm dependent people, who buy food from the market, would like the food prices to be kept low in perpetuity. In addition to these internal contradictions, KS, like most other communist organization adheres strictly to so called *party* discipline. This means that conflicting views within the KS leadership can not be expressed in public and all have to agree with the official line.

It is then hardly surprising that the KS has so far not taken any stand against the state government regarding the issue of either SWID certificate or electricity tariff. Thus, while the KS did launch an agitation against the *Jute Corporation of India* in 2004, a government of India body, for offering low procuring price for jute, it has not to date spearheaded any protest against the state government's policy of increasing the electrical power tariff. In West Bengal, from 1996 to 2007, there had been a progressive increase in the electricity tariff from Rs 1,100 (US$ 27.50) per year per pump to Rs 10,800 (US$ 270) per year per pump, a ten fold increase over 11 years. Most of the pumps in West Bengal are of 5 HP. Thus per HP, the electricity tariff works out to be Rs 2,160 (US$ 54), which is one of the highest in the country. Yet, other than few sporadic farmer protests where 100–150 farmers assemble to protest in front of a local electricity office, there has been no organized protest at all, while the ruling front has since then organized hundreds of protest marches on themes as unconnected to farmer interest as the Iraq War and USA policy and so on. Indeed, the interests of taxi drivers (70,000 or so) are better represented than that of the 11 million farmers in West Bengal because the state faces a transport strike every time there is a hike in the petrol/diesel price. Thus, in effect, GoWB has successfully co-opted and consequently captured the only farmer organization in the state, the CPI(M)s *Krishak Sabha*, which in turn has lost its voice and acts as a spokesperson for the ruling alliance. In Gujarat, on the other hand, the BKS successfully protested against the rise in electricity tariff, even though the *Bharatiya Janata Party* (BJP) (of which BKS is the peasant wing) was in power in the state. This happened precisely because the leadership of the BKS is in the hands of the peasants unlike that of the KS.

5 CONCLUSION

This chapter is about economics, ethics and politics of groundwater. In this chapter, I have shown that the state of West Bengal is well endowed with groundwater resources. Groundwater irrigation has played a crucial and positive role in bringing about unprecedented agrarian growth in the state. However, its role has been relatively undermined in existing literature. This is the ethical dilemma. This chapter is a step towards understanding the significant role that groundwater irrigation has played in agricultural transformation in the state. Of particular interest has been the evolution of informal groundwater based irrigation services markets. In this chapter, based on evidence from 40 villages spread across 17 districts of the state, I have documented the extent, functioning and impact of groundwater markets. I have shown that in the absence of state provisioning of irrigation, these informal markets have done a commendable job of distributing benefits of irrigated agriculture to those do not own any irrigation assets. In sharp contrast to many other states

located in arid and semi-arid regions with hard rock aquifers, groundwater markets have had highly efficient and equitable impacts without putting resource sustainability at risk. Given the positive impact of groundwater on the state's agricultural development, one would have expected policies that encourage further expansion in groundwater irrigation. Ironically, this has not happened. What has happened instead is that the GoWB has formulated policies directly aimed at curtailing access to groundwater. This will have serious repercussions for the agriculture sector in the state, as I have shown in this chapter. Not merely content with pointing out the anomalous state policies on groundwater in water abundant West Bengal and other water scarce states (for example Gujarat), I have in this chapter taken a step closer and tried to explain these paradoxes in terms of politics of groundwater.

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VI
Ethics of water ownership and management

CHAPTER 14

Achieving ethical business conduct in public and private water enterprises—Troublesome challenge or enhanced opportunity?

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ABSTRACT: This chapter addresses the challenges facing both public sector providers and private operators in providing adequate, reliable and sustainable water services. This includes both the realms of provider corruption and inefficiency and consumer non-payment and the cycle of uneconomic and inadequate water service that these foster. The chapter examines emerging business, legal and institutional models, such as public-private partnerships, in addressing these problems and in creating the ethical standards, and the legal and financial models, that can provide the basis for achieving these goals and managing the problems that hinder them.

Keywords: Water; Corruption; Corporate Social Responsibility; Public-Private Partnerships; Transparency; Financial tools; Sustainability

1 INTRODUCTION

One of the greatest current challenges to economic development in many developing countries, especially those in Africa is the lack of access to basic infrastructure services, such as water and electricity and the solution lies in providing these as quickly as feasible.

Feasible in this context means as fast as sustainable flows of private investment or public aid can be obtained and targeted by host countries; and how efficiently and quickly the legal and institutional frameworks of the host country can be developed to accommodate this aid. Experience shows that if all these are not synchronized properly, development programs can go awry and precious aid funding can be wasted.

Given the positive economic multiplier effect that full access to these basic infrastructure services (which we tend to take for granted in many Western countries) will have on developing economies, a focus on achieving full access should be one of the top priorities of those involved in the development business. This is justified even on purely economic grounds, quite apart from the moral, political and social reasons.

Achieving the goal of universal access to infrastructure services, such as water and electricity, is one of the biggest challenges facing many developing economies—and certainly facing the international development community and International Financial Institutions (IFIs) such as the World Bank. The potential for well provided basic infrastructure to move countries forward into new phases of economic development is a driving motivation for the IFIs, and magnifies the critical importance of getting *frameworks* right.

Critical contributors to getting these frameworks right include:

1. The presence of effective regimes for creating and enforcing the transparency and accountability of the institutions receiving and spending the financial support; and
2. Instilling in these institutions the broader notion of *Corporate Social Responsibility* (CSR). A critical part of CSR is the presence of ethical conduct by both private and public corporations as part of their day-to-day operations. CSR requires much more than pious pronouncements. That is why the focus of this book—on water ethics—is so timely.

2 PUBLIC SECTOR SHORTFALLS AND PRIVATE SECTOR FAILURES IN PROVIDING UNIVERSAL ACCESS TO POTABLE WATER

2.1 *Addressing the challenges of inadequate access to and sustainability of basic water services*

The positive economic and social effects of expanding access to potable water, electricity and other infrastructure services, such as transport, and the negative effects of not doing so—have long been recognized by the IFIs, such as the World Bank and *International Finance Corporation* (IFC). Major new and much heralded initiatives, such as Tony Blair's *Commission for Africa* and George W. Bush's *Millennium Challenge Corporation* (MCC) have emerged over the last few years to provide new dimensions to solving this mammoth shortfall in basic infrastructure services such as water.

Considerable funds have been expended, or at least promised, under these and similar initiatives, e.g. by the MCC in several countries in Africa—attempting very quickly to develop the capacity of host governments to manage sizeable investments in infrastructure sectors. Concerns have often been expressed that pace of these programs are driven largely by political timetables. The present authors', having just worked on the *due diligence* exercise of the MCC's program for the water and sewage sectors in Mozambique, witnessed the extraordinary speed of the exercise for Mozambique whereby a major action plan was produced by 50 expert consultants in just a couple of months. This is a nice contrast to the snail's pace that sometimes plagues other IFI programs.

There is also a renewed emphasis at the IFI level and in a growing number of lesser developed countries (LDCs) on tackling some of the basic governance problems that have long plagued the traditional public provision of these services. These services have usually been carried out by non-competitive state-owned enterprises (SOEs), which have typically been run on non-business principles and have been too often plagued by gross inefficiency and rampant corruption—with not even the partial disciplines that a for-profit enterprise might instill. That is why one of the most popular emerging concepts for business models in this arena is the Public-Private Partnership (PPP) concept. While PPP is widely discussed in a variety of business and legal circles, but as yet, in our view, there is still a need of considerable specific definition in different business contexts. For example, the *International Bar Association* (IBA) held an entire conference on PPPs in 2006 in Buenos Aires. It was also a major theme of the IBA's 5th biennial conference on Project Finance (focused on the infrastructure industries) in Washington, D.C. in April 2007.

2.2 *The urgent need for a viable, adaptable and sustainable PPP model: Past failures and future lessons*

The need to pursue the PPP concept, and turn it into viable business models in different contexts in the infrastructure industries such as water, is driven not only by the renewed urgency to reduce the huge shortfalls in these services in many countries. It is also driven by the growing recognition that most of the older models for private sector participation in these industries that emerged internationally in the 1990s, have not worked very well.

Perhaps the most vivid example of this may be found in the failure, and virtual collapse, of the effort of some of the major private power developers from the USA and Europe. These developers, mostly major corporations, had elected to go international in a big way and entered into major emerging markets such as India, China and Brazil. In the mid-1990s, major independent power developers (IPDs), such as Enron, AES and CMS, entered these markets aggressively. They promised literally hundreds of billions of dollars of investment in this sector over the next two decades. That all collapsed in less than a decade—with dramatic examples widely publicized such as Enron's notorious Dahbol project in India and Enron's subsequent demise. Only now are the first signs of a re-emergent IPDs visible in the power sector where the need has remained enormous and urgent, as it is in the water sector today.

Development in both power and water sectors in the LDCs is plagued by two fundamental realities:

1. That they are both very capital intensive sectors—which has created a special need for well financed international companies with sophisticated expertise, and experience to tackle the LDC *need* issues; and
2. That both sectors present a complex range of legal, regulatory and institutional issues, which often have many country-specific and regional features that can add complex international law dimensions (such as *power pools* in electricity). What this means for development, especially by the private sector, is that governments need to address these issues head on and engage in complex and quite protracted *sector reform* programs—usually as a prerequisite to getting any significant level of private investment.

In power, there is at least some sign of the cautious re-emergence of this IPD industry—Aldwych in the UK and Globeleq and AES (again) in the USA. All of them were visible at the infrastructure conference of the *Corporate Council on Africa* in Washington (2006); but their investments in and penetration of developing markets is notably more cautious and currently more modest than it was in the 1990s. Also, there is not much indication to date as to how far they will explore new development models with a PPP component. Part of the reason for that is that their choice of host countries is usually a long process—carefully assessing the overall business and regulatory framework and especially the governance regimes. However, the potential for viable partnerships with entities emerging from SOM status should be part of that search—and, today, too seldom is.

Fortunately, the handful of Western companies active in this arena in the water industry did not fall over a financial cliff in a dramatic fashion that so many in private power companies did in the 1990s. The only disappointment is how few water companies from the USA and Europe have been aggressively engaged in developing countries and how little progress has been made in their engagement in these countries.

Moreover, there is currently not much sign of the major water operators in the international arena embracing and implementing the anti-corruption, transparency, accountability and self-monitoring standards that will be critical in achieving the goals of universal access to water and sanitation services. This will become even more critical as the water sectors in the developing economies move towards more universal service, and towards more business-oriented private sector involvement—including much needed sizeable investments. However, this aspect of the water industry is perhaps in earlier stages in developing economies. They therefore have the opportunity to learn from the failures in ethical behavior (and ultimately dire economic failures) of the power industry.

The power industry has important lessons for the water industry which are going international at present. So we will examine that experience, and its lessons, in this chapter. Major reasons for power sector demise in the 1990s were serious failures in terms of standards for transparency, accountability and especially, business ethics. The most dramatic and publicized example of such ethical failure was the case of the Texas-based Enron company, though there were other similar failures among the major international power companies of that time. One matter we will focus on in this chapter is what those standards should be for the international water sector.

Another hindrance to the major water operators in this arena may be more technical—the combination of capital intensity and high level technical specialization which may restrain the desire to develop serious partnerships with local companies. This is in stark contrast to many of the other service sectors. However, as lawyers, we have found that one rarely wants to move in other economies without the input of *local counsel*. The major Western water operators, as they go more international, should share a similar desire—to develop strong partnerships with local companies, especially in culturally different and developing countries where their synergetic relationship could have major benefits. That is why, because so many of the local providers may be State enterprises, or have public elements, we will devote attention in this chapter to PPPs.

3 THE UNDERLYING CHALLENGES TO ETHICS IN THE WATER INDUSTRY

3.1 *Tackling the basics—Building an ethos of adherence to sound economic principles; avoiding rationalizations for unethical consumer behaviour*

There is a need to enhance private sector interest in water development in emerging economies. This can be achieved if the ethical lessons of fighting corruption at all levels are carried over into the operations of water companies and consumer behavior. Indeed, one of the principal barriers to attracting private investment in both the water and power industries in all too many developing countries has been a high prevalence of lost revenues for services provided but not paid for. These losses may have occurred in part because of inefficiencies in delivery services that lead to product losses (*technical losses* in transmission—in power parlance); but all too often they are what are euphemistically called *non-technical losses* (NTLs) in electricity sector, which means power knowingly taken by consumers (often through illegal connections) but not paid for. In water, there is an approximate equivalent term to NTLs: NRW (*non-revenue water*).

Various arguments were put forward to justify these NTLs practices in the electricity sector. Most often it was blamed on poverty; sometimes these losses were justified as a means of compensating past discriminations. For example, during the apartheid era, consumers of water and power companies in Soweto in South Africa routinely refused to pay for public services as a protest against the oppressive regime. But this created a habit that became an immediate cause of concern for the new *African National Congress* (ANC) government when it came to power in the mid-1990s. However, the underlying cause was the failure to recognize that water and power are not just social rights but products that have costs to produce—and should be paid for in the most rational and economic way. That recognition does not preclude using tariff structures to subsidize consumption, e.g. low income consumers getting subsidized tariffs, to certain levels often called *lifeline rates* in USA power parlance. However, the cross-subsidy should be transparent and appropriately debated and carefully monitored to ensure it meets the specific social need aimed at, and does not become a means of exploitation of some consumers by the others.

In addition to the negative social consequences of unjustified non-payments for services, (NTLs or NRW), the long term economic consequences on the industry itself and its ability to serve additional population are even more devastating, especially if this problem presents a serious barrier to private sector investment. In short, consumer theft becomes a barrier to investments in facilities to serve the under-served communities. Indeed, its negative impact on power service will be highest in the very communities who may need it most and where it could have the highest positive economic impact—but whose current economic bases make them least attractive to the investors.

The dramatic example of the IPP industry in the 1990s presents another good lesson for the water industry in this NRW problem area. The high prevalence of NTLs in India's state run local electricity distribution companies (the State Electricity Boards—SEBs) who in some cases had NTLs approaching 50% of the total output created an enormous economic barrier and led to demands for exorbitant returns on capital from all the international IPP developers. The recent MCC analysis of the water sector in Mozambique revealed that the issue of theft, or *planned non-payment* as it was phrased, is a potentially serious one—but less easy to measure for technical reasons than NTLs in power. There are some potential solutions emerging such as building on models for local community control of and investment in these industries. This will be dealt with in a later section.

3.2 *The ugly cycle: Inadequate service-consumer non-payment-inadequate investment to provide service*

However, there is a closer connection between the unethical consumer behavior and provider inefficiency than meets the eye. The experience of both the power and water industries is that a primary cause of consumers not paying for service is a loss of faith in the reliability of the provider

of that service. If the company that promises to provide a necessity such as water on a reliable basis does so only on a sporadic basis, the perceived moral obligation of consumers to pay for the service drops dramatically. This inadequacy in service may well be the result of inadequate capital generated from the providers' revenues to finance enough investment and operation and maintenance (O&M) just to retain existing service levels, let alone to expand to unserved areas. The result, then, is a vicious circle of NRW leading to inadequate revenues, inadequate investments, leading to inefficient service and unwillingness of the consumers to pay for the service. It really does not matter where one starts to find the root cause of the problem. Once the vicious cycle is created it leads to a downward spiral in service and revenues, unless the governments or NGOs continue to pump in assistance capital—which will not be amortized and could be better spent.

3.3 *Defining the concepts relevant to ethics in water*

In this section, basic legal concepts as they apply to the legal/business and related corporate accountability are discussed. Two concepts spring to the mind in this context—*corporate accountability* and *corporate social responsibility* (CSR). The latter we discuss in several contexts in this chapter.

The former is normally a part of quite detailed and country-specific legal regimes that focus on the governance and disclosure systems of major corporations—certainly a major source of ongoing attention in the EU and the USA and is beyond the scope of this chapter. The concept of CSR, is a much newer, broader and currently far less defined concept that has, at least in the near term, major political, social and even economic dimensions. CSR also has a broader international ambit than *corporate accountability*, even with the impetus that was created to take transparency and anti-corruption regimes international by the enactment in 1977 of the USA *Foreign Corrupt Practices Act* (FCPA).

The best wisdom we have heard in comparing these regimes and summing up their differences came from leading lawyers at an *IBA Regional Conference* held in Lagos, Nigeria, in 2004, titled "Developing the Law as an Instrument of Social and Economic Rights", and attended by some 650 lawyers. Ramon Mullerat, a Spanish lawyer who was then co-Chairman of the *IBA's Human Rights Institute* made the same basic point that the concept of CSR is far broader than, and hence distinguishable from, the narrower concept of corporate accountability. The latter focuses on the effectiveness of existing governance and disclosure systems of major corporations—not surprising in light of the massive corporate scandals that have rocked both the USA and EU over the last decade.

In contrast, CSR embraces a much broader concept of corporations themselves voluntarily deciding to respect and protect much broader interests than those of their corporate shareholders, or even of their employees. As noted by a leading Nigerian lawyer, Mr. I. Odeleye, the *Company Secretary* of Shell, Nigeria, there is no universally precise definition of CSR. It embraces, he said, a wide range of "often competing or conflicting environmental, economic, human, and societal imperatives". We discuss CSR a good deal in this chapter and for this rely on this definition.

3.4 *Meeting the real challenge in ethics and Corporate Social Responsibility (CSR) in infrastructure industries: By melding two fundamentally different experience and capability bases—Those of private developers and those of state-owned enterprises (SOEs)*

Recognizing the enormous challenges for achieving ethics and transparency that have faced traditional SOEs, and then compounding it by the enormous scandals that rocked the private sector entry of IPPs into the international power scene (symbolized by the disease of *Enronitis*) would seem to exacerbate the difficulty of tackling these problems. However, putting these two entity types together by creating workable PPP models could have exactly the opposite effect. The potential for *on the job* cross-education in production and achieving synergies in business relationships, and for cross-education on CSR and ethics, may need a carefully crafted corporate structure that would meet these needs on several levels and the PPP models may be the best way there. Because of their

dramatically different backgrounds, the very notion of an effective business partnership between these SOEs and private developers will require careful attention to all the issues of corporate accountability (to shareholders, stakeholders, and the public), transparency and anti-corruption; and then careful analysis, development (and, ideally, testing) of potential models for PPP relationships. So let us give some attention to the PPP concept—what it actually means in practice; and what it will take to really achieve it.

Some of that has been started—at least conceptually—within organizations such as the *International Bar Association* (IBA). For example, at the *IBA's Sixth Conference on Project Finance* (a series which focuses heavily on the challenges facing the infrastructure industries, especially in LDCs), several panels focused on the challenges in putting effective PPPs together, especially in the light of the world's infrastructure shortfalls. Ensuing panels focused on emerging models for PPPs and their growing role in the design, construction and operation of *social infrastructure* (social housing, hospitals, defence institutions, etc.); and others focused on the emerging challenge of CSR, and the role of funding mechanisms in contributing to sustainable economic growth.

Several programs at the *IBA's Annual Meeting* in Chicago in September 2006 had similar themes, covering both the infrastructure and mining industries.

4 EMERGING SOLUTIONS: NEW LEGAL AND INSTITUTIONAL MODELS FOR SAFEGUARDING ETHICS IN INFRASTRUCTURE INDUSTRIES

4.1 *Public-Private Partnerships (PPPs)—A new paradigm for effective development; or a horizon too far?*

PPPs have become a popular concept, certainly in the legal and business circles. They are now mentioned so often that one might fear that they are more an ephemeral fad rather than an emerging reality. Our sense is they are the latter—but that they do need far more definition and attention as to how they will actually be constructed and how they will operate. In the legal circles, there is indeed a good deal of attention to these issues of definition and operation; and the experiences of different legal systems and institutional models for implementing them are being examined more closely. So what are they; and how are they best constructed and what challenges do they pose for the ownership and management of water enterprises? The concept is still in the relatively early stages of development in the infrastructure industries; and they pose special problems for its application. But there are interesting array of experiences from the different legal systems; and their applications in different countries, including developing countries where the water supply needs are most urgent.

One of the more interesting presentations we have heard on PPPs, by Professor Doug Jones from Sydney, Australia, focused on the advantages of PPPs as delivering value for money while protecting the public interest. He also noted a number of *significant benefits* of PPPs to government purchasers (who are often the client in LDCs) for example by the *Australian Council for Infrastructure Development*. But there could be equal benefit to private partners, namely:

- Delivered earlier as private involvement more easily overcomes funding constraints.
- More efficient, due to market competition in the procurement process and their encouraging greater innovation.
- More efficient, mainly because the private side wants to retain customers.
- More broadly funded because private consortia have broader access to sources of capital than governments which often have to rely on guaranteed bonds which transfer the risks to the taxpayer.
- More maintainable because PPP structures encourage the private players to protect their investments and ensure a project's sustainability during its entire projected life.
- Better equipped technologically because the private parties generally have better access to technologies that have worked in similar projects than do government enterprises acting on their own. And (perhaps most vital).
- More likely to be economically sound, usually based on careful due diligence studies, because they are motivated by financial and not influenced by political objectives.

While these observations are based primarily by the experience of the Australasia and surrounding regions, they appear to us to be of universal, and especially applicable to striking the necessary balance between ethical focus and economic sustainability in the water arena.

4.2 *The NRECA Rural Electrification model for community ownership, control and partnership in expanding capacity and service*

One of the biggest challenges for achieving effective and sustainable infrastructure development and management and hence sustained investment to expand capacity and consumer coverage has been the inability to gain the close working relationship between providers and consumers. Such close working relationship would reduce the potential for serious abuses on both sides that we have noted earlier in this chapter. In industries with major elements of public ownership and social need, such as water and electricity, bridging what can in some societies be enormous gaps between the perceptions of business operators, state-owned providers and consumers (especially small residential consumers), and creating a viable and sustainable business model that is based on commercial principles, is a special challenge.

One experience from the electricity sector that, over several decades, developed an institutional, business and social model that confronted these challenges with considerable success is the so-called *rural electrification* model. Another, of potential application to all infrastructure sectors with a strong public/governmental interest, is, of course, the PPP model we have just examined.

So let us now focus on the rural electrification model and see if it has any useful lessons for the water sector. In the 1930, USA faced similarly challenges on rural electrification as many of the LDCs of today are facing, namely that power plants and distribution systems located themselves close to the major city areas and supplied electricity only to urban and peri-urban populations and there was a void in the rural areas. As a response to the Great Depression of the 1930s—the USA Congress voted funds (relatively modest by modern standards) to create a program and fund the *rural electrification* (RE) scheme. This scheme over the next two or three decades helped change the face of the USA industry and create almost universal coverage. This in turn helped spur economic recovery and growth. At the heart of the RE model was the notion of local communities taking the initiative to set up their own consumer co-operatives and act as business entities, at least in the electric *distribution* function of procuring power and supplying it locally through their own distribution *wires* systems. Sometimes, they have also gone into the supply function (generation and transmission); but often they have acted simply as wholesale purchasers of power.

The model was so successful that the several hundred rural co-ops formed a national organization (NRECA) and then, after World War II, decided to take their model international with major initiatives in several countries. Of these, two in particular are often used by NRECA as case studies of success stories, namely that of Bangladesh and Bolivia. More recently, NRECA has shown interest in taking its model into Africa; and we have helped NRECA carry out initial surveys of several African countries as possible candidates for pilot schemes—recognizing that successful pilots will be very dependent on aligning the RE initiative with the evolving power sector regimes and reform programs, and the local government regimes, that are distinctive to each country analyzed—but may face similar challenges.

Recognizing the enormous turn-around the model has made in expanding coverage for populations, especially un-served rural populations, in the electricity sector, we believe the lessons of its success (and failures where they have occurred) should be analyzed and a specific model developed for the water industry by taking note of the differences between the two sectors. Once developed, it should be applied to the water industries in developing countries with the same rigor—and with the initial financial support of the IFIs and bilateral funding agencies, and perhaps of the major private sector players in the international arena. It is interesting to note how little of this experience was drawn on in the MCC's initial due diligence of the Mozambique water sector.

4.3 *The Inter-American Development Bank's Building Opportunity for the Majority (BOM) model*

A much newer model—in fact still in its formative stage—is an initiative being launched recently by the *Inter-American Development Bank*. It is designed to develop a new approach to the IDB's entire development program and it focuses on how to bring all levels of governments and the IFIs under coherent development policies that will reach all levels of societies. The IDB published a primer on the subject to launch its debate on the program. The IDB envisages that the program will be developed over the next 5 years (2007–2011) and implemented over even longer timeframes.

Because of the relative infancy of this BOM model, and of the program to conceptualize and launch it, we will not dwell at length on it here, but only note its high level of potential relevance to the subject of this chapter and the many creative ideas it is already fostering. Indeed, the primer has a specific chapter titled *Reaching the Majority by Improving Access to Basic Infrastructure Services*.

4.4 *The New Anti-Corruption Initiative of the US Overseas Private Investment Corporation (OPIC)*

One of the most significant and directly relevant initiatives of current interest to our topic is the launching in September 2006 by OPIC, the USA Government agency with a mandate to promote international development and protect USA investments abroad, of its *Anti-corruption and Transparency Initiative*. Most notably, it has been identified by *Transparency International-USA* (TI-USA)'s Chairman, Alan Larson, as "an important element of the USA government's anti-corruption agenda", in part because it "recognizes the critical role of the private sector in reducing corruption and its provisions promise to enhance standards of international business conduct".

The *Initiative* is supported by an impressive 32 page *Anti-Corruption Policies and Strategies Handbook* that lays out the legal basis for, and the specifics of OPIC's "general anti-corruption policies and procedures", including its role in the *Extractive Industries Transparency Initiative* (EITI) that has received so much attention in countries such as Nigeria. The *Handbook* provides a detailed overview of both the bribery and accounting dimensions of the *US Foreign Corrupt Practices Act* of 1977 (FCPA), and the role of OPIC and other agencies in implementing and enforcing the FCPA and its anti-bribery provisions.

Because OPIC's role is so central to facilitating USA private sector investment in developing countries, especially in the infrastructure areas, the OPIC's anti-corruption programs and initiatives, has a special relevance to the subject of water ethics.

5 THE ULTIMATE CHALLENGE: RAISING PRIVATE CAPITAL FOR WATER INFRASTRUCTURE EXPANSION

5.1 *New funding options for the water & sanitation infrastructure and service sectors*

There is a continuous and growing war cry over the enormous sum of funding that will be needed to achieve the *Millennium Development Goals* (MDGs) for the water and sanitation infrastructure and service sector. A *Lehman Brothers* report produced over 4 years ago projected that 689,000 million € will be required to achieve the MDG's relatively modest targets for water and sanitation, let alone what will then be required to exceed these goals and to continuously sustain the water and sanitation infrastructure and service delivery in communities around the world.

It has been generally acknowledged that grant financing from governments and IFI's cannot alone serve the extensive financial investment needs the global water and sanitation infrastructure and service sectors. As a result, much attention is being given to the exploration of other kinds of viable financial tools and mechanisms that could effectively contribute to creating sustainable sources of cost-effective long-term funding for water and sanitation infrastructure projects and services—not only in developing countries but in the OECD countries as well. New initiatives to

develop and refine these tools need to be pursued by development banking institutions like the *World Bank* and the *Inter-American Development Bank*, but also by aid institutions like *United States Agency for International Development* (USAID), *Department for International Development* of the United Kingdom (DFID) and *Japan Bank for International Cooperation* (JBIC); and by function-specific government agencies such as the *United States Environmental Protection Agency* (USEPA). These efforts are not only about implementing targeted donor grant assistance more effectively, but also about identifying innovative means to better leverage private sector resources.

5.2 *Overview of new financial tools and mechanisms*

Much analysis has been done in this area by the so-called *Financial Tool's Taskforce* of IPWA. The following serves as a general overview of the new funding initiatives that are being pursued for the water and sanitation services. Many of these are local currency funding vehicles—funding options such as local bank financing at more acceptable rates/longer tenors, local capital market development, pooled financing vehicles such as revolving funds, and a more expanded use of guarantee instruments. A brief overview of each of these financing options is given below.

5.2.1 *Local bank financing at more acceptable loan terms*

There is a need to encourage local banking institutions in developing countries to lend funds for infrastructure projects at better terms—longer repayment periods and lower rates. Without improved lending terms from local commercial banking institutions, it will continue to be difficult to finance water and sanitation infrastructure, and infrastructure-related investments, through local banks, simply because these kinds of investments may not yield sufficient revenues in the short-term to repay the types of loan local banks can finance. Additionally, the onerous collateral requirements that are often required by the local banking institutions can create another burden for the water and sanitation infrastructure and service projects seeking local bank loans. The local banks are making lending decisions that are mostly based on the existing value of the assets pledged at the time of the loan request, rather than requests based on the project's expected future cash-flows and revenues. Efforts to change the perceptions by the local commercial banks of infrastructure project financing, or to extend the use of partial guarantee/credit enhancement tools, need to be accelerated in order to expand the role of local bank financing as a viable resource for funding in-country water and sanitation infrastructure projects and services.

5.2.2 *Local capital markets development*

The international development bank and aid institutions (*the IFIs*) cannot wave a magic wand and instantly create robust capital markets in developing countries (along with robust credit markets). The challenge of creating sustainable local capital markets is considerable, as we have witnessed in developing countries in which we have worked, such as Nigeria.

However, all IFIs recognize that the absence of such markets is an impediment for achieving sustainable economic growth. Efforts are being pursued by all the development banks and many of the aid institutions to work with the governments of developing countries on the specific goal of establishing sound and transparent local capital markets frameworks. They acknowledge the potential role that local equity and bond markets can play in attracting untapped local institutional funding resources, and in creating the long-term funding engines that could dwarf the IFI funding efforts. Indeed, one of the best outcomes any IFI can have in an infrastructure sector is to be able to exit from a country after the funding has been so successful that IFI funding is no longer needed. Through the local equity and bond markets, these resources can be used to fund water and sanitation infrastructure projects and services.

There are select initiatives in place that involved the establishment or rather implementation of capital market bond issues at the sub-sovereign level. Through the use of credit guarantees extended by an IFI or an aid institution, local authorities such as the city of Johannesburg in South Africa (the IFC), or the State of Tamil Nadu in India (USAID), and the State of Tlantelpantla in Mexico

(the IFC) issued municipal or state bond in local currency which were then used to fund water and sanitation projects in the respective region.

5.2.3 *Pooled financing vehicles such as revolving funds*

The concept of pooled financing vehicles such as revolving funds to help support local government borrowing for infrastructure project needs is not new. Many OECD and developing countries have set up pooled financing vehicles of various types to help facilitate the borrowing needs by the local governments. Most of the vehicles were set up with a limited objective in mind which was to serve as pass-through institutions that would appraise the viability of projects and then lend to the projects if selection criteria are met.

Most of these were set up to serve a general goal, namely that of financing a wide range of sub-national infrastructure projects. The goals of these pooled financing vehicles are similar to those established by the *State Revolving Fund* programs in the USA (one of the oldest pooled financing programs in the world). Essentially pooled financing vehicles exist to help small and medium-sized local governments take advantage of more favorable bond or loan terms by pooling the borrowing needs among several sub-national/local government entities. These smaller municipalities, by participating in a pooled financing vehicle, can essentially take advantage of economies of scale and shared risks. Pooled financing vehicles implement operating principles that seek to enhance security and raise credit ratings of the participating municipalities to levels far higher than they could achieve on their own.

Pooled financing vehicles such as *State Revolving Funds* (SRF's) can help smaller municipalities and local government entities have better access to municipal credit markets. Often the access to municipal credit markets is cost effective only to larger municipalities or local government entities and to authorities that need to access large amounts of debt financing through bond issues or competitively priced bank loans. It is simply too costly for smaller and some times medium-sized municipalities to access smaller quantities of funds at competitive prices.

To tackle this problem, larger pooled financing vehicles (with better credit ratings) can borrow funds or issue bonds at more competitive terms and then lend a part of the proceeds to the smaller municipalities at more attractive terms than they would receive on their own. While there are extensive efforts still being pursued to push the establishment of pooled financing vehicles in developing countries, there are select success examples already in place including those in Colombia, India, the Philippines, and Brazil. For example, in India, there is the Tamil Nadu *State Municipal Fund* that is modeled on the USA SRF format. In Colombia, the financial intermediary called *Findeter* has facilitated funding to local municipalities and in Brazil, a financial intermediary called *Paranacidade* is in place within the State of Parana to facilitate funding to local municipalities. In the Philippines, there is the *Municipal Development Fund*. Often these financial intermediaries essentially act as *pass through* institutions which appraise sub-national/municipal infrastructure projects like water and wastewater infrastructure projects and essentially *retail* central government and multi-lateral development bank lending to the numerous local governments seeking funds for infrastructure projects.

5.2.4 *Expanded use of guarantee instruments*

Guarantee instruments are tools that can help build robust local capital markets and local credit markets. They can also encourage financial innovation, new types of financing, and promote structured finance techniques.

A partial loan guarantee helps reduce a lender's risk by lowering the lender's potential loss in the event of a loan default. A guarantee from an institution with a *Triple A* rating enables the local commercial banks to lower the reserves that they need to set aside for a loan. Additionally, the provision of a guarantee can reduce the collateral requirements being imposed by the lender as well as extend the repayment period that the lender is requesting for the loan. And a partial bond guarantee can improve the terms of a bond being floated on behalf of a municipality or government entity that does not possess the favorable bond rating on its own.

It has been noted that infrastructure projects, and particularly water and sanitation infrastructure project and services, face a unique set of challenges. They required long-term lending and in local currency in order to avoid currency depreciation risk. And they need to receive investment-grade ratings.

Partial guarantee instruments can provide the necessary credit enhancement that can improve the terms and length of the bank loan or bond issue. They can contribute to lower collateral requirements. The use of partial guarantee instruments can also help harness the financial resources of the local private sector and open the doors of their participation on the local domestic credit and capital markets. This in turn can help fuel sustained economic growth. Partial guarantee instruments can be a mechanism for unlocking some of the liquidity within the commercial banking system and allocating the capital for productive and much needed water and sanitation infrastructure projects and services.

Various development banks have begun to actively use partial guarantee instruments to stimulate the development of local capital markets, local commercial bank financing, and sub-sovereign financing of infrastructure projects without the need of a sovereign guarantee. Notable recent successes have been the use of a partial bond guarantee extended by USAID for a sub-sovereign bond issue in Tamil Nadu to set up a revolving fund-type vehicle and a partial bond guarantee extended by the IFC for the city of Johannesburg to fund select infrastructure projects. DFID through the *Private Infrastructure Development Group* (*PIDG)'s GuarantCo* product and IADB (*Inter-American Development Bank*) also offer partial guarantee instruments directed at the sub-sovereign government contingent.

5.3 *Challenges to implementation of new financial tools and mechanisms*

There are two final thoughts that must be raised when discussing the implementation of new financial tools and mechanisms. One is the critical importance of establishing the appropriate and viable legal, financial, regulatory, and institutional frameworks that support and guide the proper use of these tools. It must be incumbent upon the country governments to put a workable and transparent system or framework in place in order to ensure effective, legitimate and ultimately sustainable employment of these new financial instruments. This observation holds true both in OECD countries as well as developing nations.

Lastly, the implementation of new financial tools and mechanisms cannot be fully realized unless there are viable bankable PPPs and/or bankable utilities that are available to take advantage of these new funding options. Consequently, it is also important that more effective bankable models be designed that can ultimately turn troubled service providers into bankable utilities by involving more competent management, recovering O&M costs, and implementing acceptable and realistic tariff structures and transparent tariff collection plans.

Without the implementation of appropriate and viable legal and business regulatory frameworks, or proper PPP project design options, an effective sustainable long-term use of new financial vehicles will be difficult to achieve.

6 CONCLUSION

The following are the main conclusions of this chapter:

a. The vicious circle of inefficiency in service from producers/suppliers and consumer nonpayment, or NRW, is one of the biggest economic and social challenges facing the water industry in many developing countries.
b. The economic fallout from this *vicious circle* is to greatly limit the volumes of private sector investment needed to complement public sector expenditures in infrastructure in order to achieve the desired goal of universal access to potable water.
c. The development of new business models for developing public-private partnerships, drawing on the experience of PPP models from other infrastructure sectors, would be a good starting

point for achieving the needed levels of corporate accountability, transparency and economic sustainability that are required to break the vicious circle and enable the drive to achieve universal water and sanitation coverage of all population segments.

d. These new business models need to be supported by the creative use of emerging mechanisms for project financing, local capital market development, pooled financing funds and the expanded use of IFI guarantee instruments.
e. The ability of these business models and financing mechanisms to achieve the desired economic and social goals (such as universal access) will require the adherence of both suppliers and consumers of water services to sound ethical practices relevant to their functions. Water ethics is central to these business and financial building blocks for universal water service.

CHAPTER 15

Water ethics and business

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ABSTRACT: This chapter takes a holistic view of the challenges involved in modern water and wastewater management. It argues for the inclusion of private business and industry in managing some of these challenges. It seeks to examine, from a standpoint that combines practical and ethical considerations, the relative roles and boundaries of the areas of activity that are appropriate for governments, business and civil society. In particular, it looks at how this kind of approach can be used to clarify questions about private ownership and management of water.

Keywords: Ethics; Ownership; Water services; Human rights; Water governance; Private sector; privatization

> "*Treat people as if they were what they ought to be and you help them to become what they are capable of being*."
>
> Johann Wolfgang von Goethe

1 INTRODUCTION

There is no sound reason to contest the role of business in water on the grounds of ethics. There is however a strong basis for using ethics as a guide to resolving the many complex relationships, decision-making and management actions that are inherent where water issues are concerned in all societies.

This chapter examines water ethics in relation to two sensitive and related issues. It seeks to clarify the confusion and emotion that exists around the concepts of the ownership of water resources and the management and operation of water services delivery. It identifies and clarifies the ethical issues that arise from these two questions. In particular it seeks to answer the question: what should be the balance between the public and the private domain in water resources management and how this should be determined?

Private here is limited to the role of business and industry. This excludes the important dimension of agricultural water uses, as well as domestic uses. However, all of these are inter-related and inseparable in practice.

The chapter deliberately avoids a more general discussion of business ethics, preferring to concentrate specifically on issues relating to water.[2] It seeks to differentiate between theoretical concepts and practical aspects that arise from implementation in the *real world*.

[1] The ideas and opinions expressed in this chapter are personal reflections and responsibilities of the author. They should not be taken as a representation of the position of any organisations with whom he works or is associated.

[2] There is a significant body of literature on this subject and measures and ratings are now produced. A useful summary of key issues is contained in *Ask the Experts* interview with A. Persaud & J. Pender, published in the *Financial Times* of August 21, 2006.

2 WATER ETHICS AND HUMAN RIGHTS

In the culture of the *North* there is a natural inclination to link any discussion of water ethics with the concept of human rights. This starting point would be contested by people with other cultural backgrounds. The rights based approach has nevertheless been adopted here.

2.1 *Three dimensions of the water ethics and human rights discussion*

Much discussion on water ethics and the *Human Right to Water* concentrate on the point of view of individual human rights. This is a reasonable starting point because of the vital need to have access to a minimum and reliable quantity of water to sustain survival, and a dignified and healthy life for each individual. From this standpoint, the rights of the individual are given the central position and overwhelming importance. The elaboration of the concepts follows the intellectual evolution of rights thinking. This takes a viewpoint where *immaterial* rights exist. The human rights approach confirms and defines these individuals' rights and sets up systems to ensure their protection. It often neglects that *material* rights such as water and sanitation have concrete and practical aspects because these rights actually have to be delivered. Exercising the right to water requires adequate quantities of water, in a regular and predictable manner and of sufficient quality, as well as sanitation, to be made available to everyone. Having a right to water, but no water is not a satisfactory position. Thus, focussing solely on individual rights is insufficient and can even be counter-productive. There are two other viewpoints that need to be taken into account and balanced with this first one.

The first of these viewpoints is the collective rights and ethics that enable a community[3] to function as an organised entity: the communal dimension. This dimension is essential for the effective functioning of any integrated community. There is a requirement to take and enforce collective decisions that reconcile the needs and powers of different segments of the community, its individuals and their activities. It is important that the *water cycle* within the community is managed in such a way that both individuals and the group as a whole have their needs met. This approach requires the integration of a sustainable development approach to ensure that social, environmental and economic concerns and constraints are embodied in the process in a balanced and equitable way.

Water and sanitation service provision embraces a series of very tangible and practical elements of delivery. This leads to the necessity of the third dimension, which is the rights and ethics of the providers of water and water services. In this context it does not matter what form this provider may take; communal organisation, public or private entity, formal or informal. Service providers need to be treated fairly and predictably by both the community and the individuals they serve. They in turn have to respect the rights of the individuals that make up that community and also the rights of the community as a whole.

It needs to be stressed that these three viewpoints are separate and distinct, but they are also interlinked by intricate relationships which will be examined later.

There is a complex set of relationships to be maintained between these three concordant positions. Balancing the three kinds of rights and interests in this triangular set of relationships, requires a system of ethics that is accepted and acted on by all the stakeholders involved (Figure 1).

2.2 *The individual exercises ethics*

Whilst rights and ethics may be individual, collective or specific to a provider, their actual exercise is dependant on the action of an individual. Both individual and collective action is the result of decisions taken and behaviour exhibited by individuals. They may act on their own or as a group, but their actions are based on their own set of values and judgements—that is their own ethical

[3] For the purpose of this chapter, *community* means any collective and organised society of any scale, from the smallest village unit to a large conurbation.

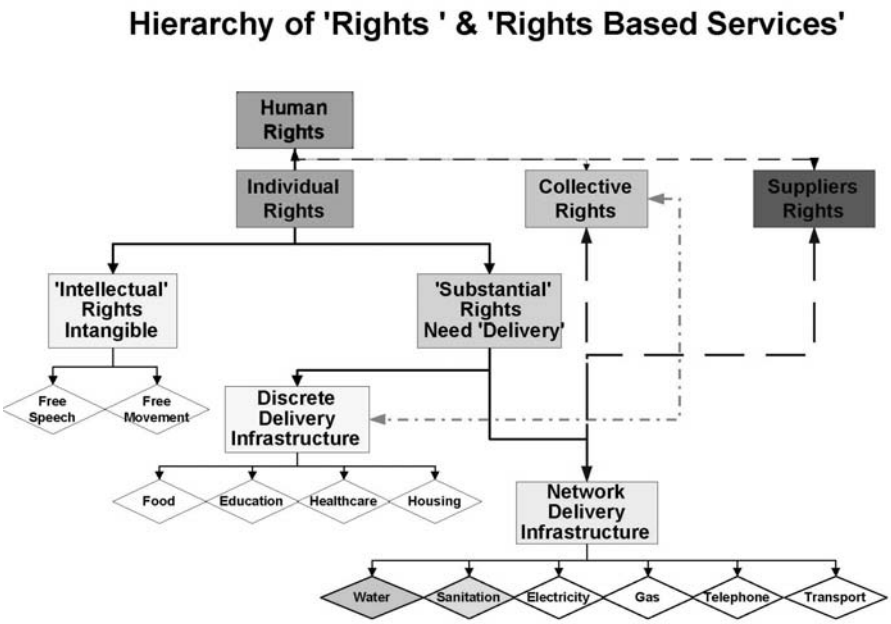

Figure 1. Hierarchy of human rights and linkages between individual, collective and supplier's rights.

position. What conditions this ethical position, the resulting ethical behaviour and how it varies, is a fundamental and neglected dimension of water governance.

3 INFLUENCING INDIVIDUAL'S WATER ETHICS

Water has a special relationship in people's minds and activities that make it one of the fundamental elements that underpin all their ethical thinking and behaviour. There are some more or less universal elements to this, but also many that vary with different sociological, geographical, religious and temporal dimensions. These complicate discussion, because they lead to different communities having different sets of underlying principles when thinking about the same basic issue. Some of the most common viewpoints are as follows.

3.1 *Water is life*

Water is life is more than just a slogan. It is a deeply held understanding of the absolutely vital role that water plays in survival, not only of humans, but of all forms of life. This almost certainly results in a subconscious concern within each individual to maintain, preserve and defend the access to the water that they need for their own survival. This concern can easily be transferred into emotions that can be triggered even when there is no real threat or pressure on the water needed by that individual.

There is a very real and justifiable basis for this view of water being a fundamental part of an individual's ethical framework. It also leads to the ethical need to recognise the importance of water for other individuals and other forms of life.

The same deep rooted emotions can be manipulated to meet other objectives. They can provide a fertile ground in which doubts and uncertainties can become matters of major concern to individuals and groups.

3.2 *Water is community*

One is not used to hearing the slogan *water is community*, but it is equally appropriate. As outlined above, water management is one of the essential parts of the organisational structure of community life. This function can be seen even in some of the simplest family groups, and generally becomes more complex and important in response to situations of water scarcity or increasing population density. This is clearly demonstrated by the way water that is ignored for much of the time, leaps to the head of preoccupations in almost every humanitarian crisis.

The combination of the *water is life* view with the understanding that *water is community* is an explanation for water's central significance in many forms of religion.

3.3 *Water, one of the four essential securities*

Life requires four interlinked and interrelated basic securities (Figure 2): water security, food security, energy security and territorial security. These are essential to individuals as well as to communities, industries, states and the planet as a whole. In a sustainable situation it is not possible to have one of these securities without the others.

There is a minimum level of security that is necessary for an individual, community or a business to survive. Adequate security requires larger quantities of any of these essential securities to permit reasonable individual and collective lifestyles and reasonable business success. Excessive security can lead to wasteful, unsustainable behaviour that eventually leads to the breakdown of societies, the environment and economies.

3.4 *Lifestyles*

Another dimension is particularly relevant in the domestic water use context. This is the way perceptions and reactions change as societies evolve away from subsistence situations. At subsistence

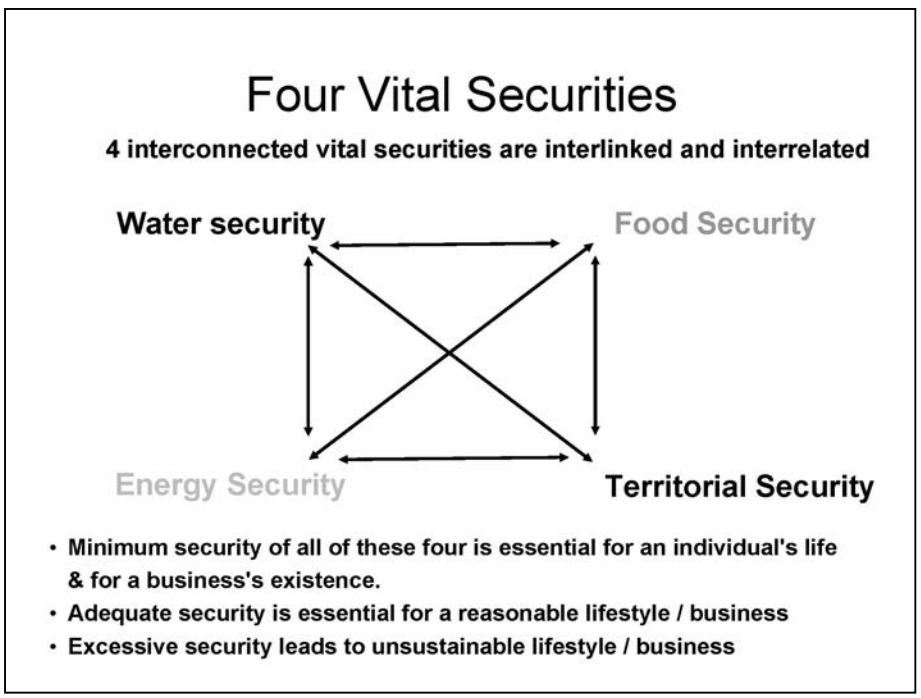

Figure 2. Linkages between four vital securities.

level people's preoccupations are to have sufficient quantities of water, then reliability of access and then quality of water. Once these needs are met on a regular basis, a certain level of access becomes an accepted norm. The same people will take those aspects for granted and start to look for additional attributes such as continuity of service, reduced cost of delivery or quality of accompanying services. They may eventually seek other attributes such as water for leisure or even fashion statement uses.

4 COMMON GOOD

Water is often seen as a *common good*[4] and this seems to be consistent with the picture painted above. In the declining number of cases where water is abundant and demands on it are few, the challenge of managing this common is not great. However, in the world today, the issues of effective management of water are becoming more and more important. These issues are evolving and the challenge will become increasingly difficult in the future. Population growth, increasing food production and changing lifestyles increase demand. Climate change and manmade pollution reduce the availability and reliability of the water needed to meet these demands. Multiple uses lead to multiple impacts and increases potential tensions between different users at different times. Some of the changing pressures are predictable and others are less so. Some occur very slowly. Others manifest themselves very suddenly and with catastrophic consequences.

This is not a problem that can be adequately managed as if it were a simple steady state. It is not one that can be managed by any *actor* independently of all others. Allocation of available water resources can not always be managed on a *win-win* basis either. Unfortunately there are often winners and losers. To make matters worse there is rarely, if ever, the information and data needed to enable decisions to be taken, monitored or adjusted in an appropriate manner. If the information needed is available, are decision-makers all equipped and prepared to use it?

Against this background, it is scarcely surprising that in so many situations the *crisis of the commons* is amply and tragically illustrated by examples in water and sanitation. In a *crisis of the commons* situation, life tends to become a *free for all*. Everybody becomes constrained to look after themselves as best they can. This tends to favour those who have fewer principles and lower levels of ethical behaviour over those who have strong positions and ethical values with regard to others.

4.1 *Beyond a messy problem*

Following a multi-stakeholder forum held in Switzerland in 2002 (*The Rüschlikon Conference on Sustainable Water Management*), the workshop report (Anderson & Hall, 2002) suggested that the challenge of sustainable water management is a classic example of what management consultants call a *messy problem* (Conklin & Weil, 1998). This is certainly a better way of looking at the question than to consider it a linear problem. Even the messy problem approach is probably too simple for water. If some modern societies are to avoid the kind of collapse discussed in a the book by Jared Diamond (2005), the organisation of these extremely complex problems will need to break away from *rock logic* and harness the power of *self organising systems* (de Bono, 1999). Such systems will almost certainly need to integrate ethics as a key component.

5 DETERMINING WHO DOES WHAT IN WATER

There are many different and all equally legitimate claims, rights and obligations that concern water. Dealing with the complex interrelationships of all these between the many different stakeholders is

[4] Some people contest the *good* element of the term *common good*, claiming that water is so important that it should not be treated as if it could be considered as having any monetary value or merchant value.

beyond the scope of this chapter. It is something the author attempted to clarify in an earlier paper on water governance (Moss *et al.*, 2003).

To clarify who is entitled to water and the counterpart to these entitlements, it is helpful to look at a number of practical principles. The following six interrelated concepts give a good platform for constructing a societal water ethic.

The concept is to establish what are the roles, responsibilities, rights, recourse, risks and rewards (*Rs*) that each stakeholder should both enjoy but also recognise and accept for others.

It may be tempting to look at these 6 keywords in pairs. However, when one looks more deeply, each of the keywords is related with all the others. Ultimately they need to be considered in a fully integrated fashion.

5.1 *Roles and uses*

Every individual and all organisations have numerous different roles to play and interests to protect in their use of water. The intensity of these interests and whether the roles are active or passive can change very rapidly in place and time. In many cases different roles can be contiguous with each other. They are nevertheless separate. To be able to resolve many of the challenges that face orderly management of this complex public good relationship, it is necessary to identify all the roles for each individual or group with as much clarity as possible.

It may seem simple to divide water usage into domestic, industrial, transport, agricultural and so on. In practice this kind of simple subdivision is inadequate. The domestic use of water for human hydration does not bear the same weight as water used for household cleaning or for domestic leisure purposes. The water used for subsistence agriculture cannot be viewed in the same way as water employed for industrial beef farming. It is not so simple to allocate priorities between different uses and users, because of the interdependencies between them. This is a challenge that is fundamental to managing water and has been given due importance in this chapter.

5.2 *Responsibilities*

As a counterpart to the roles of individual users and uses one can recognise the responsibilities associated with them. Such responsibilities are not limited to using the water wisely for the purpose in question. They also require the user to take account of the impact its use can have on the enjoyment by other people of their legitimate roles. Even if roles can be defined and allocated to particular parties, the responsibilities for many aspects of the water cycle may need to be shared between those exercising different roles.

5.3 *Rights*

The *rights* of stakeholders are those positions discussed in Section 2.1. They are the interplay between the individual, the collective and the provider's rights in relation to the roles and responsibilities that have been defined. Roles are placed before rights in this discussion, but this has been done deliberately because the rights will not be the same for different roles.

5.4 *Recourse*

Recourse is the procedure and cure available to a stakeholder in the case that rights have been infringed, denied or in some other ways interfered with. As with the other ethical principles outlined here, recourse needs to be equitable to all parties with respect to the roles and responsibilities accorded. One of the challenges is to determine who can adjudicate over infringements, related recourse and how can this be done equitably.

5.5 *Risks*

The risks associated with water are extensive in both number and nature. Water related risks range from shortages to excesses of water, direct and indirect impacts, quality, health, environmental, economic and many others. Water related risks are also very variable over space and time. They affect different stakeholders in different ways. Different people or organisations may have different capacities to overcome similar water related or water induced risks. In some cases one stakeholder may be able to help others face or overcome a risk. In other cases inappropriate action by one stakeholder may worsen or even create a water risk for others. For all these reasons the identification and allocation of risk to different roles is important and can only be completed successfully if an equitable and ethical approach is adopted.

5.6 *Rewards*

The question of rewards needs to be examined from two standpoints. One is the rewards or benefits that a stakeholder should be allowed to enjoy as a result of the water allocation that has been granted. The other is the reward or recompense that a stakeholder should be entitled to for absorbing a risk for others or providing a water-related service.

The first of these carries the ethical responsibility of the *individual* use of the allocated part of the common. The second involves the collective ethics of a fair return from society to a stakeholder who takes on some individual role in the common good or interest. This can include providing a value enhancing service that enables the common to deliver greater benefits to society, or taking actions that preserve and protect the common interest or the environment.

5.7 *Moving from theory to practice*

These six keywords provide a basis on which to start to determine answers to the questions concerning water ownership and operations. They can be used to develop the basis of positions that are both ethical and also practical and applicable in the *real world*. However it also gives rise to next set of questions. How and by whom are these *principles* converted into action? How is this action to be sustained and adjusted in an equitable way? How are changing circumstances and priorities taken into account and adjusted to? What about unforeseen consequences?

Three levels of decision and action can be identified: individual, by a single person; collective, which are initiated through consensus; and political that are imposed by a political process.

In an ideal world one might expect individual decision to prevail. In reality, one can not expect even the most *ethically minded* individuals to be able to answer these questions dispassionately in all circumstances. It is sometimes difficult for an individual to have the information, understanding or even the impartiality that would be needed.

One could hope for some kind of *consensus decisions* emerging from collective discussions among stakeholders. In reality this is also likely to have its limits. Lack of information, time and understanding are also a problem here. In addition there is the problem of the weak voices, not to mention the *voiceless* stakeholders.

The individual and collective application of the six principles enumerated above will certainly help, but can they go far enough? Both individual voluntary actions and consensus can be a big help, but they are likely to come up against real difficulties at some stage. The probability that such difficulties will crop up increases when a party is asked to *give up* an advantage it already enjoys in favour of another party, or where there are perceived asymmetries in the power of different parties. These kinds of situations are likely to lead to impacts that require an arbitrating decision to be taken and enacted. This creates the necessity for government and governance.

Individual and collective actions are necessary and need to be encouraged. Their effectiveness is greatly enhanced when they are underpinned by a system of shared values and ethics, but they also have practical and ethical limits. The most important of these limits being where one individual or group could take action that limits the rights and or freedoms of another individual or group.

This is an unethical and indefensible position and is not accepted in most modern democratic societies.

Communities at different levels give power and authority to governments[5] at the appropriate level. They place individuals in power to make this kind of, often difficult, decision in *the public interest* through the political process. Governments and the individuals that form them also need the guidance of ethics in their comportment. This is ultimately a product of the individual ethics of the people involved.

The need for actions to be guided by structured ethical principles has been stressed repeatedly. The set of six principles attempts to be practical by determining who does what, by what right and with what consequences. Throughout, the difficulties and complications have been stressed. It appears sensible to suggest that where an individual has the clarity of information and ethical basis to take a decision, such decisions should be taken individually. When this cannot be achieved the consensus decision is the next most appropriate step.

One could argue that government decision should be the last resort, to be used when the situation becomes too complex or involves too many parties for the other forms to be effective or ethically sustainable; in other words when the common good is too strongly in play for any alternative to work. In reality this may be the most commonly prevalent situation. As water stress increases, governments must prepare themselves to take more and more difficult decisions about allocation of water resources.

In the complex world of water, governments often find themselves presented with decisions that are essential, but very difficult to take. Such decisions may cost them *political capital*. They may be subject to a multitude of conflicting signals and special pressures. The timeframes which they have to work with are often not aligned with those required for the implementation of water policy and management. Frequently they also lack good information.

This shows that the world of water governance is one of complexity and imperfection. Complex decisions are required but these are almost inevitably condemned to be imperfect from the start. Faced with this realisation, societies have no choice other than to engage in a continual process of discursive political debate that constantly seeks to optimise the situation in the common interest of all parties.

It is necessary to examine in some detail how governments and private businesses interact in this process of discursive politics. We start with an examination of the roles and responsibilities of governments.

6 PUBLIC INTEREST—WHAT GOVERNMENTS MUST DO?

The essential roles and functions of any government are to plan, administer and police the common assets and interests to ensure the security, freedom and quality of life of the community that has empowered it. In the densely populated and closely interconnected world of today, this poses the difficult question of what community one is talking about. The case of water provides an answer to this, but unfortunately not a perfect one. It is advisable for all government decisions and actions to be devolved to the most local level possible. With this *caveat*, we can construct a generalised inventory of the tasks the government must fulfill to promote and protect the public interest in water. In practice these steps are part of an iterative and not a linear process.

6.1 *Consultation*

A starting point for the government to do its best to understand what the public interest of its community is. This can be done by collecting facts and opinions from all the stakeholders in the

[5] Throughout this chapter we use the term widely to mean any level of politically empowered government, from the most local to national level. This is not intended to obscur the differences that exist in the real powers and responsibilities of governments at different levels within a country.

community. This exercise is difficult even in small isolated communities. It becomes extremely difficult as scale and complexity increase. In addition it is a process that can never be completed because of the iterative nature of stakeholders' interests and their varying understanding of their own preoccupations and needs as well as the trade-offs they must be prepared to make with others.

6.2 *Collect and compile information*

Governments should also collect information about water resources, water uses, and water related risks from the various technical sources available to them. This data should be collated with the information gained from consultation to provide structured input to many of the processes outlined below. The size and complexity of this task presents an enormous and complex challenge. It is also necessary to recognise that even in the most sophisticated of today's societies this information will be far from adequate.

6.3 *Policy formulation*

On the understanding gained from the consultation process, including recognising the level of imperfection inherent in it, government should set out clear policies that will guide its own actions and those expected of all members of the community. The six principles outlined above should be a helpful guide. All such policies should be carefully reviewed from time to time to ensure that they meet current conditions that may have changed from the point when the policy was originally made.

6.4 *Allocation*

The challenge for governments is to allocate the water available to the range of uses required within the community. This has to be done in a way that is fair, efficient, and sustainable and recognises both public and private interests in water uses. In situations where water is abundant and demands few, allocation presents little difficulty. As demands increase in relation to the resource available the problem becomes increasingly difficult. When it reaches the stage where the reallocation of water requires that a stakeholder, who has hitherto enjoyed the benefits of water, gives up those benefits to other stakeholders, the problem can become very substantial. These decisions have to be made even if a complete consensus cannot be reached.

6.5 *Licensing*

In all but the simplest situations, it seems advisable for governments to confirm the allocation they have made with the system of *Licenses*. These can be in the form of permits to extract or discharge water in predetermined quantities for specified uses and at specific points.

The combined process of allocation, supported and formalised in some form of licence or other agreement, is critical and central to this discussion. It is the process whereby some part of the common good (or bad) is converted into a private interest. For this reason it is fraught with difficulties. These range from the weight of history, through various social conventions, to economic and security issues of the moment.

It is particularly important to note that while an allocation and its supporting licenses are in many ways an intellectual construct, the needs of different stakeholders to be able to access or discharge water are very real and practical. This is one of the dimensions that make the definition of the human *Right to Water*, and even more the *Right to Sanitation* so difficult. It is easy to say that everybody has a right to water and sanitation. It is not easy to define practically what this means or how to deliver the right in real terms.

The human right obligation to water has a higher priority than right for agriculture, power generation or industry. But does this always work in practice? Water is needed in the production of food necessary to fulfill the *Right to Food*. It is essential in the energy production necessary to alleviate poverty. It is vital to most business and industrial activity, even at the very small scale, that supports the *Right to Employment*.

The governmental processes and activities linked to the allocation of water and the administrative mechanisms that are needed to control and enforce it, must involve the whole water cycle. All stakeholders must participate fully and continuously. This is already difficult to achieve for the human stakeholders, particularly for those with *weak voices*. The *voiceless* stakeholders of the environment and ecology also need to be involved. The process can only be truly effective if all the stakeholders are engaged all the time. They should recognise the need to inform the government of their real needs and concerns. They should express their needs and concerns accurately and also with consideration for the equity of others. Governments should take all these needs and concerns into account and make their decisions in a way that make the best possible balance in the interest of all. This is often a practical impossibility; key stakeholders are not available, have no organised representative, sometimes show no awareness or interest. It is frequently impractical for all stakeholders to meet with sufficient regularity. Even if they could, they would probably not have the information necessary to inform the decisions that need to be taken. Governments still have to make these difficult decisions and therefore need to engage in a certain number of activities in good faith. Stakeholders need to empower them and also help and support them. This requires ethical behaviour and trust on all sides.

6.6 *Planning and anticipation*

Planning in relation to water management has many facets. Perhaps the most important is the land use and spatial planning that needs to occur at several different scales. It has particular significance at the urban level. The appropriate zonal planning determines what activities can and cannot be carried out in specific places because of the constraints or availability of water resources and the attendant infrastructure. Alternatively it may determine where water resources or ecosystems need protection against human activity and the issues related to flooding. This kind of planning has a fundamental impact on investment planning for both public and private infrastructure and therefore is extremely important in the trade-offs between the public and private interests. It can also have very significant impacts on the private freedoms to use land assets and on their market values.

6.7 *Investment*

Governments, usually at the local level, carry the responsibility of making the investments in the water, sanitation, irrigation and other infrastructure necessary to meet the public interest. This responsibility comprises both the physical and the financial aspects of establishing, maintaining, and paying for the infrastructure that they have decided is necessary to serve the community. In practice governments at all levels can delegate much of the *mechanics* of such tasks to the appropriate specialists.

6.8 *Costing and pricing*

6.8.1 *Charging and taxation*

All the stages indicated incur real costs for the community and therefore its government. They also create real and valuable benefits both for the community as a whole and for the individual interests that make it up. Sustainable water management requires governments to have long-term policies for covering costs. This means that they have the obligation to understand the totality of those costs and to recover them in a realistic and transparent way from the community and the beneficiaries. If they do not do this, they are effectively misusing the assets entrusted to them by the past and present generations to subsidise or penalise the future ones. Regrettably this is a behaviour that is commonly encountered in water and wastewater infrastructure and leads invariably to the downward spiral of system degradation because of under funding (Figure 3).

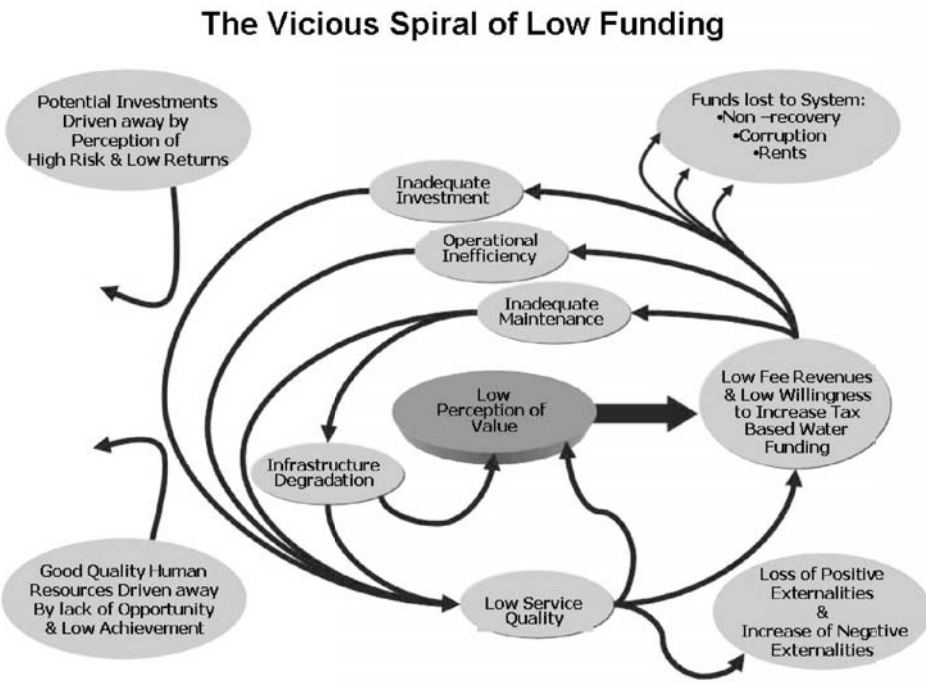

Figure 3. The *Vicious Spiral* of low funding that undermines water services and infrastructure.

In the long-term there are only two sustainable mechanisms which can recover costs. These are taxation or charges levied on water users (tariffs). In practice governments can use a combination of taxes and tariffs.

Overseas development aid (ODA) can be a very considerable help to local governments in establishing the initial infrastructure needed in their communities, but cannot be a sustainable solution in the long-term. Preferential development loans are also useful but eventually need to be repaid.

A fairly common, and politically understandable, trap is for governments to set prices as a function of what they consider to be the affordability of the services for users and the impact that this has on the poorest segment of the population. The result is that cost recovery is based on what the politicians think the poorest users are prepared to pay irrespective of the real costs. Frequently this leads to a situation where the costs are not covered by the revenues, which is clearly unsustainable. It creates a structurally non-viable system, which goes against a basic government objective, which is to create viable communities and conditions under which community members can prosper.

6.8.2 *Subsidies*

To overcome these difficulties, a government can turn to a variety of subsidy mechanisms. By this approach the real costs are recognised and recovery designed to cover them. A support system is then set up to help those who really cannot afford to pay. The fundamental principle being that some users will be asked to pay more than the costs alone would dictate so as to generate money that can be used to reduce the charges to be levied on other users. This is another example of where government needs to make trade-offs between elements and benefits of the public and private good.

A detailed discussion of pricing and subsidies is beyond the scope of this chapter. It should however be pointed out that this is a subject which is fraught with pitfalls and real practical difficulties. A good reference on this subject is Komives *et al*., 2005.

6.9 *Social policy*

To determine a subsidy policy effectively, a government needs to have in place a well structured and transparent social policy. The determination and execution of such a policy invariably involves decisions that cannot be taken by individuals. It also involves compiling and using information about the population that poses many ethical issues in its own right.

6.10 *Quality*

Recognising the need to manage water throughout the water cycle in ways that determine the quality of water for specific uses and the quality of used water discharges, it is normal for national governments to establish water quality standards within their jurisdiction. Here again we see the necessity for governments to constrain the activities of individuals, businesses and water service providers in order to protect public interest.

6.11 *Regulation*

It is pointless for governments to go through all the steps outlined above if these processes are not followed through so that both the governed and the government can feel confident that the appropriate actions are being carried out by the various different parties involved. This requires that policies and plans are backed with regulations and the appropriate agencies to enforce them.

In the complex area of water there is usually a necessity for several different kinds of regulatory agency. Some of these may be required to regulate the activities of parts of the government system itself. Others may be required to regulate water users and water service providers.

The independence, even-handedness and even the individual ethics of the regulator and the regulator's staff can be a very significant issue in the proper outworking of these principles.

6.12 *Enforcement*

The final step in this iterative process is enforcement. This is necessary to both encourage the activities that have been planned and to penalise parties that have not performed to the obligations that governments have set for them on behalf of the community. This is another example of something that cannot ultimately be done by private parties.

6.13 *Different stages of governmental development*

It is unrealistic to think that every government in every country should undertake all these tasks in exactly the same manner. Countries find themselves in significantly different stages of social and economic development and are subject to widely different geographical conditions. They have different traditions and legal structures. Some countries have complex water laws whereas in others it is unnecessary.[6]

6.14 *Practical issues*

The above provides some indication of the challenges that governments must face. However such a list ignores the many difficulties that have to be overcome in putting these concepts into practice. A few of these are illustrated below.

[6] An interesting tool for comparing countries water laws is provided by *Water laws and standards*, a joint project of the FAO and WHO: [http://www.waterlawandstandards.org]. Accessed on February 2008.

6.14.1 *Time lags*

One of the most challenging issues is that of the time dimension. The decision making process itself is frequently protracted as a result of its complexity. This means that decisions are taken on out of date information and by the time they come to implementation they are seriously affected by time lags.

6.14.2 *Conflicting interests*

A direct function of the multiplicity of stakeholders is the challenge of overcoming the conflicting interests of different parties and different points of view. It is difficult at times to separate the conflicting interests that are real and justified from those that are based on more abstract foundations. In either case resolving these can be very difficult in practical terms, and even more so, in the political costs associated with their resolution.

6.14.3 *Interface between administration and politics*

Almost all the issues listed involve a significant *technical* input from various different disciplines (social sciences, planning, finance, engineering, legal, etc.) of the public administration. At the critical level of local government, this is often limited by shortages of resources and skills. The decisions that have to be taken are fundamentally political and must be taken in the uncertain and sometimes contradictory environment of politics.

6.14.4 *Unintended consequences*

All these practical difficulties lead to a series of unintended consequences that arise from decisions, that may or may not have been made with the best of intentions, but are certainly made in very difficult environments on inadequate information. Examples of unintended consequences include the effects of pricing policies and subsidies. Frequently these benefit rich consumers, who are connected to a water or sanitation network, instead of the poor they are intended to help. These subsidies cannot reach the poor because they have no connection to the networks that are the vehicle for the subsidy. An interesting example of unintended consequences has been described recently in terms of the stranded social, environmental and economic assets that have arisen or are likely to arise as a result of efforts to restore the ecological health of the Murray Darling basin in Australia (Freeman, 2005; Beattie, 2007).

7 WATER AND BUSINESS

So far, this chapter has examined the tensions and trade-offs that surround the public and private good aspects of water. This sets the scene for a closer look at the two fundamental questions of business ownership and management of water.

7.1 *Business is part of the community*

Business and industry fulfill a key role in the development process and the life of communities. The only exception is *subsistence societies* and even there one finds the beginnings of the role of specialisation that is a precursor to business.

Industry converts natural resources, including water, into products and services that all societies require, provides employment and generates local economic activity. Water is a key natural resource that is vital to businesses for their own survival and for their contribution to society's needs. The question of water security referred to in Section 3.3 above is therefore a matter of survival for businesses and the communities that depend on them.

There are different kinds of business and industry, and these provide widely differing products and services to society. Four industrial groups can be identified: those that use water directly in the products and services that they sell (food products, etc.), those that need water for their industrial

processes (steel making, computer manufacture, etc.), those that supply materials and equipment for water management (water pipes chemicals, etc.), and those that are engaged in managing water services delivery (water operators).

The continuity and future success of any business, and the societies they support, are impacted by the availability, cost, and quality of water at many points along the *value chain*, including *upstream* (in the production and supply of raw materials), *midstream* (in the manufacturing and production process), and *downstream* (consumers need water to be able to use most products, and everyone needs their used water to be treated and recycled).

When one uses the term business there is a tendency always to think of very large business entities. In practice water is required by every business starting on the very smallest scale of cottage industry and working right through to the largest global organisations. No matter where a business is situated on this range of scale the fundamental issues are the same.

7.2 *What can business do and not do?*

Following the arguments and the processes outlined above, one can now look at the opportunities and limitations for business action and how these interact with those of government and other stakeholders. Three different situations can be identified (WBCSD, 2005). One is where business can take a lead in its own activities, another is where businesses should work in partnership and collaboration with other stakeholders from civil society, and another is where business must recognise that the prime role must be taken by the government.

Businesses should consider their water needs and interactions under three major headings. The first is the impact of the activities *upstream*. This is the way their activities have an impact on water before it reaches their premises. To a large extent this is the role of water in the upstream supply chain. The next area is the water use of that business *within the fence line*, which is directly associated with the businesses production processes or incorporated directly into its products. The final area is the impact of the business or its products *downstream*. This is the way its products or services impact water when they are used by customers, or how the availability of water or sanitation limits or enables the markets for these products.

Businesses that have carried out an analysis of their water needs under these three headings understand the importance of water to very many aspects of their activities. They also understand that their water requirements are intimately involved but not necessarily aligned with those of many other stakeholders. This is aptly summed up in two frequently used sayings: *no water no business* and *business cannot thrive in societies that thirst*.

7.3 *What business can do?*

Given this background, it is possible to identify from both of the practical and ethical points of view some of the things that businesses can do to ensure their active and constructive participation in water management.

7.3.1 *Recognise its different interfaces with the water cycle*

Businesses can and should take steps to identify the different points at which they have an interface with the water cycle.[7] They can do this by looking at the social, environmental and economic facets of the inter-relationships between their business activities, their markets and their role in the societies and the natural ecosystems that surround them.

Any business should look at water as it does all other resources. It should maximise the efficiency and productivity of its water use and minimise or where possible eliminate any negative impacts that it may create.

[7] WBCSD Global Water Tool: [http://www.wbcsd.org/web/watertool.htm]. Accessed on February 2008.

7.3.2 *Compile and maintain data*

Businesses are generally in a better position than many stakeholders to compile and maintain data that helps them to manage and optimise their water use and water discharges. By measuring and monitoring the state of the natural resource upstream and downstream of their activities they can anticipate risks for themselves and for others (GEMI, 2002). They may be able to provide helpful input to wider water cycle management and they should also be able to use this kind of information to demonstrate that they are conducting their operations in a water sensitive and responsible way.

In addition they can measure, account and audit the efficiency of the water use within their own projects and operations. Using this kind of information and conducting internal and sector benchmarking many industries have been able to make very significant strides in improving their water use. The great improvement in water consumption per tonne of product produced in sectors like paper and steel are good examples.

7.3.3 *Interaction with other stakeholders*

Businesses need to understand the wide range of interactions that they will inevitably have with other stakeholders through water and water management. It is much better for them to engage positively and proactively with stakeholders and to try to make a positive contribution to the issues that concern them than it is to ignore them or to wait for them to react.

Interaction with stakeholders is much easier in the immediate vicinity of the business premises than it is some way up into the supply chain, or out into the market for the product. For large businesses operating on multiple sites it will be necessary for the local site management to deal with the immediate neighbourhood issues, whilst it might be necessary for other parts of the organisation to take account of supply chain and product interface issues.

7.3.4 *Work with and support government*

When one understands all the complex issues required to enable a government to manage water issues effectively it becomes easier to understand that businesses can and should play an active and constructive role. Businesses have a strong interest in the outcome of water management decisions for themselves, particularly as this affects water availability, water costs, the value of assets, the reliability of supply chains and the robustness of markets. Businesses are also interested in the quality of the environment, particularly that in close proximity to where they are operating. That they take an interest in and seek to exert responsible influence upon water decisions is therefore both legitimate and desirable. It is however fundamentally important that they exert their influence and participate in the process in an open, transparent and ethical way. It becomes even more important for those businesses that are delivering water or sanitation services directly to the population on behalf of the government.

7.3.5 *Recognise and articulate its position on the 6 Rs*

To assist businesses in their interactions with governments and with other stakeholders it would be useful for each business to examine carefully its position with regard to the six *Rs* discussed in Section 5. It needs to be able to explain this to all concerned. This would provide each business a strong analytical framework on which to base its positions.

7.3.6 *Define, publish and act upon a code of ethics*

It is good practice for all major businesses to define the code of ethics that is relevant to the business that they are in. Their staff should be trained to understand and act upon such codes and companies should be prepared to publish their codes wherever they operate. A meaningful code of ethics for business practice will certainly extend into many areas that do not specifically impact water, but undoubtedly should enable members of the company's staff to interact with governments and stakeholders in an ethical way.

7.4 *What businesses can not do?*

There are also a number of areas where businesses cannot and should not act. They have to pay attention to the limits of their legitimacy, recognise the boundaries between public and private domain and be sensitive to the six *Rs* of other stakeholders and of government. Some specific examples are as follows.

7.4.1 *Allocate itself water*

Individual businesses cannot legitimately allocate themselves water either by simply drawing in an unrestricted manner on the available resources, or by exerting undue influence in the allocation process. A business should be able to present its case for a water use allocation and defend it on the basis of cogent arguments.

7.4.2 *Decide priorities between users*

Businesses cannot unilaterally determine the priorities of water access between themselves and other users. In both the case of allocation and definition of priorities, it is expected that businesses would legitimately articulate their needs vigorously. However the ultimate power of decision is not theirs. This is a clear function of government as indicated in Section 6.

7.4.3 *Rely entirely on markets to resolve water allocation issues*

Some commentators advocate that free markets are the best way to allocate water effectively to different uses. Markets do have a role to play, but at present they cannot be sufficiently clear, well informed and efficient to be relied on as the sole mechanism for water allocation. The techniques of economic evaluation of water are gradually improving. They still have a long way to go before market allocation can be used as the sole mechanism and this may never be a practical possibility.

7.4.4 *Operate in isolation from others*

As a corollary to the need to interact with the rest of society, it is ill-advised for a business to try to operate in the field of water in isolation from other stakeholders and interests.

7.4.5 *Operate outside the law*

No business should operate outside of the law of the country in which it is operating or outside local bylaws and regulations of the specific locality concerned. Unfortunately the law is not always as clear, consistent or complete as one would wish.

8 PRIVATE *OWNERSHIP* OF WATER

This chapter was requested to look at two specific questions relating to water ethics and business. These concern the *ownership* of water and *operation* of water services by private businesses. These questions are addressed in the context established above in Sections 8 and 9.

8.1 *The myth of private ownership of water*

In the strictest sense can anyone *own* water? Water is an ephemeral substance that constantly moves through space and time and through the states of solid, liquid and gas during its passage through the water cycle. To own it one needs to contain it, store it, transport it, *use* it, and enjoy the benefit of it. For ownership to make sense eventually one has to be able to *disown* it. In other words sell it. The concept of ownership implies that the *item* in question can be acquired and also that it can be passed on to another owner. An item cannot be owned by two competing interests at the same time. Ownership implies certain benefits as well as obligations.

The enigma of water is that in some circumstances it can meet these criteria and in others it cannot. From very early in the development of human societies, people have tried to resolve these

questions. They have used traditions, taboos, religion and ethical codes. As societies became more complicated, some jurisdictions and legal systems have contrived to create an apparent ownership of water.

These *apparent* systems of ownership have changed from the *ownership* of the water itself to a system of ownership of *water rights*. Water rights are created to give defined beneficial access to the water in a certain place or under certain conditions. In this sense water rights are place specific or use specific, but are not water specific. They can work reasonably well for relatively large units of land or where the number of competing or potentially competing water users is small. They probably work less well and may even fail when there is a plethora of different and competing uses in densely occupied and subdivided areas.

Some see the advantage of water rights to be in the ability to trade them on the market and therefore create a proxy market for water itself. The pro-market thinkers would argue that the market is the best mechanism to ensure that water is allocated to its highest value generating use in a system of priorities. They may be partly right. Others would say that this *commodification* would deprive users with low leverage in the market (essentially poor people and environment) of access to a vital good. They may be partly right as well.

The fundamental weakness with water rights systems is that they are not dealing directly with water itself, but with a proxy for it. In addition that proxy is itself based on the *ownership* of something else: land or historical usage rights.

If one goes back to the question of water itself and looks at why somebody should want to *own* water, one sees that it is rarely the water itself that is the real objective. Users of all kinds usually want to have access to a source of water so they can utilise it for some specific purpose or purposes before releasing it back to where it came from. The more numerous these users become, the more densly they use the territory; and the scarcer the resource becomes, the harder it is to identify and isolate the different interests. Water rights have growing limitations under these circumstances. They do not take any account of the actual quantity of water present in a given place. Neither do they take account of where the water has come from or where it is going to.

Another viewpoint is that water is a common and is *un-ownable*. There is much that is attractive about this idea. In practice it does not stand the reality test of overcoming the challenge of equitable allocation between multiple users and uses in densely populated areas any better than the other approaches do. Indeed in many places where water governance is weak a de-facto free for all occurs, which can degenerate into a classic *tragedy of the commons* situation.

One can identify distinct and different fundamental approaches, but also one needs to recognise that none of them provide a complete solution to the challenge of allocating an essential resource between those who need it. How does one resolve the problem so that all these users can, need to, and cannot own the water they require for activities that are essential to them and to their roles in the community?

It seems that faced with these challenges the general trend is towards the viewpoint that water needs to be treated as a common good but also be allocated and apportioned in a way that transfers predictable and beneficial usage to specific stakeholders (Wodraska, 2006). This appears to be done most successfully using a system of licensing in the way outlined in Section 6.5 above. Countries like UK and France with a long tradition of riparian rights are gradually evolving in this way.

8.2 *Water ownership or water uses for business*

The short answer to the question of whether *business can own water* depends on the jurisdiction in question. Under some legal systems it is possible to effectively own water through the proxy of water rights. Other places have legal systems which have not resolved the question in any way, while others are evolving away from the concept of ownership to something which is probably more workable based on systems of licences that permit and control the beneficial uses of water. One cannot generalise to say what the ideal system is or if any one of the systems are right or wrong. Businessmen need to play by the rules of the place where they are operating. Those who

are judging businesses must also take account of the case specific nature of the question and not judge one country by the rules of another.

This brings us back to the question of security of the water that is essential for business to function. Water ownership as such may not be necessary, but water security is essential. For this reason the challenges of the allocation of water abstraction and discharges as discussed above is crucial.

8.3 *Allocation and Licensing: Who does it and how well does it work?*

The difference between theory and practice in the real world can be very large. This is a reflection of the extremely complex and dynamic nature of the *messy problem*. At times the situation can be more or less in equilibrium, and at others elements of the whole get out of step with each other causing all kinds of difficulties. Examples of success and failure abound. In some places there is progress and in others the opposite. It is instructive to look at a few examples.

In booming Asian mega-cities such as Bangkok or Jakarta, water and water related issues are a real and serious concern. Individuals, businesses, governments and others are trapped in a downward spiral that is extremely difficult to control and correct. The various stakeholders have not been able to fulfill a number of the tasks outlined above adequately. The consequences are seen in many water security problems. Faced with this lack of water security many businesses, from manufacturing to property development, have turned to the solution of drilling their own deep wells. In theory these are licensed, monitored and controlled. The wells and water that is abstracted are supposed to be charged for. In practice many things go wrong. Some wells are drilled without permits; the volumes of water abstracted are not measured and sometimes not paid for. There is no coherent tariff policy so that charges undermine the municipal water service tariff structure. The consequences are depletion of the aquifers, saline intrusion and land substance that aggravates flooding. This has a negative impact on economic growth and public health, and the damage is irreversible. The problem is made more acute because to overcome it in the past massive schemes that transfer surface water to the city have been constructed, but these have faced allocation, maintenance and operational difficulties. Numerous un-coordinated government agencies and public authorities and a diversity of territorial responsibilities exacerbate the difficulties (Syaukat & Fox, 2004). It is easy to blame either the individuals and the businesses concerned or the governments that should be presenting solutions to this situation. In reality they all share the blame but they also all suffer the consequences. On their own neither good governance, good business practices nor ethical behaviour can solve these problems. It requires concerted collective will and strong and principled leadership. Recent attempts to make progress are now trying to involve consultation with all interested parties.[8]

One should not fall into the trap of criticising the people involved in these cities thinking that this kind of situation is a new phenomenon. The situation in London was very similar at the height of the industrial development in the 19th century. At this time in London, boreholes were also being used to extract water for the booming industries of the East End. The water was drawn out faster than nature could replenish it. Groundwater levels fell by around 90 meters creating similar problems and challenges to those currently being experienced in modern Asian mega-cities. Since the mid 1960s, the rates of abstraction have declined rapidly as industries with heavy water demand have moved out of London or greatly increased their water use efficiency (Environment Agency, 2006). The London artesian basin is now recovering, but with its own adverse consequences. As the water levels and groundwater pressures rise again, new problems present themselves that affect both public and private interests. These include problems for foundations of large buildings and deep structures such as underground tunnels. They impact public transport, underground service networks, property developers, construction activities and insurance. Over the last few

[8] ADB (Asian Development Bank) Press Release, 15 February 2007.

years a multi-sector group calling itself GARDIT (*General Aquifer Research Development and Investigation Team*) has been set up to develop strategies and actions to overcome these risks. The group includes organisations from central and local government and the private sector. It has developed a programme for actively monitoring and managing the groundwater levels, including increasing the amount of water pumped out and using it in economically sustainable ways so that the programme can be self financing (Water & Waste Treatment, 1999).

The example of Chile is often held up as a model, and in many ways it is. It is a case that illustrates a good interplay between the public policymakers, public administration and private interests including business. It shows how social and macro-economic policies need to be integrated with water policy and governance. It also shows the importance of taking a progressive approach that involves tackling problems in a prioritised way and maintaining public support. Equally it demonstrates the success that can be achieved when parties take an adaptable approach and are prepared to make changes when these appear necessary, because conditions have changed or policies are not achieving the desired results.

From the mid-1970s, Chile has pursued a development policy based on maintaining a macro-economic equilibrium, using markets in the allocation of resources and opening to world trade, especially by exporting products when it has a competitive advantage. This policy has been successful economically, but has also created a marked increase in the demand for water. The use of wells for agriculture increased over 6 times and for drinking water over 4 times in 2 decades (1980–2000). New abstraction licences have been refused in at least 40 aquifers to prevent over exploitation (Global Water Partnership, 2006). Water use efficiency in both agriculture and industry has increased significantly in response to increases in the prices of water rights. Chile's water policy has relied heavily on strong tradable water rights as a means of allocating water to highest value uses. At the same time cost recovery policies have led to a 10% reduction in water consumption while social policies have protected the poor and helped absorb the 38% increase in domestic water supply charges that were observed between 1998 and 2002.

This success story has not been without its difficulties and critics. At the early stages there was some evidence of unethical behaviour in the form of hoarding, speculation and the use of water rights to block competitors. At the beginning there may have been too much emphasis on the economic aspects of water and not enough on social and environmental sustainability. Over time these issues have been addressed using changes to the law, fiscal and regulatory mechanisms. A much better understanding of the needs and constraints of water rights and water markets has been developed (Solanes & Jouravlev, 2006).

A final example that illustrates the challenges of integrating past water management decisions and actions into the present and future is a case involving mines in South Africa (WBCSD, 2006). When one gold mining company went bankrupt, it stopped pumping mine water from its shafts. This exposed other mining companies in the same area to the risks of their mines flooding. This threatened economic loss to these companies, closure of their operations, loss of resources and employment to the community. Faced with this threat, the remaining mine owners took legal proceedings under the national water law against the failed operation, but more importantly devised a positive action plan to solve the problem. They proposed the creation of a water company owned jointly by the mining companies and the government. This would manage and operate the water pumping for the future working life of the mines and a period after final closure. It would extract the water and treat it so that it could be provided as an additional resource to local towns. In this way the solution is economically self-sustaining. This proposal by private business required legal and technical support from government as well as consultation with the local stakeholders.

All these examples show how the imperative for business of all kinds to have access to water cannot be reduced to a simple question of ownership. They all illustrate in different ways the need and the complexity of reconciling legitimate *private good* aspects of water with the essential *common good* issues. They also illustrate the need for both a practical and ethical approach to these complex problems on the behalf of all the actors involved.

9 THE PRIVATE SECTOR IN PUBLIC SERVICE DELIVERY

As with business in general, there are no ethical grounds for excluding the private sector from participating in the management and operation of water services delivery. The role of business is as legitimate here as in any other business sector. This statement obviously hinges on what is meant by the term *legitimate business*. As with many other questions concerning ethics and norms, this can be made extremely complicated. For the purpose of this discussion it can be presumed to mean: *the conduct of a legal activity that provides products or services that benefit the common interest of a community and the individuals that comprise it (the stakeholders), while at the same time providing an adequate return for its owners or shareholders*. The services provided by private water services certainly fit into this context. Delivering water to homes, businesses, and fields; collecting and de-polluting used water; providing protection to people's health and to the environment; are all activities that benefit the common interest and individual stakeholders. The returns that private operators earn for their owners and shareholders are often modest when compared with other kinds of business activity. In addition because these businesses operate in a context where market forces are more limited than in many other sectors, they are usually subject to higher levels of regulation and control than most other businesses.

There are very large numbers of private businesses that are involved in the management and provision of water services throughout the world. There is no accurate knowledge of their number or of the proportion of the world's population that they supply. One recent study has suggested that there may be over a million private water operating businesses (McGranahan & Owen, 2006). Others have given more modest figures, but these are almost certainly incomplete (Kariuki & Schwartz, 2005). These businesses range from very small informal operations, through formal local businesses, to a very few businesses that operate in several countries.

Some commentators try to suggest that the involvement of the private sector in water management is a new phenomenon, but this is certainly not the case. Private provision of water services can be traced back for millennia.

For many of the reasons and complexities outlined above, there have been differing views about the relative merits of different forms of service provision. These range from individual self provision, through informal private operations, formal contract provision, private asset ownership and provision (privatisation), mixed public private joint ventures, provision by local, regional or national operators or state owned companies.

The current controversy about the involvement of private business working in the field of water and sanitation services is a recent phenomenon that can be linked to the conjuncture of two occurrences over the last two decades.

The first of these is the extensive privatisation by asset sale of the publicly owned and operated water and sanitation services in England and Wales in the late 1980s. Having effectively nationalised a large part of these services in the early 1970s, the British government had allowed them to fall into a very poor state. Faced with a serious problem of declining performance and a huge burden of asset renewal, at the same time as meeting new standards imposed by the European Union and the *World Health Organisation*, the government decided to pass the problem to the private sector. The regulatory framework, restructuring and public relations aspects of this exercise were much more challenging than for other privatisations such as airlines, telephones, gas and electricity. The asset sale was finally accomplished in 1989, against strong opposition from certain parts of society, especially the employees.

The second *event* is the development of the *anti-globalisation* movement that gathered momentum in the 1980s as a reaction to growing international trade and the *neo-liberalism* epitomised in the so-called *Washington Consensus*. This movement, which arguably places too much weight on environmental and social ideology, in the same way that others do with economic ideology, has undoubtedly found that the emotions that can be raised around water are useful in its attacks on rich country governments, the *International Financial Institutions*, the *World Trade Organisation* and large international businesses.

Whilst the controversy is almost certainly exaggerated, there is no doubt that it exists. Is it based on real substance or on specious, ideological arguments, corporatist interests or other foundations? This is not so certain. Looking at the question from a point of view of ethics can be constructive. The tests described in Sections 5, 6 and 7 above can be applied to the situation of private operation of public services in the same way that they can be applied to other business related water activities. Following these steps helps to build effective partnerships between water users, governments and private operators.

9.1 *Components of water services*

A number of components make up *water services*. Identification of these is needed to position water services within the wider understanding of the necessity to manage the *water cycle* in an integrated manner. They also connect it with the imperatives of water security and its links with the other securities outlined in Section 3.3. In this context, three activities can be recognised: policy-making and review, administration and oversight, service delivery and operation. The nature of each of these is different and distinct. However, there is no clear boundary between them. They are all necessary for a satisfactory outcome. There needs to be consistency and collaboration between them, because if there is not, any one can undermine or even negate the effects of the others. To be successful there needs to be a good exchange of information between the functions. Above all, they all rely on the quality and consistency of judgments and decisions made by the individuals involved. This brings us back to the need for strong individual ethics.

9.2 *Separation of roles*

Because the nature of these components is different, there is a need for a real functional separation between them and the people who carry them out. This need is both a practical and an ethical necessity. Often this separation does not occur, leading at best to poor decision-making, and at worst to corruption and conflicts of interest. One of the arguments used to support the British asset sale privatisation was exactly this point. The state owned Regional Water Authorities were justifiably identified as being both *poacher and gamekeeper* and as a result were seen as *a law unto themselves* with many inherent internal conflicts.

Applying the tests outlined in this chapter, the nature of these three areas can be understood more precisely. It becomes clear that policy and administration need to be independent of one another, but ultimately they are both spheres of activity that must be carried out in the public domain by politicians and public officials. This is because they involve collective *governance* issues where private individuals or organisations are not legitimate.

The service delivery and operational functions are much more of a business or industrial nature. They should be run on this basis, and therefore they can be *delegated* very effectively to the private sector. The word delegated here is important. Delegation comprises a controlled and structured arrangement that maintains continued and active links with the other two components. It is very different from the *abdication* or *abandonment* of public responsibility that unfortunately frequently occurs in both public and private water service delivery. This is one of the reasons for the *downward spiral* referred to in Section 6.8.

Delegation of operations to the private sector is one the most important benefits of private sector involvement. It is both effective and it calls for a level of rigour that rarely exists when one part of the public sector delegates to another part of the same sector. The advantages of this separation as well as some of the weaknesses of *public to public* delegation are clearly outlined in a recent study in Australia (Davis & Cashin, 2003). In particular the study states "the required performance standards stipulated in the operating licences of the major corporatised utilities in Australia are far from comprehensive, particularly when compared with the performance requirements typically included in a private sector outsourcing or service provision contract", and that the public corporations studied " . . . are required to meet only two water network standards and one wastewater network standard under their operating licences", whereas " . . . the contractor is typically required to

meet up to 30 different standards. The standards set in these situations are much more responsive to customer needs and expectations than the standards contained in the [public corporations] operating licences".

This separation and delegation is also relevant to the question of who owns the water. Delegating the service delivery functions, to either a public or private operator, does not mean that the water itself becomes the property of that operator. There are many cases where public operators are required to have extraction and discharge licences in the same way that private operators and other users do. The author knows of no cases where a private service operator owns the water. They frequently have the responsibility to manage and protect it so as to be able to fulfil their service delivery functions, but this is not the same as owning it. The use of the private sector to fulfil service delivery is therefore in no way contradictory to the concept of water being a common.

9.3 *Some ethical obligations of operators*

Conducting the operational functions of an essential public service like water and sanitation, and to a lesser extent of the water related services like flood protection and irrigation, impose some ethical obligations over and beyond those identified in Section 7.

9.3.1 *Efficiency in operation*

A private operator has an obligation to operate efficiently. This is an obligation that he bears to all the stakeholders involved. However the details of those obligations differ depending on whom or what that stakeholder is. This apparently simple statement hides the huge complexity, range of options, and ethical challenges of water services. For example, efficient operations viewed from the end-user customer's point of view might mean a reliable service of good quality at a reasonable price. Viewed from a municipal authority's point of view, it might mean meeting contractual obligations, including the minimisation of investment and operational costs, while meeting customer service standards, system upgrading and expansion, and at the same time improving long-term environmental protection. There will be many others, which may or may not be mutually conducive to each other. Practical and ethical challenges are posed when the operator comes to try to balance all these many efficiency requirements. For example how reliable is reliable? (Supply never interrupted, only interrupted very rarely, an interruption of no more than 4 hours once every year, water that is delivered predictably at a precise time each week?) What is good quality? What is a reasonable price for a reliable and quality service delivered under what circumstances? How long is long-term and so forth? Efficiency in these terms is not easy to define and not all stakeholders will see it in the same way. An operator has to operate efficiently. He also has to do it sustainably and respect the social, environmental as well as economic parameters. The judgments of others, as well as the operator's staff, are inevitably involved. Once again we come back to the individual and collective ethics as a component of these judgments.

9.3.2 *Comparable status for all users*

Fair, even-handed and equivalent treatment of all users in the delivery of essential public services is important. Private operators take this very seriously. Many operators have evolved in cultures and jurisdictions that recognise, either formally or informally, the principle that all service users stand in the same status as each other in relation to the public service and the service provider. A good example of this is the French definition of *public service*, which in the eyes of some, stresses *equality* to the point where affirmative action towards disfavoured members of society becomes difficult. Following a submission made to the *World Summit on Sustainable Development* in 2002, this has been refined recently into the *Charter for Essential Services* and the *Charter for Local Public Services*.[9]

[9] *Institut de la Gestion Délégué*, Paris, France. [http://www.fondation-igd.org]. Accessed on February 2008.

Private operators have consistently supported the *Human Right to Water* and work actively to realise implementation of this right in the places where they operate. Operators played an active role in deliberations to clarify this right in the UN-ECOSOC *General Comment 15* on the *Right to Water* (UN-ECOSOC, 2003). They have given the *Right to Safe Water and Sanitation* prominence (AquaFed, 2006) and have provided input and evidence to the UN bodies working on this (AquaFed, 2007).

The importance of equity is stressed in *General Comment 15*. It seems that for some people the concept of equity is not clear. Most operators interpret this obligation as meaning that they should strive in their operations to provide a fair share of the available water resources and infrastructure and services that are set up to make water and sanitation available and accessible to all users on a reliable and predictable basis.

9.3.3 *Implementation of social policy*

Many commentators are concerned about the effects of social exclusion and *water poverty* (Lawrence *et al.*, 2003) on disadvantaged segments of populations. Private operators share this concern. Many of the smaller scale operators have been created specifically to overcome this challenge. Operators also support the principles of affirmative action. However as this chapter has indicated, private operators on their own are not legitimate or empowered to make social policy. It is legitimate, and desirable for them to provide input, advice and opinions on such policies, but not to decide them. For the same reasons, they are not empowered to make decisions that could be interpreted as judging the social or economic status of an individual and thus who should be beneficiaries of affirmative action. They are however competent to implement such policies and decisions on behalf of the public authorities once they have been made. Frequently they do so. A well known example is the case of Chile (Shirley *et al.*, 2000; Gómez-Lobo, 2001).

They can work with the appropriate governmental and social authorities and services to determine who or what segments of the population should benefit from what forms of affirmative action. This can take many forms that are beyond the scope of this chapter. It can range from specific assistance with paying water bills, through specifically targeted tariff and subsidy structures, to special campaigns designed to facilitate extension of services to low income areas.

There are good examples of where private operators have undertaken pro-poor actions that extend well beyond minima required by their contracts and limits of their contractual responsibilities. Examples are documented in many cases, for example in Buenos Aires (Schusterman *et al.*, 2002) and Manila (Capistrano & Gerlach, 2005).

10 REAL OR IMAGINED ILLS OF PRIVATE BUSINESS

Businesses in general, as well as individual firms are often criticised for various forms of unethical behaviour and unethical constructs in their makeup. Fair and ethical criticism of unethical activities is justifiable and even necessary. However criticism itself must be conducted ethically. Where businesses in water are concerned this is not always the case. Some people make criticisms that are unfounded and unfair, while they are not prepared to recognise ethical failings in other sectors. The private sector does not have a monopoly on bad behaviour any more than it does on good.

It is worth singling out two ethical constructs that create animosity and controversy when water is concerned. These are the role of profit, and the apparent power of businesses. With both subjects it is important to make the difference between an ethical construct and ethical behaviour. It is possible to display unethical behaviour towards an ethical construct. For example, profit *per se* is an ethical construct, but excessive profit taking can be unethical behaviour.

10.1 *Profit*

There are suggestions that it is in some way immoral to make a profit from any activity that involves the *common* water. This is an illogical, inconsistent and unhelpful approach. There is nothing unethical about the principle of making a profit, even on the provision of something that has a vital nature like water and sanitation. Equally vital products and services are provided where few if any contest the profit element that makes it possible to make them available. Profit in itself is an element of survival for individuals, organisations and businesses; even if in some structures it is called something else, such as the fruits of labour, a surplus or a benefit. Activities of all kinds are not sustainable if they consume more than they produce, and this applies to public operations and NGOs as much as to business. This is why public water operators that are required to operate at a loss are faced with the impossibility of escaping the vicious downward spiral and successful ones are required to make the equivalent of a profit even if they don't call it that. In many cases the real profit margins of public sector operators are higher than their private sector equivalents.

10.2 *Power*

In a similar way, there is nothing inherently unethical in possessing power. Power often comes with expertise and the knowledge to do things and accomplish change. This is precisely what businesses are required to do by societies and by public sector authorities. In the case of very large and complex delegated water management contracts for example, a business needs to be large and powerful if it is to be able to meet the requirements set for it by the government.

Power is counterbalanced by systems of accountability, regulation and reporting. In theory this occurs in the public and the private sector, but as already discussed there is often a considerable difference in the way these are applied to public sector and private sector organisations. The rigours imposed on the private sector are frequently significantly more stringent than on equivalent public sector ones.

10.3 *Ethics and regulation*

These two illustrations are sufficient to remind us of the importance of individual and corporate ethics in the conduct of any operation, especially ones where sensitive questions arise. Ethics can and do prevent undesirable behaviour, but few would argue that they are sufficient on their own. Ethics and self discipline need to be integrated with other systems of checks and balances as we shall examine below.

11 A WAY FORWARD?

A fundamental issue that appears repeatedly in this chapter is the challenge of reconciling individual and collective interests in workable management and governance systems. This is why we referred to the *messy problem* earlier. New approaches and new tools need to evolve as various societies travel their own paths to reconcile these issues.

The enigma of water is in its *and/and*. Water is not an either/or matter, it is almost always the question of this *and* that. Water is solid, liquid *and* gas. It is both life-giving *and* death delivering. It is a natural good *and* a social good *and* an economic good, all at the same time. It is valuable *and* priceless. It is a cause of unity *and* a source of strife. Water is vital for individuals (personal survival, health, dignity, *spirit*), *and* it is essential for communities (collective survival, health, security, governance) *and* it is indispensable for business (productive survival, resource security, market enabler) *and* it is all of these things at the same time, *and* often in the same place. It is this little *and* that makes water, water ethics, water governance and water management so challenging.

The enigma of *and* means that water issues of all kinds cannot be solved by simple binary *either/or* decisions. *Fix it and forget it* is a disastrous approach to water. It needs constant attention,

adjustment, involvement and review. The *rock logic* so convenient in much human thought and decision-making processes, needs to give way to the *fuzzy logic* of neuronal systems and self organising structures. But this last statement is an error in itself, because in water, one needs to think *and*. There are times when quick, authoritarian, rock logic decisions are needed *and* there is a constant need for governance to be more flexible and inclusive.

As societies become bigger and more complex, as water scarcity increases, as economies grow and inter-connectivity intensifies, so the challenge of the '*and'* increases. It makes it more and more important that individual, collective and commercial viewpoints are involved and reconciled. It requires more and more dialogue, information, structuring and restraint, but none of these will work if there is no alignment between individual and shared water ethics.

Four sets of instruments that can be employed to make a contribution to this challenge have been identified (Harremoës, 2002). These are:

- Command and control: laws, directives, standards, norms, codes, regulatory bodies.
- Economic instruments: taxes, levies, subsidies, tariff policy.
- Consensual approaches: hearings, consensus conferences, stakeholder participation, peer reviews, public information.
- Ethical approaches: ethics, morals, attitudes.

These have all already been implied in this chapter. This suggests they all have a role to play. The challenge is to bring them together in a sustainable and workable way that enables the complexities to be handled in practice.

The cultural theory outlined by Dipak Gyawali (this volume), combined as he suggests, with the concept of constructive engagement might provide a way forward. He has used this recently to examine the challenge of operationalising this kind of decision making and management in the context of a review of EU IWRM research programmes (Gyawali *et al.*, 2006). This analysis can no doubt be extended to the even more complex issues implied in this discussion.

The analysis focuses on the political difficulties of integrating different viewpoints and competing interests into a management framework that enables the allocation and re-allocation of water between users. In such complex and dynamic systems, all stakeholders must be constructively engaged in the process. This requires the deep involvement of a large number of diverse stakeholders. The concept of the *dialogue space* was introduced to suggest how a very large number of different parties and value perceptions could be brought together (see Figure 4). How can this be done in practice?

Many recent discussions have placed increasing stress on the need to involve the *community* in water decision processes and water governance. Whilst this is undoubtedly desirable, it is rarely if ever workable on a practical level. Indeed the articulation of power and the ability to act between *community representatives* and *empowered governments* is a challenge in many fields besides water.[10] It is not always possible to have all the stakeholders together for sufficient time. It is virtually impossible for them all to have and to interpret all the information needed, even it is available. It is unlikely that consensus between them can be established, because they will of necessity have different imperatives and different ethical frameworks. It is for this reason that there is considerable dissatisfaction in many circles with the results that representative democracy achieves in water governance.

Alternatives that can mix the ability of elected representatives to act relatively quickly with the requirement for much more *buy-in* that can be created by dialogue are being sought. The concept of discursive politics or deliberative democracy may be such an avenue. This is an approach that attempts to achieve working tradeoffs between consensus decision making and representative

[10] For example, this has been a consistent theme of the work of the UK *Department of Communities and Local Government* (formerly *Office of the Deputy Prime Minister*), which has issued a number of reports including, *Citizen Engagement and Public Services: Why Neighbourhoods Matter*, January 2005.

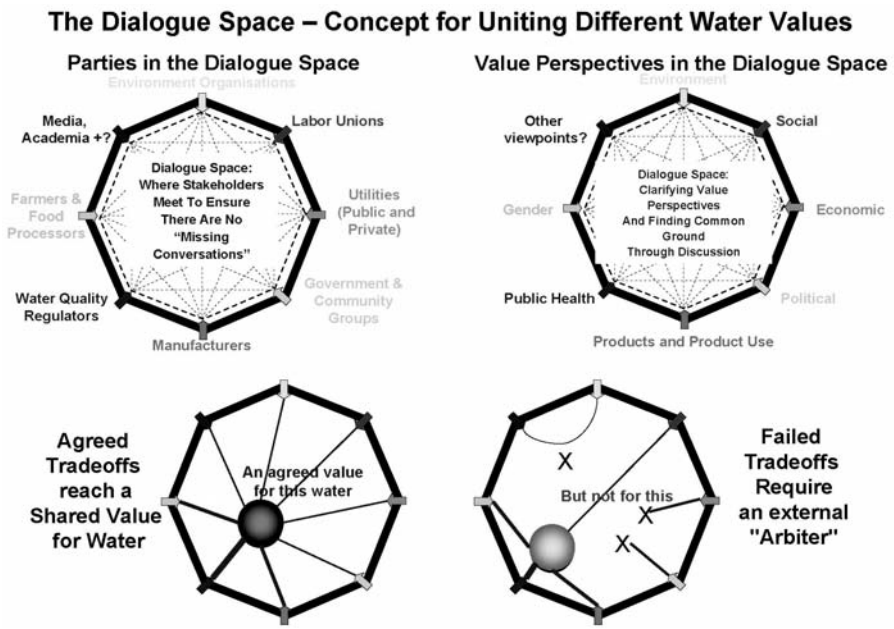

Figure 4. The *Dialogue Space* concept to maximise the common ground between multiple stakeholders. Adapted from "Valuing Water for Better Governance"—Moss *et al*., 2003.

democracy. It is a meeting and mix of the first two and last two of the four bullet points listed above.

Looking at the business world over the last two decades, one can observe a trend in this direction. Sustainable development, corporate social responsible and ethical investment, coupled with increasing transparency and reporting is evolving in this way. In this sense the business world is often leading the way and putting pressure on politics and the public sector to respond.

12 CONCLUSION

This personal views shows just how complicated and difficult it is to achieve solutions in practice in water management. Water pervades an enormous number of human as well as non-human activities. It presents people at all levels of the decision chain and in all kinds of society with difficult choices between almost irreconcilable options.

The actions and decisions that need to be taken leads to a constant struggle to find the best balance between individual and collective interests. In some situations water seems to be capable of being treated as private property, whilst in others this appears to be impossible.

There are aspects of water that suggest that it can be treated as a commodity and obey the *laws* of economics and markets. There are as many that indicates that it must be viewed as a *common*. Management of the common is a challenge that appears virtually impossible for modern and complex societies to conclude with success.

Water requires active management. This has to include the resolution of the kinds of tensions, conflicts and contradictions indicated in this chapter. It needs to be conducted with a long-term view, paying particular attention to sustainability and equity. Management decisions need to be consistent within an overall framework that enables individuals to thrive as well as for their communities to flourish. The individual interests involved cover a full range from single households, through subsistence uses, small scale entrepreneurial activity, to formal businesses of all sizes. They concern the individual interests of people involved in all kinds of organisations, including

private enterprise, public organisations, public administrations and different levels of government. Businesses of all kinds and sizes must be included and must play an active part.

This chapter has suggested a number of approaches that can help individual stakeholders to play a constructive role and make their own contribution to good outcomes. Because of the complexity of the issues that frequently involve trade-offs between individual, collective and providers rights, many of the decisions can only be made in the political context. There may be structural or operational weaknesses in the political systems and processes that make the political decision-making process inefficient and ineffective: the often cited water governance challenge. Businesses are able to respond to the need for change in a positive and often more rapid manner than other sectors. They should therefore be embraced as positive change agents rather than being excluded.

Faced with all its imperfections, it is in the interest of individuals, businesses, politicians and other stakeholders that everybody is instilled with a strong sense of ethics that will help them to conduct themselves and their actions in ways that lead them to share both public and private benefits.

There are those who seem to believe that a simple worldwide ideology can be applied that will resolve all these difficulties. The author does not subscribe to such a view. Different societies at different levels of development with different traditions, laws, geographies and levels of resources needed to work continually on locally relevant, adaptive and evolving solutions that are applicable in their own case.

As the world becomes increasingly more interconnected one can hope and strive for the exchange of good practices and supporting technology that will help. There is, and there should be, a full role for business to play in this. Businessmen must take a positive approach to this opportunity in meaningful concert with other stakeholders to support good political processes and sound political water decisions. Those businesses that take these questions seriously and innovate to create new methods and processes for managing and caring for water are helping to advance the cause of good water management. In doing so they are making their contribution to a wider range of societal objectives that communities cannot achieve without them.

"*Knowledge is not enough, it must be used; will is not enough, we also must act*."

Johann Wolfgang von Goethe

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VII
Corruption, transparency and participation in the water sector

CHAPTER 16

Corruption and transparency in the water sector

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ABSTRACT: This chapter sets out the experience of *Transparency International* (TI) in fighting corruption worldwide in the water sector. It focuses on identifying the sources of corruption in the sector and the available toolkits (best practices) for combating it. Case studies from Cambodia, Japan, Colombia and Pakistan are used to illustrate some of the major points. The chapter highlights the importance of forming inclusive multi-stakeholder approaches to fight corruption, involving government, regulators, utilities, the private sector and civil society organizations (CSOs) and uses as an example the *Water Integrity Network* (WIN)—a recent initiative to set up a network to combat corruption in the water sector.

Keywords: Water; Corruption; Transparency; Accountability; Governance; Anticorruption alliances

1 INTRODUCTION

> "Corruption wrecks good governance, inhibits development and sustains despotism. Taken together this can easily translate into economic and societal failure: not only an affront to decency but the tinder that ignites conflict. Stamping out corruption altogether may be unrealistic. Making the world less hospitable to crooks is not."
>
> (Extract from an Editorial in the Financial Times, April 10, 2007)

Water has an enormous impact on the quality of life worldwide. In addition to meeting the water supply and sanitation (WSS) needs of the world's 6,000 million people, the water sector is responsible for providing 40% of the world's food requirements, through irrigation (which also accounts for approximately 70% of all worldwide freshwater withdrawals) and for generating approximately 17% of the world's electricity. Water resources management requires the responsible stewardship of the earth's water. The financial resources tied up in the water sector are enormous. According to JP Morgan, the world's municipal water and wastewater business amounted to US$ 465,000 million equivalent per year in 2005; by 2015, it estimates it will have almost tripled to US$ 1,200,000 million (Graff, 2007). However, the sectoral performance is quite uneven, with more than 1,100 million people (approximately 1 in 6) without adequate access to drinking water and more than 2,600 million (approximately 40%) without access to sanitation. In fact, 1 out of every 2 families does not have tap water at home or even, nearby. More than 2.2 million people, mostly in developing countries (and many of them young children), die each year from diseases associated with poor water and sanitary conditions. The situation is most grave in Africa, where 1 African out of 3 lacks access to safe drinking water and 1 in 2 lacks access to sanitation (see also African Development Bank, 2007; AquaFed, 2007; Van Norden, 2007).

According to *Transparency International* (TI), corruption is defined as the "misuse of entrusted power for private gain". Private gain is interpreted to include gains accruing to an economic actor's close family members, political party and in some cases to an independent or charitable institution, in which the economic actor has an economic or social interest. Corruption can take many forms, including bribery of local and foreign government officials, politicians and private companies,

extortion, facilitation payments, fraud, cronyism/nepotism, embezzlement, election vote-buying, collusion among bidders, etc.

This chapter has been prepared to contribute towards raising awareness of corruption issues in the water sector as well as identifying opportunities for addressing them. It is divided into the following sections:

- Propensity for corruption in the water sector.
- Tools for diagnosing corruption and impact indicators in the water sector.
- Tools for addressing corruption in the water sector.
- Examples of addressing corruption in the water sector.
- Action plan for addressing corruption in the water sector.
- Conclusions.

2 PROPENSITY FOR CORRUPTION IN THE WATER SECTOR

The special characteristics of the water sector (including monopolies, the high levels of discretion and the low levels of accountability) make it highly vulnerable to corruption. Many of the issues mentioned in this chapter are not specific to water. But they have a higher relevance in the water sector than in many other areas. Even more important, in real life they often do not appear separately as presented here but are combined in different ways thus increasing their potential for causing damage. This section draws on the paper of Elshorst & O'Leary (2005).

2.1 *Traditional and socio-cultural reasons for endemic corruption*

There are areas in which corruption is a relatively new problem, at least on an extended scale. If the reasons for its prevalence can be analysed and removed, the problem could be solved with relative ease. Many types of corruption have a long tradition; they may even be rooted in socio-cultural patterns. A lot of literature about the cultural roots of patronage, cronyism and rent-seeking is also typical of the water sector. The elites and the patrons are now part of an administrative system: politicians serve their clients by offering jobs and services in water sector organizations. Farmers have learned to apply their skills in traditional patronage systems, particularly in dealing with irrigation officers (Duflo, 2003) in the same way that consumers deal with water company officials.

2.2 *Buying profitable positions in a rent-seeking system*

A hierarchy of rent-seeking officials and managers, supported by local politicians, enforces a system of *transfers* and/or promotions that counteracts meritocracy in public service and stabilises the need for rent-seeking. Positions that are most desirable are those posts that involve regular interactions with contractors and suppliers (where kickback systems are in place). The consequence is worse service and a blockade against attempts to reform the system from top to bottom (officers have to refinance the price of getting a position). Drawing on nine case studies in India and Pakistan relating to the management of the WSS sector in urban and rural areas, Davis (2004), has documented some of these practices under the heading of "The Market of Transfers".

2.3 *Water fits the definition where corruption flourishes best*

Monopolies, the level of discretion and power of public officials and lack of accountability are determining factors in the most famous formula explaining corruption (Klitgaard, 1988):

$$\text{Corruption (C)} = \text{Monopoly (M)} + \text{Discretion (D)} - \text{Accountability (A)}$$

Monopoly and discretion are common in water schemes, probably more so than necessary. Typically water is produced and distributed by *monopolies*, usually water utilities. *Discretionary power* is not reserved to management but also includes the operational level of repair, fee-collection, and control of illegal connections. All things being equal, the risks do not become smaller if these roles are carried out by private sector employees. These problems are typically compounded by deficient *accountability* as exemplified by institutional weaknesses in water utilities as well as in regulators charged with sectoral oversight.

2.4 *Corruption helps promote inappropriate types of projects*

Dreaming of the big jump, in the early times of development large scale solutions and their respective technologies were copied in good faith. In the process, financing agencies and business in the North as well as the political elites in the South got used to this transfer-approach to development.

When problems became obvious in the 1980s, discussions about more appropriate technical solutions became widespread. Business reacted to this threat by bribing the political leadership in the South to continue to request large-scale solutions. An example is a case of blatant corruption in connection with a water supply project for Mombasa in Kenya (Eigen, 2003). The financing agencies did not object because these solutions corresponded neatly to their instruments of planning, appraisal and supervision. Developing country water supply distribution networks as well as sanitation and irrigation systems continue to hold a preference for large scale solutions.

2.5 *Corruption-promoting activities of northern governments, International Financing Institutions (IFIs), Bilateral Donors, and Export Credit Agencies (ECAs)*

Northern governments, international financing institutions (IFIs), bilateral donors, and export credit agencies (ECAs) have been responsible for, at least, facilitating corruption. This was particularly likely to be tolerated in a sector such as water, where disruption of aid seemed particularly inappropriate for humanitarian reasons. Some examples:

- The role of legislation in northern countries, which until recently, allowed bribing abroad and tax-deduction of such bribes.
- The tendency of IFIs and bilateral donors, up to recently, to turn a blind eye to corruption for reasons such as cold war alliances, disbursement pressure, and reluctance to intervene in internal and institutional affairs of the recipient countries.
- The role of consultants and northern companies commissioned by southern public sector water agencies.
- The role of northern banks offering safe havens for stolen assets.

2.6 *High-risk procurement*

Procurement and tendering is particularly prone to corruption if the products offered cannot be standardised. It is for this reason that the construction sector is perceived to the most corrupt (Transparency International, 2003a). Standardisation is also difficult if the project site conditions affect the technical specifications and quantities of a project. Both elements often are combined in water-related projects, which make these projects even more susceptible to corruption than projects in other sectors with easily controllable unit-prices and specifications. Some of the most frequent fraudulent procedures used include:

- Including unnecessary elements in planning and cost estimates.
- Skewing bid specifications to favor particular contractors or suppliers.
- Building into the tender the necessity to renegotiate the contract.
- Executing substandard quality work at the expense of project sustainability.

Corruption in procurement makes up a large part of damages caused by corruption. Official procurement is estimated to amount to approximately US$ 3,000,000 million each year. The press release for *Global Corruption Report* 2005 (Transparency International 2005c) states that some US$ 3,200,000 million per year are lost due to corruption in the construction sector. Thus the amounts wasted globally each year are staggering.

2.7 *Decentralization*

Decentralization is an important component of ongoing reforms in integrated water resources management (IWRM) and WSS. IWRM consists of an inclusive multi-stakeholder approach (involving representatives of government, the private sector and civil society) based on water as part of the ecosystem and its economic value. In particular, stakeholder participation is based on a catchment or sub-catchment level. Through decentralization, the expectation is that by involving those who would be the hardest hit by corruption (i.e. poor communities); there would be fewer incentives to engage in corrupt practices. In addition, decentralization is also expected to increase the levels of transparency (including available information for management and oversight) as well lead to closer relationships between service providers and their customers.

2.8 *The role of small-scale entrepreneurs such as informal suppliers of water*

In the peri-urban areas of some major cities, informal suppliers (who sell water from donkey carts, from tankers and from knots of spaghetti pipes trailed around back alleys) often play a very important role in meeting the water requirements of the inhabitants. On occasion, the informal water suppliers source their supplies from illegal connections with the water network or through non-transparent arrangements with the network water supplier. In Tegucigalpa, the capital city of Honduras with a population of approximately 1 million inhabitants, for example, approximately 55% of the population is linked to the water network; the remaining 45% depend on informal suppliers for their water needs. According to CIPRODEH (2007), the tariffs of the informal water suppliers can be up to 40 times those of the network supplier.

2.9 *Corruption causes huge direct, indirect and cumulative damages for the water sector*

In summary, corruption in the water sector:

- Undermines delivery/performance of the WSS system and thus discourages investment.
- Decreases government and water utilities' revenues, while ever more resources are needed to cope with the cumulative damage caused by corruption in the past.
- As a consequence of the above and of current losses, increases in operation and maintenance costs of providing given levels of services, e.g. in Africa (Estache & Kouassi, 2002) if water utilities were working in non-corrupt environments, their costs of operation and maintenance would be reduced on average by 64%.
- Reduces the quantity and quality of services and limits access, especially for the poor.
- Breeds impunity and dilutes public integrity and thus undermines the basis for legitimatizing public support for government.

3 TOOLS FOR DIAGNOSING CORRUPTION AND IMPACT INDICATORS IN THE WATER SECTOR

This Section will discuss tools for diagnosing *grand* corruption (see also O'Leary, 2006a). Section 4.2 discusses *petty* corruption.

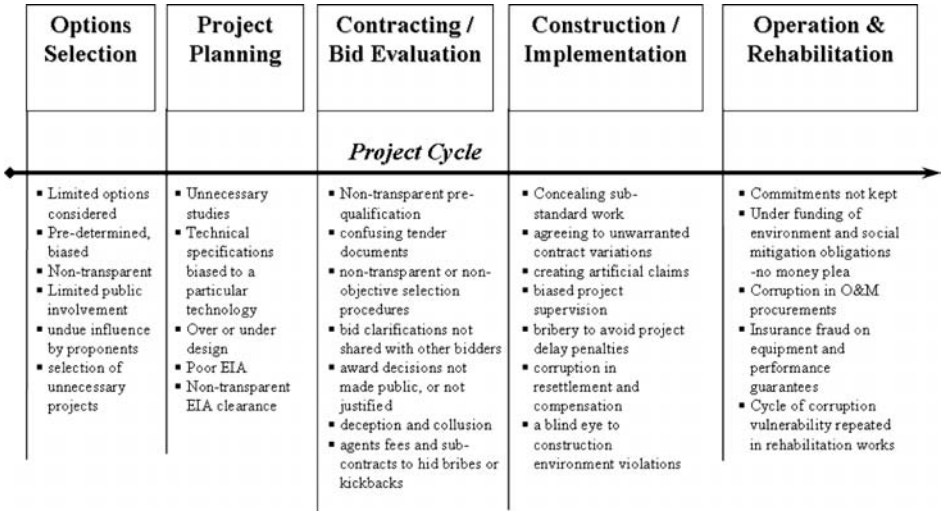

Figure 1. How corruption happens in hydraulic infrastructure projects.

3.1 *Grand corruption*

Grand corruption is found in all stages of a water project, including planning and design; prequalification and tendering; project implementation; and operations and maintenance. Figure 1 sets out many of the sources of corruption.

3.1.1 *Corruption in project planning*

Corruption in Project Planning can lead to the selection of unnecessary projects. In a similar fashion, authorities may be persuaded to accept unsolicited project proposals, without subjecting them to a rigorous review. Corruption can also be facilitated when planning permission and other approvals (such as environmental licenses) are not awarded transparently.

3.1.2 *Corruption in project design*

Corruption in Project Design is facilitated when specifications are biased towards a particular technology, supplier or contractor; the project is over-designed and thereby overpriced; the project is under-designed, leading to increased operations and maintenance (O&M) costs and thereby higher *life-cycle* costs; or when the tender documents are confusing, thereby leading to opaque bid evaluation.

3.1.3 *Corruption in prequalification and tendering*

Corruption in Prequalification and Tendering is facilitated when decision-makers are biased; contractor selection procedures are non-objective or non-transparent; clarifications are not shared with all the bidders; and contract award decisions are neither published nor justified. Many stratagems can be used to hide the payment of bribes, including through an agent, a joint venture partner, or a subcontractor. In addition, contractors can collude to keep the costs of contracts high as well as to manage the bidding process to assure that bids are awarded to different contractors, under different contracts.

3.1.4 *Corruption in project implementation*

During project implementation, there are many opportunities for corruption. These include:

– *Concealing substandard work* (including bad workmanship or substandard materials) occurs frequently in infrastructure projects, which by their nature often involve concealment of work

and materials (e.g. structural steel by concrete). This can be achieved by bribing the project engineer responsible for certifying the work before it is concealed. It bears noting that the impacts of the substandard work may not come to light until many years after the project completion.

- *Project delays* are endemic to infrastructure schemes due to adverse weather conditions, contract variations, subcontractor under-performance or defective materials. Depending on who is adjudged responsible for the delay, the contractor may have to pay liquidated damages to the client or the contractor may be able to obtain addition payments due to delay or disruptions caused by the client. Consequently, the persons or organization responsible for deciding which party is responsible for the delays (including their time and cost impacts) are vulnerable to bribery.
- Agreeing to *contract variations*. Contract variations occur frequently in infrastructure projects due to changes occurring in the scope of work after signing the contract (including changes in the design and/or construction methods to correct design errors; and unforeseen ground conditions), which can also be due to changes requested by the client. Since contract *variations* usually involve cost increases, which have to be agreed by the stakeholders, variations provide opportunities for bribery between the contractor and the client or his representative (architect or engineer).
- *Creating artificial claims*. For example, when a client agrees to a contract variation, a contractor may take advantage of the situation to exaggerate the cost of the variation or the delay it causes. On the other hand, a client may create artificial claims against a contractor to lay the foundation for an exaggerated or false claim to be set off against sums due to the contractor.
- *Biased project supervision* by project architects and engineers can lead to incorrect decisions and inflated costs in relation to contract variations, project delays and concealing substandard work.

3.1.5 *Corruption in project operations and maintenance*

Once a project is completed, long term contracts may be awarded for its operation and maintenance (O&M), especially for power plants (both hydroelectric and thermal) and high technology projects. Bribery may be used to influence the award of these contracts.

The level of O&M contracts may reflect corruption in the bidding phase (over-specification or under-design of a project, which may increase O&M costs) or in the construction phase (substandard construction may lead to increased repairs and maintenance). Where private-public partnerships are concerned, for example in the power sector, there are opportunities for bribery in relation to the negotiation of the power purchase and other agreements related to independent power projects.

The paper of Stålgren (2006) provides a useful framework for analyzing corruption in the different water sub-sectors, including WSS, IWRM, hydropower, irrigation and groundwater extraction. Within each sub-sector, corruption is broken down into different spheres of interaction including: public-public, public-private and public-consumer. Stålgren also notes the importance of private-private interactions, including collusion among contractors bidding for public financed projects.

4 TOOLS FOR ADDRESSING CORRUPTION IN THE WATER SECTOR

This Section features some of the available anticorruption tools for addressing *grand* and *petty* corruption in the water sector.

4.1 *Instruments for Addressing Grand Corruption*

The instruments for addressing *grand* corruption include (see Transparency International, 2006a): International Conventions; National Integrity Systems (NISs); Integrity Pacts (IPs); and Business Principles to Counter Bribery (BPCB). These instruments are described below:

4.1.1 *International conventions against corruption*

The following are the most important international conventions against corruption:

- *UN Convention against Corruption*: (UNCAC), which came into force on December 14, 2005, has been signed by 140 countries and ratified by 117, as of June 2008. The UN Convention contains provisions at the preventative-organizational level; at the repressive-penal level; as well as concerning international cooperation. One of UNCAC's most noteworthy aspects is that it elaborates *an asset recovery* framework for the first time on a global basis. Other notable features of the UNCAC include: the requirement to adopt broad penal provisions against bribery, including bribery of persons in political office; measures relating to the private sector, including accounting requirements and liability of legal persons; provisions for whistle-blower protection; and a provision on compensation for damages. Of all existing anti-corruption Conventions, the UNCAC has the most *extensive provisions* on the ways, means and standards for preventive measures in the public and private sectors. UNCAC calls for *criminalization* of a wide range of offences and contains a broad definition of the term *public official*. Moreover it includes offences relating both to public sector corruption and private sector (private-to-private) corruption.
- The OECD *Convention on Combating Bribery of Foreign Public Officials in International Business Transactions* ("The OECD Convention") was adopted in 1997 by the OECD member states and associated countries and entered into force on February 15, 1999. There are now 37 parties to this agreement. A companion instrument is the *Revised Recommendations on Combating Bribery in International Business Transactions* ("The Revised Recommendations"). Under the OECD Convention, the signatory states undertook to modify national legislation to impose criminal and administrative sanctions on those convicted of bribing foreign public officials to obtain business. The Convention also provides for monitoring and evaluation through country peer reviews. Major OECD and EU member states (e.g. Germany) have extended their national criminal statutes to include the bribery of private business partners in other countries, and some (e.g. the UK) include facilitation payments, i.e. small payments aimed at ensuring low-level administrative action as opposed to larger scale bribes. In parallel with the implementation of the Convention, many OECD states eliminated the tax deductibility of bribes, pursuant to the 1997 Recommendation. The OECD Convention does not cover private to private bribes and can be interpreted to contain loopholes regarding facilitation payments and bribery through subsidiaries. By focusing on deterrence and prevention of foreign bribery, the Revised Recommendations complement the Convention.
- *Regional Conventions and/or Initiatives* have been adopted in Europe, the Americas, Africa and in the Asia-Pacific. In Europe, the most important regional conventions are the *Council of Europe Criminal Law Convention on Corruption* and the *Civil Law Convention on Corruption* that entered into force in 2002 and 2003 respectively. Neither has been ratified so far by several of the leading industrial European countries. These instruments are monitored under the *Group of States against Corruption* (GRECO) monitoring process, which includes countries that have not yet ratified the Conventions. There is also the *EU-Anti-Corruption-Law of 1998* and the *EU Frame Agreement*, dated July 22, 2003, of the *Council of the European Union* concerning the fight against corruption in the private sector. The first regional anticorruption convention was the *Inter-American Convention against Corruption* (IACAC) that was adopted in Caracas, Venezuela, in 1996 and came into force on March 6, 1997. It criminalizes active, passive and transnational bribery, illicit enrichment, the improper use of classified and confidential information, using influence on public authorities for illicit personal gain and the diversion of property or assets. Signatory states are obliged to incorporate these provisions into their own legal systems. The *African Union* (AU) adopted a *Convention Combating Corruption* on July 2003 in Maputo, Mozambique and came into force on August 6, 2006. The Convention covers a range of criminal offences including bribery (domestic or foreign); diversion of property by public officials; trading in influence; illicit enrichment; money laundering and concealment of property. It calls on measures on prevention, criminalization, regional cooperation, mutual legal assistance and recovery of assets. It covers public and private sector corruption, on both the

demand and supply sides. It contains unique mandatory provisions relating to private-private corruption and transparency in political party financing. The ADB/OECD *Anticorruption Initiative for Asia-Pacific* led to the adoption by 27 countries of the region in December 2000 of the non-binding *Anticorruption Action Plan for Asia and the Pacific*. The Action Plan refers to three pillars including "developing effective and transparent systems of public service; strengthening anti-bribery actions and promoting integrity in business operations; and promoting active public involvement". The Action Plan builds on cooperation among governments, international financial institutions, civil society and the private sector. The Action Plan refers to the protection of whistleblowers and the monitoring role of NGOs.

All of the instruments provide for monitoring of implementation of their provisions by the respective countries, with monitoring already under way for the OECD, Council of Europe, OAS and ADB-OECD instruments. Monitoring activities are being planned for the UNCAC and the AU Conventions.

The key to the success of all these conventions is to have the signatory countries ratify them in a timely manner; then assure that their provisions are fully incorporated into their legal systems and their institutional framework; and finally that their provisions are actively enforced. Effective intergovernmental monitoring has a key role to play in this regard. Among the countries that have ratified the UNCAC is the USA, which has previously passed the *Foreign Corrupt Practices Act* (FPCA) in 1977 as well as the *Sarbanes-Oxley Act* in 2002. Civil Society Organizations (CSOs) can play an invaluable role in advocacy and monitoring of the ratification and implementation of international anti-corruption conventions as well as of national anticorruption laws and other related legal instruments.

4.1.2 *National integrity systems*

4.1.2.1 Institutional pillars

TI developed the National Integrity System (NIS) concept, which takes as its starting point that a society becomes resistant to corruption when a whole series of institutions are present and functioning well (see Pope, 2000). These include an elected parliament; an executive; an independent judiciary; the civil service; the enforcement agencies (including the police); the watchdog agencies (Public Accounts Committee, Auditor-General, Ombudsman, Anti-Corruption Agency, etc.); civil society (including the professional associations); the private sector; the media; and the champions of reform (including the international agencies). They are represented as pillars in Exhibit 2 (Figure 2). The pillars are supported by the dual foundations of society's values, including fairness, integrity, accountability and honest dealing, as well as public awareness. Finally, as Exhibit 2 shows, the goal is not the NIS itself, but rather good governance supporting the goals of the rule of law; sustainable development and the quality of life. As of March, 2007, TI has undertaken diagnoses of the status of NIS in 66 countries, broken down as follows: Americas (12); Europe and Central Asia (11); Africa and the Middle East (12) and Asia-Pacific (31).

4.1.2.2 TI's tools to enhance national integrity

In its Corruption Fighters' Toolkit (Transparency International, 2003b), TI has developed a suite of tools to fight corruption and facilitate NISs. These include:

- *Awareness raising* tools (such as publications, advertisements, conferences and classes) to bring the corruption issue to the public's attention.
- *Free and fair election campaigns* are a fundamental NIS pillar. TI chapters have developed tools to monitor media coverage and political spending and encourage accountability among the political parties.
- *Access to information* tools includes developing materials for citizens on what to expect of government and how to get government services and how to protect the whistleblowers.

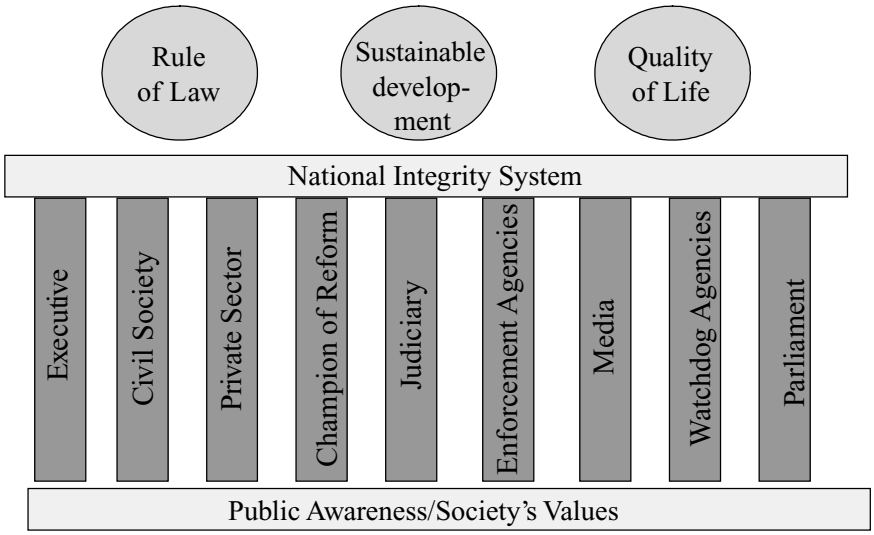

Figure 2. Pillars of integrity.

– *Public institutions* tools focuses on providing information to the general public on government activities, including the activities of legislatures, courts and the local governments.
– *Diagnostics* include TI's *Corruption Perception Index* (CPI) (which documents a country's reputation for honest practice), the *Bribe Payers' Index* (BPI) (which ranks the propensity of private enterprises in particular countries to pay bribes) and the *Global Corruption Barometer* (which measures attitudes towards corruption and expectations of future corruption levels, thereby measuring trends in attitudes over time). While the TI Secretariat (TI-S) publishes the international versions of these surveys, some of TI's national chapters have undertaken surveys to document corruption at national and local levels.

In addition, TI's Toolkit covers public procurement and business ethics, which are covered in the following Sections.

4.1.2.3 The Japan NIS

The *Japan NIS* (Transparency International, 2006b) highlights two issues that have a direct bearing on the water sector: a) *amakudari* (the golden parachute in Japanese), and b) *dango* (bid rigging in Japanese). Under *amakudari* retired government officials approach semi-government or private companies two or three times after they first retire for post-retirement employment at much higher salaries than they had in government service, their retirement packages are often times higher than that of the Prime Minister of Japan. *Amakudari* is tantamount to bribery, with favorable treatment of a certain supplier or contractor bid being given in exchange for post-retirement employment of the government official in that company. In relation to *dango*, procurement prices and project costs are raised at the expense of the consumer and/or the taxpayer. Authorities have recently cracked down on bid rigging in public construction contracts, in which public officials in awarding contracts in exchange for post-retirement employment with the winner bidder. An example of bid rigging in the water sector was an investigation undertaken by the Yomiuri Shimbun (2006), using the *Freedom of Information Law*, as reported in *The Daily Yomiuri*. In this investigation, "local governments allowed 16 of 49 sewage plant building to go ahead despite knowing that bid rigging had possibly been conducted to determine the prospective winners". Six of these projects were subsequently investigated by the *Fair Trade Commission* on suspicion of violating the *Anti-Monopolies Act*. To address *amakudari*, the report inter alia recommends that all hiring of retired government officials

be endorsed at a general meeting of the shareholders of the employing corporation. In relation to bid rigging, the report recommends vigorous enforcement of *anti-dango* legislation, including the *Anti-Monopolies Act*. In addition, the report recommends the widespread adoption of TI's *Integrity Pacts* and the *Business Principles*, particularly by construction companies (see Sections 4.1.3 and 4.1.4).

4.1.3 *Integrity pacts*

Integrity Pacts (IPs) are based on a tool, developed by TI in the 1990s, to help governments, the private sector and civil society organizations (CSOs) fight corruption in public contracting. They can be described under the following headings: process; rights and obligations; monitoring; and sanctions:

- The *Process* includes an agreement between a government, government department or utility and all bidders for a public sector contract.
- *Rights and Obligations*, set out in the contract are such that neither the government nor the contactors shall pay, offer, demand or accept bribes or collude with competitors to obtain the contract or during the execution of the contract. Also, bidders are required to disclose all commissions and similar expenses paid by them to anybody in connection with the project.
- *Monitoring* could be carried out by CSOs or by independent private sector individuals or companies, hired by the government, with the obligation to inform the public of any impropriety, which the contract parties are unwilling to correct. Alternatively, the government could commit itself to provide full public disclosure of all relevant data regarding the evaluation of competing bids.
- *Sanctions* will apply when violations occur. They can range from loss or denial of contract, forfeiture of bid or performance bond and liability for damages, to blacklisting for future contracts on the side of bidders, and criminal or disciplinary action against government employees.

4.1.3.1 Applicability of integrity pacts

IPs can be applied in the following situations:

- Selection of (architectural, engineering or other) consultants.
- Award of construction and supply contracts.
- Selection of a buyer/recipient of state property under a government's state asset privatization program; or
- Selection of the beneficiary of a state license or concessions (such as for oil or gas exploration or production, mining, fishing, logging or other extraction rights) or for government-regulated services (such as power, telecommunications, and water supply utilities or garbage collection services).

To be comprehensive, the IP should cover all activities, from the beginning to the end related to undertaking a project to award of licenses or concessions. For example, for a water project, the IP should cover all activities from the selection of consultants; undertaking feasibility or other preparatory studies; preparation of bidding documents; award of contract; right through to project implementation and handover to the client. It bears noting that 57 IPs have been put in place worldwide over the period 2003–2007 (April) of which 4 were in the water supply and sanitation sector; 5 were in the energy sector (including the power sector); 10 were in the telecommunications sector; and 11 were in the construction sector.

4.1.3.2 Minimum standards for public contracting

These standards focus on codes of conduct for the employees of the contracting authority and the bidder; debar companies blacklisted by *multilateral development banks* (MDBs); require that all contracts entered into by the authority and its contractors comply with strict anti-corruption policies (using a tool such as the IP); promote open competitive bidding; promote easy access to information by bidders (and ideally the general public); and ensure that internal and external control and auditing bodies are independent and functioning effectively, and that their reports are

Table 1. Results of application of an Integrity Pact to the Pakistan Greater Karachi Water Supply Scheme, Phase V, Stage II, 2nd 100 MGD, KIII Project.

Nature of assignment	GOP approved estimated cost	Contract award	Saving amount	Saving (%)
Design and supervision consultants	248 million	62 million	186 million	75.00
Construction contracts	5,286 million	4,448 million	838 million	15.85
Total	5,534 million	4,510 million	1,024 million	18.50

Source: Transparency International Pakistan (2003).
All figures in Pak rupees (PKR). Note that the exchange rate as of July 1, 2003 was: 1 US $ = 60 PKR.

accessible to the public. Further information on the *Minimum Standards* are available in the paper of O'Leary (2006b) and on IPs is set out in the TI document entitled "The Integrity Pact", dated May 5, 2003, which is available under TI's *Integrity Pact and Public Contracting Programme*.

4.1.3.3 Example of an Integrity Pact

An example of an *Integrity Pact* is the IP agreement between the Karachi Water and Sewerage Board (KW& SB) and Transparency International Pakistan in relation to the award of contracts for the *Pakistan: Greater Karachi Water Supply Scheme, Phase V, Stage II, 2nd 100 MGD, K III Project*. Following an invitation, dated April 13, 2001, by the Managing Director (MD) of the Karachi Water and Sewerage Board (KW&SB), to Transparency International Pakistan (TI-Pakistan) to "establish procedures, which should be built to include the Integrity Pact (IP) for Transparency in Public Procedures within the KW&SB" the Board and TI-Pakistan agreed to implement the IP in the *Pakistan: Greater Karachi Water Supply Scheme, Phase V, Stage II, 2nd 100 MGD (the K III Project)*, with an estimated cost in Pak Rupees (PKR) of more than 6,000 million.[1]

The KW&SB implemented a multi-phased approach in close cooperation with TI-Pakistan:

a. An IP, developed by TI-Pakistan, was signed between the KW&SB and all the participating consultants and contractors in the *K III Project*.
b. Based on the IP, the KW&SB awarded, in July 2002, the consultancy contract for PKR 62 million[2]. This compares with the estimated cost of PKR 248 million[2], i.e. a savings of approximately 75%.
c. The selected consultants agreed to follow transparent procedures in the award of the construction contracts for the *K III Project* and the consultancy contract included the TI-Pakistan IP.
d. Tendering for the *K III* construction contracts was concluded in September 2003 and were awarded for a combined sum of PKR 4,448 million[2], i.e. resulting in a saving of 15.85% compared with the estimated approved cost of PKR 5,286 million[2]; and
e. As a result of a well-managed procurement process, including an IP, the total cost of contracts awarded, over the period 2002-2003 was 18.5% less than the cost estimate prepared under the Government of Pakistan (GOP) (see Table 1).

The *K III Project* was completed ahead of schedule and below the official estimated cost; it was inaugurated by President Musharraf on May 21, 2006.

Among the lessons learned were:

a. In tendering for the consultancy and construction contracts, the KW&SB, in collaboration with TI-Pakistan, fully implemented the procurement guidelines of the *Pakistan Engineering Council*.

[1] 1 US $ = 62.7 PKR (as on March 31, 2007).

b. The project tendering was reorganized by reducing the number of packages from 18 to 8. This process facilitated the work loads of the bidders; speeded up the tendering process and enhanced the ability of the KW&SB to monitor the awarded contracts; and
c. The role of the MD of the KW&SB was critical in assuring that contract award followed transparent and merit-based tendering. During the entire process, including pre-bid meetings, bid evaluation and contract award, *no negotiations were held to change the contract stipulations, scope of work or reduction of contract prices*.

4.1.4 *Business principles for countering bribery*

The *Business Principles for Countering Bribery* (BPCB) (see Transparency International, 2005a) state that:

– The enterprise shall prohibit bribery in any form whether direct or indirect.
– The enterprise shall commit to implementation of a Programme to counter bribery.

These principles are based on a commitment to fundamental values of integrity, transparency and accountability. Enterprises shall aim to create and maintain a trust-based and inclusive internal culture in which bribery is not tolerated. A Program is the entirety of an enterprise's anti bribery efforts including values, policies, processes, training and guidelines.

The BPCB have been complemented by a suite of tools produced by TI to help companies wishing to implement the *Business Principles* or review their existing anti-bribery processes.

– A *Guidance Document* provides background on each section of the *Business Principles*, explains how to implement each Principle, answers frequently asked questions and gives examples of corruption and of good practice.
– The TI Six-Step Implementation Process (See Figure 3) is a how-to guide for companies who wish to introduce an anti-bribery programme within their organization. This tool is also available as an interactive electronic module.

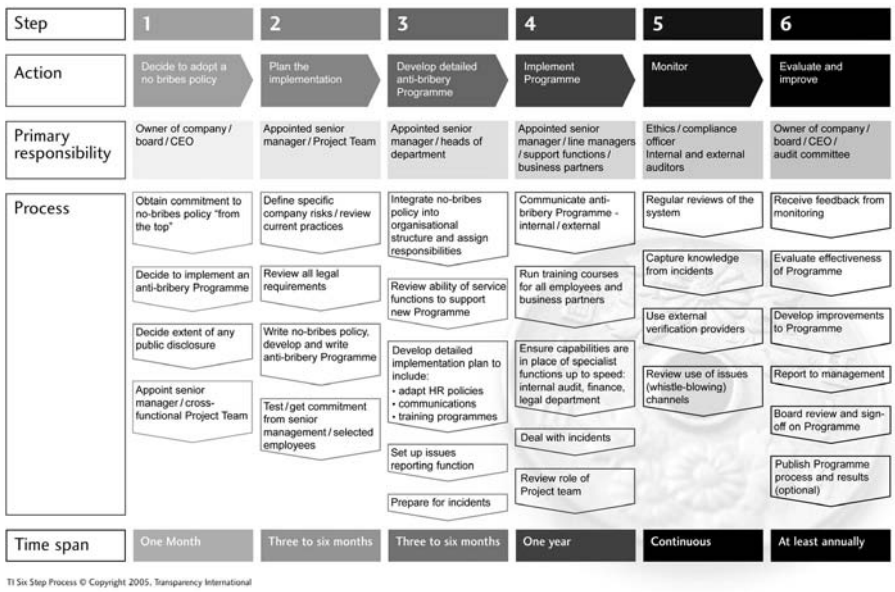

Figure 3. TI Six-Step Implementation Process (Transparency International, 2005a).

- TI is currently developing a *Self-Evaluation Module* (SEM) to assist companies in assessing their anti-bribery performance, which can also serve as the basis for external verification. The SEM includes over 200 indicators, which companies can use to check progress.
- TI also plans to develop an *External Verification Tool* which would be used by companies to obtain verification (by a 3rd party or an internal auditor) of their compliance with their anti-bribery codes. This tool will be based on the BPCB and the SEM.
- In addition, TI is developing an *Interactive Knowledge Tool* as well as a tool for small and medium enterprises (SMEs).

The guidance documents have been field-tested with several focus groups and with managers and staff in three diverse corporate environments: BP Exploration, Azerbaijan (a multinational corporation operating in a transition economy); Tata Iron and Steel Company, India (a major national corporation in a developing country), and Sika AG Switzerland (a medium-sized enterprise in a developed country). Both company executives and compliance managers found them to be comprehensive and realistic. The BPCB initiative is overseen by an international steering committee, consisting of representatives of companies, NGOs, trade unions and academia.

The objectives of this program is not to get individual companies to adopt the *Business Principles per se*, but to provide a model or benchmark against which corporate anti-corruption programmes could be assessed. A number of international corporate reporting initiatives and indices are using the BCPB as the standard for one of the criteria they use to evaluate company performance:

- UN Global Compact.
- Global Reporting Initiative (GRI).
- FTSE4 Good Index.
- World Economic Forum (WEF), Partnering Against Corruption Initiative (PACI).

4.1.4.1 The Role of the BPCB in the Anticorruption Policy of the Overseas Private Investment Corporation (OPIC)

OPIC, an *export credit agency* (ECA), based in Washington, DC, requires (see OPIC, 2006):

- Companies to have anti-bribery programs in place, such as TI's BPCB.
- Certification by officers, directors, employers and especially agents that the project is being carried out in compliance with all applicable laws on corrupt practices; and
- Disclosure by project sponsors if they are under investigation or have been convicted of FCPA violations.

Through incorporation into recognized corporate reporting standards, anti-corruption programs are increasingly accepted as a normal part of good corporate governance. These important reporting initiatives are creating a strong incentive for companies to adopt adequate anti-bribery programs and the *Business Principles* offer the tools to help companies comply. The following exhibit sets out the BPCB *six-step implementation process*.

4.1.4.2 Sectoral BPCB Agreements

In April 2005, the TI Chapter in Colombia sponsored the signature of a sectoral anti-bribery agreement between 11 water pipe manufacturers. This agreement was based on the BPCB. The agreement included:

- Establishment of a general anti-corruption policy in each company.
- Development of specific guidelines in each company regarding each of the forms of bribery specified in the BPCB.
- Development of specific policies regarding pricing policy, distribution and sales schemes and transparent purchasing.

- Development of implementation mechanisms within each company including designating legal representatives, internal controls and audits, human resources, communications, internal reporting and consulting, as well as protection of *whistle-blowers*.
- The roles of the Ethics Committee and the Working Group.

Implementation of the Agreement is supervised by an *Ethics Committee* whose decisions are mandatory on all parties and lack of compliance would make the guilty party legally liable. *A policy of penalties* would be applied in those cases of non-compliance with the Agreement. It is also be the responsibility of the Committee to report to the relevant authorities any questionable behavior that is brought to its attention. A *Working Group* was established with the following responsibilities: a) develop an action plan to promote the Agreement; b) establish parameters to monitor implementation of the Agreement; and c) evaluate compliance with the Agreement. The Working Group consists of members of the water pipe manufacturing companies and receives administrative and technical support from ACODAL, the *Colombian Association of Sanitary and Environmental Engineers*, with which all the piping manufacturing companies are affiliated.

Issues addressed in developing the agreement included:

- Assuring sufficient funding for developing the Agreement.
- Involving top management of Companies, a *sine qua non* for the success of the Agreement.
- Keeping the National Interest as the point of reference for the Agreement rather than specific needs of individual businesses.
- Interacting with all participants on an equal basis, regardless of each company's sales volume.
- Coordinating all issues with up-to-date national legal and commercial legislation as the basis for the Agreement.
- Assuring that the Agreement is followed up by parallel work in the public sector to prevent corruption risks arising from the State.

Opportunities provided by the Agreement include:

- Inducing some Government agencies to develop internal anti-corruption policies.
- Inducing more transparent processes in public procurement processes.
- Promoting good practice in self-regulation for other industry sectors.

Future challenges relate to:

- Continuously improving the environment of trust related to the Agreement implementation and particularly in the Ethics Committee.
- Taking into account the Agreement in the procurement of water distribution and sewage piping by the public sector.
- Continuing the downward pressure on contractual prices of water distribution and sewage piping and thereby reducing the scope for paying bribes.
- Developing similar anti-corruption agreements in complementary business sectors such as public sector companies, consultancy, design companies and contractors.

Further information on this agreement is available in the reports of Balcázar Romero (2005, 2006).

Largely self-financed by the signatories of the agreement, a similar agreement was signed by nine water pipe manufacturers in Argentina in December 2005. The TI Chapter in Argentina was very instrumental in facilitating this agreement, including organizing a high-level workshop in Buenos Aires, in June 2005, which was attended by senior representatives of the industry as well as senior management and staff from the TI Chapters in Argentina and Colombia as well as from the TI Secretariat. The next steps are to extend this process to other Latin American countries, including Mexico and possibly Brazil.

Table 2. Water Utility Performance: Where we are and where can we go?

Utility performance in a majority of developing countries	Currently recorded	Attainable levels*
Unaccounted-for water (UFW)	>45%	<25%
Staff /1,000 connections	>20	<6
Bill collection period	>18 months	<3 months
Working ratio	>1	<0.7
Connection charges (% GDP/capita)	5–60%	<20%
Service continuity	<12 hours/day	24 hours/day

Source: Janssens (2005).
*Based on the performance of the top 23% of utilities in the data set.

4.2 *Instruments for addressing petty corruption*

In reviewing the instruments that can be used to address *petty* corruption, it is very illuminating to discuss them in the context of improving sectoral performance. The example discussed below is taken from the water sector.

Table 2 summarizes the current performance of water utilities, based on a worldwide survey; and compares the potential for performance improvement, based on the performance of the top 23% in the data base. In the short to medium term, the easiest problems that can be addressed are related to *Non-revenue water* (NRW) reduction because it is not necessary to deal with buried infrastructure (piping) and high investment costs. An integrated approach to reducing NRW addresses key parameters of operational/financial efficiency as well as service and institutional sustainability (including demand management, capacity increases and financial flows) and the elimination or reduction of corruption. Further information on well-performing utilities is included in the report of Baietti *et al.* (2006).

Frequently, NRW and other water utility management issues can be addressed by *outsourcing the management of the utility through a performance-based management contract* (MC), (Mariño *et al.*, 1998). The management contractor will be paid through a fixed fee with bonuses against baseline targets. Given the major institutional changes involved in implementing an MC, their acceptance by all the stakeholders (customers, staff, management and the Board) is essential. An effective external and internal communications strategy is essential. The World Bank is building up experience with existing or planned MCs in Africa, Asia and South America. As described by Kingdom *et al.*, (2006), another promising approach in addressing NRW and related management issues is the use of *performance-based service contracting*, which has shown good results in countries as different as Brazil, Ireland, Malaysia and Thailand.

For revenue earning organizations in the network sectors (power telecommunications and water supply), there is also scope for adapting the BPCB, through focusing more on both extortion and bribery. The key requirement is for these organizations to demonstrate that they in place a comprehensive program to combat bribery and extortion including values, policies, processes, training and guidelines (see Section 4.1.4).

4.2.1 *Case study: CAMBODIA. Performance of the Phnom Penh Water Supply Authority (PPWSA)*

The story of the PPWSA, as summarized in Table 3 is remarkable. In a post-conflict country, the PPWSA has been converted into a well functioning organisation in just over 13 years. Providing 90% coverage and 24 hour service to a city of 1.3 million, the PPWSA has reduced NRW from 72% to 8% and has reached full cost recovery with tariffs covering water production and distribution costs.

Tariffs and connection fees are subsidized or paid in installments by the poor. Crucially, the PPWSA also is able to provide water to Phnom Penh's formally unconnected residents at Riels[2]

[2] 1 US $ = 4.1619 KHR (Riels), as of April 1, 2006.

Table 3. Performance of the *Phnom Penh Water Supply Authority* (PPWSA).

	1993	2006
Staff per 1,000 connections	22	4
Production capacity	65,000 m^3/day	235,000 m^3/day
Non-revenue water	72%	8%
Coverage area	25%	90%
Total connections	26,881	147,000
Metered coverage	13%	100%
Supply duration	10 hours/day	24 hours/day
Collection ratio	48%	99.9%
Total revenue	700 million riels[a]	34,000 million riels[a]
Financial situation	Heavy subsidy	Full cost recovery

Source: Asian Development Bank (2006).
[a] 1 US $ = 4.1619 KHR (Riels), as of April 1, 2006.

5,000 per month compared to Riels[2] 1,000 per day, when water was supplied from a water tanker.

The keys to PPWSA's success include: a) the strong political support of the Cambodian Government particularly in relation to the institution's autonomy and its financial viability (through permitting the utility to raise tariffs to cover costs); b) having an outstanding *water champion* at its helm. Last year, Ek Sonn Chan received the prestigious 2006 *Ramon Magsaysay Award for Government Service* for his "exemplary rehabilitation of a ruined public utility, bringing safe drinking water to a million people in Cambodia's capital city"; and c) being able to invest in and motivate its staff. It set up inspection teams to find leaks and illegal connections and had the power to cut off water supply of high-ranking delinquent clients and dramatically increased billing and collection through installing meters for all connections; computerized billing systems and updating its customer base.

4.3 *Citizen report cards*

The concept of the *Citizen Report Card* (CRC) has been used with great success to help improve public services, particularly for the poor in Bangalore, India (see Thampi, 2005). The CRCs were first introduced in 1994 by the *Public Affairs Foundation* (PAF) because of dissatisfaction of the poor quality of service and the high levels of rent seeking by public service officials, pointing to very low levels of public accountability. Over a ten-year period, the PAF has noted significant improvements in public satisfaction with the quality of WSS services and a noted reduction in the corruption levels associated with routine transactions. In addition to the CRC, these changes were also driven by the establishment by the State Government under the leadership of the Chief Minister of the *Bangalore Agenda Task Force* (BATF), a public-private partnership that catalyzed and provided assistance to service providers to upgrade their services and responsiveness.

The keys to success of the CRC include: use of shame/pride as non-monetary incentives to improve institutional performance; importance of communication campaigns, including the role of the media; the use of comparative ratings to introduce an element of competition amongst service providers; the importance of an *independent and neutral monitor* to keep the pressure on supply-side reforms; user surveys of perception to provide real-life check; the need to build up a culture of accountability amongst public agencies as well as among CSOs; and the need for clarity in relation to the design, measurement and implementation of the CRCs. It also bears noting that these changes did not occur overnight; significant time and pressure was needed to bring about these changes.

5 THE WATER INTEGRITY NETWORK (WIN): EXAMPLE OF A SECTORAL COALITION TO COMBAT CORRUPTION

5.1 *Objectives*

The overall development aim of the WIN is to reduce poverty by fighting corruption in the water sector. Detailed objectives of the Network include to: promote increased awareness and understanding of corruption issues related to water; research and disseminate effective anti-corruption information, methodologies and best practices relevant for organizations working in water; support practical actions and hands-on methods to fight corruption in water; develop monitoring mechanisms relating to corruption in water; and encourage and support enhanced capacity of governments, civil society, the private sector and all other interested parties to undertake, coordinate and work together against corruption in the water sector.

5.2 *Scope*

The Network's scope is to: develop appropriate balance between advocacy work (such as through media campaigns, access to information and other advocacy and awareness instruments) and concrete action (including start-up activities on the ground, particularly by NGOs); capacity building, such as strengthening anti-corruption monitoring by civil society, the private sector and public agencies in areas, such as decentralization of services; application and implementation of anti-corruption tools and methodologies (ranging from international conventions and national public sector reforms to tools developed by CSOs such as integrity pacts, codes of conduct, report cards and participatory budgeting); diagnosis, assessment and research of corruption in the water sector as well as the effectiveness of various anti-corruption measures; and dissemination and management of information and knowledge pertaining to corruption and anti-corruption measures. The network covers all aspects of water supply and sanitation (WSS), irrigation, hydropower and water resources management, in general; and since corruption is a worldwide phenomenon, the network will be worldwide. Because of the interests of the founding members, many of the network's initial activities are expected to focus on WSS.

5.3 *Membership*

The membership of the WIN is inclusive being open to representatives of Governments; utilities; regulators; the private sector; the donor community; the Water and Sanitation Program (WSP) of the World Bank; policy advice organizations including relevant agencies of the UN System and regional bodies; universities and research organizations; professional organizations; and civil society organizations. The Network was launched during *World Water Week*, held in August, 2006 in Stockholm; as of the end of June 2008, it had 673 members from 83 countries.

5.4 *Network governance and organization*

The WIN Secretariat (WIN-S) is hosted in the Secretariat of Transparency International (TI-S) in Berlin. The Secretariat currently reports to an *Interim Steering Committee* (ISC) consisting of representatives/staff of AquaFed (*The International Federation of Private Water Operators*), *Deutsche Gesellschaft fuer Technische Zusammenarbeit* (GTZ), IBON (an NGO based in the Philippines), the *International Water and Sanitation Centre* (IRC) of Delft, the *Stockholm International Water Institute* (SIWI), the *Swedish Water House* (SWH), Transparency International (TI), the *United Nations International Childrens' Fund* (UNICEF) and the *Water and Sanitation Program* (WSP) of the World Bank. The WIN ISC will be replaced early in 2008 by a Steering Committee elected by the WIN Members. A communications specialist joined the WIN-S in summer 2007; the programme manager is scheduled to join the WIN-S early in 2008. Further information on the Network governance is set out in Figure 4.

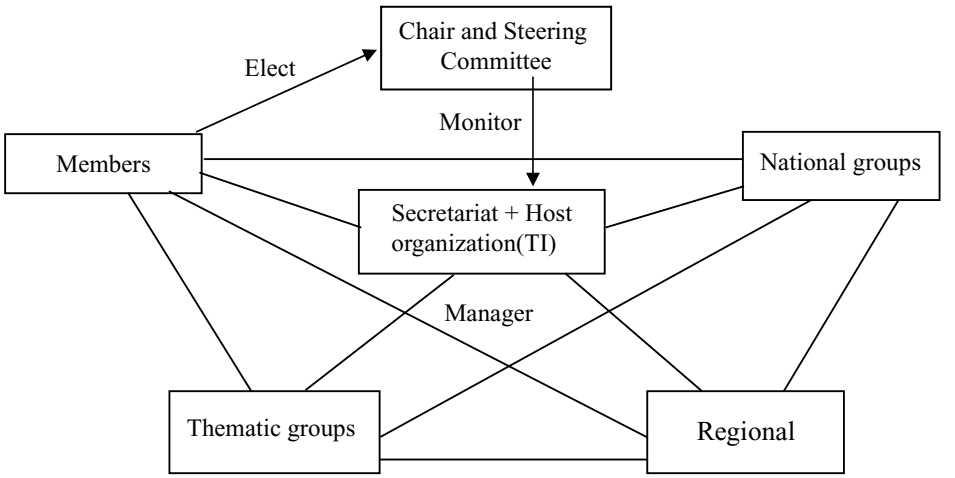

Figure 4. Governance of the *Water Integrity Network* (WIN).

5.5 *Activities*

The network activities will include:

a. Development of *Knowledge Products* including: i) research on corruption in the water sector; ii) a water sector anti-corruption toolkit, focusing on tools, methodologies and strategies; and iii) supporting TI's *Global Corruption Report* (Transparency International, 2008) featuring the Water Sector.
b. Supporting *networking activities* including: i) Developing a members' database; ii) Setting up a network *home page*, a helpdesk and a newsletter to communicate with WIN members; iii) Organization of discussions grouped around topics of interest; iv) Facilitating the setting up of national, regional and thematic groups.
c. Organization of *Regional and National Workshops* aimed at identifying and facilitating practical anti-corruption activities.
d. Supporting *Local Actions* in anti-corruption activities in the water sector, particularly by NGOs.

The Secretariat of TI (TI-S) supported a Workshop in South Asia in November 2007 organized by TI Bangladesh. Other co-sponsoring organizations included the *International Water and Sanitation Centre* (IRC) of the Netherlands and IBON, an NGO located in Manila, the Philippines. UNICEF was also involved in this event.

6 ACTION PLAN FOR ADDRESSING CORRUPTION IN THE WATER SECTOR

6.1 *Premises*

This Section proposes an action plan for addressing corruption issues in the water sector. It is based on the following premises:

– Addressing corruption is part of a wider effort to put in place the conditions for maximizing national growth and improving the quality and access to services, particularly for the poor.
– Addressing sectoral issues complements activities at the macro level, such as: civil service reform; clear anti-bribery legislation; an independent judiciary; effective access to information and relevant legislations; a strong and vigorous press and an active and autonomous anti-corruption organization.

- In relation to international and national anti-corruption conventions, it is important for the signatory countries to ratify them in a timely manner; then assure that their provisions are fully incorporated into their legal systems and their institutional frameworks; and finally that their provisions are actively applied, enforced and monitored.
- A multi-stakeholder approach involving government, the affected communities/consumers, water utility companies (either public or private), the private sector (including commercial banks), the international financing institutions, the donor community, CSOs and other organizations.
- Comprehensiveness, i.e., it needs to address corruption as it affects the construction and operation and maintenance of water infrastructure as well as delivery to and payment from consumers.
- Focused action research is needed to constantly incorporate lessons from *best practices* practiced elsewhere.

6.2 *Action Plan*

The Action Plan may be broken down into the following components:

A. Sectoral Reform:

- Government support (*political will*) is critical to facilitate the sectoral and institutional reforms needed for high-level water services to the consumer.
- Define and implement a water policy, set a regulatory framework, create a basis for qualifying and monitoring work as performed by different agents of the public and private sector, and explore effective approaches to such capacity development such as *Public-Public-Partnerships*.
- Cost recovery is one of the keys for sustainable development of the sector. *Water does not have to be free*.
- Foster an appropriate level of decentralization, including the possibility of NGO support.
- Explore under-used potential for competition.
- Active involvement of CSOs to mobilize citizen/customer involvement and support, particularly in relation to needed tariff increases as well as assuring high levels of bill collection and low levels of illegal connections.
- Be complemented by a vigorous multimedia communications strategy aimed at raising public awareness of unsatisfactory performance in the water sector, the pervasiveness of corruption and the steps that can be taken to address these issues.

Integrating a deep rooted reform program with a vigorous communications strategy should help transform political power in water from a liability to strength.

B. Institutional strengthening/Capacity development:

- Water utilities and other executing agencies should be autonomous and made attractive for high-calibre leadership (water sector 'champions') and accountable for performance and delivery.
- Public-private partnerships based on management contracts or performance-based service contracting can help utilities significantly improve performance and reduce *petty* corruption.
- Institutions should be supported with appropriate staffing levels and adequate salaries and other incentives, including relevant training opportunities.
- The BPCB, suitably adapted, could provide the framework for instilling a culture of integrity, transparency and accountability within a water utility.

C. Procurement:

- Should be based on the implementation of an effective procurement law, with acceptable controls and vigorous law enforcement.

- TI recommends that its *Minimum Standards for Public Contracting* be adopted. It bears noting that these standards refer to the provision of goods and services as well as the implementation of works.
- Embedded in this is the *Integrity Pact* (IP), which TI believes is an effective vehicle for addressing corruption in specific contracts.
- Public confidence in the procurement process can be further strengthened through involving CSOs in its monitoring.

D. Operation and Maintenance (O&M):

- Performance-oriented management contracts are a realistic option for addressing O&M issues (including NRW) in water utilities.

E. Research:

- Quantifying (by region) the benefits for the private sector to participate in IPs.
- Development of effective tools for monitoring corruption in the water sector.

The following steps can be taken by *MDBs and the donor community* in general to support the action plan set out in the previous paragraphs:

- Expand project preparation to focus on the identification of the sectoral and project corruption risks as well as developing an action plan to address them.
- The action plan would focus primarily on *preventive anti-corruption measures*.

The following due diligence can be taken by organizations facilitating or providing private sector funding for water sectors projects (including public-private partnerships) such as *export credit agencies, commercial banks and the private sector wings of MDBs* in the context of the action plan set out in the previous paragraphs:

- Require companies to have anti-bribery programs in place, such as TI's BPCB.
- Require certification by officers, directors, employers and especially agents that the project is being carried out in compliance with all applicable laws on corrupt practices.
- Disclosure by companies if they are under investigation or have been convicted of violations of anticorruption laws, such as the FPCA or have been debarred by any MDB.

In addition, TI (Transparency International, 2005b) believes that the following steps can be taken by ECAs to reduce the risks of corruption in projects for which they provide cover:

- Upgrade with due diligence undertakings required of the applicant.
- Upgrading with due diligence of the ECA.
- Disclosure by the ECA for applications for *cover* in the name of the applicant; amount(s) applied for; and the country into which the goods and services will flow.
- Clear remedies to be implemented by the ECA (e.g. refusal of cover; suspension of cover; debarment etc.).

7 CONCLUSIONS

The major conclusions relate to:

a. Progress has been made in *raising awareness* of the amount and impact of corruption on national economies and particularly the water sector, especially in the last five years.
b. Addressing corruption issues in the water sector can contribute significantly towards meeting the multilateral development goals (MDGs). According to the World Bank, 20-30% of water finances are being lost due to corruption and dishonest practices. If we assume an average corruption level of 30% in Sub-Sahara Africa, this would result in a leakage of US$ 10,000

million over the next 10 years. This compares with the estimated annual expenditures of US$ 6,700 million needed to meet the MDGs.

c. While anticorruption strategies should focus both on the prevention of corruption, its discovery as well as the enforcement of anti-corruption laws and regulations, the sustainable (and less dangerous) approach is to focus on the *prevention of corruption*.
d. Although some clear advances have been made (such as eliminating the tax deductibility of bribes in industrialized countries), due to the *lack of political will*, progress has been slow in both industrialized and developing countries in defining and implementing anticorruption strategies at both the national as well as the sectoral levels.

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CHAPTER 17

Public participation to promote water ethics and transparency

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For to him that is joined all the living there is hope (Ecclesiastes 9:4)

There is a flame, hidden in water, that gives not heat, but life (Duncan, 2001)

ABSTRACT: Addressing ethical issues concerning water requires first of all the recognition that water is different from any of the other resources managed by humans. It has been the source of all life on Earth and continues to support all life on Earth. In modern society we have separated human life from the life of other species—to our detriment. By giving priority to human life we end up by recognising the value of other species only as providers of water services to us. We mistakenly carry this to the point of increasingly misusing economics as the basis for decision-making.

Humans, because of our capacity for reflection, are (as far as we know) different from other species. But we are still a part of nature, not masters of it. All of our actions are influencing the rest of nature. We won't destroy it. But we have the capacity to knowingly bring about the end of other species, and of our own, by ignoring our linkages with the other species. The selfish gene that created us may replace us with another form of life.

Fortunately hope also lies with humans. By renewing our sense of unity with the rest of nature, we can create a sustainable future for the lifetime of our planet. This will not happen overnight. The special place of humans in nature has developed over hundreds if not thousands of years in large measure through our learning processes. Systematic public consultation is one way to influence our future evolution for the better. A public consultation process for sustainable development adopted in Québec in 1978 has been successful. Adoption of similar processes with respect to decisions related to the management of water would contribute to making us more aware of our place in nature, the dependency of nature on water, and promote transparency and reduce corruption in the water sector.

Keywords: Public Participation; Economics; Transparency; Corruption; Meme; Human Species; Nature; BAPE; Sustainable Development; Water Resources Management.

1 WATER IS DIFFERENT

Addressing ethical issues concerning water requires first of all the recognition that water is different from any of the other resources managed by humans. The following quotation from the *World Water Vision* summarises the history of water—the source of all life and sustenance of all life on our planet (Cosgrove & Rijsberman, 2000):

"All life on Earth has depended on water since the first single-cell organisms appeared 3.5 billion years ago—consuming energy, growing, reproducing. From that time until very recently in geological history, there was a balance between the needs of life and the available water. Humans appeared as a species less than 100,000 years ago. Sometime less than 10,000 years ago we developed stone tools, learned that we could cultivate our own food instead of just gathering it, established civilisations, and began migrating long distances. In the past 200 years our numbers grew exponentially—more people to be fed, and more water needed by each person for economic development.

In the past 100 years the world population tripled, but water use for human purposes multiplied six fold! Today perhaps half of all available freshwater is being used for human ends—twice what it was only 35 years ago. Looked at another way, all freshwater serves human needs, because ecosystems provide goods and services to humanity beyond the obvious water for drinking, food production, and industrial uses . . . We are not sure how much water must remain in our ecosystems to maintain them, but indications are that we are approaching—and in many places have surpassed—the limits of how much water we can divert".

This quote reminds us that for over three billion years, life has been colonizing our planet and transforming from one equilibrium state to another. It seems to adapt and transform itself according to a self-regulating process. It has suffered and recovered from disasters that disrupted this self-regulating process. We don't really know whether, just fifty years from now, the climate will be the same, the air will be breathable and water will be drinkable, or whether our wastes, more and more sophisticated and interacting with one another to create new substances, will become a source of misery and death. Once these wastes have been discharged to water, removing them may become prohibitively costly if not impossible. Even though humans might not survive, Richard Dawkins would probably argue that the *selfish gene* would find a way to adapt even in such extreme circumstances (Dawkins, 1976). We do know that eventually, as our sun ages, the intensity of its radiation will increase, heating our planet to a point where it will not support biological conditions for life as we know it. It would seem probable that at this point in cosmic time all water on Earth would once again exist only in the vapour state.

Importantly, the quote reflects a mindset common to most of us working in the water sector, and which we share with most humans—seeing ourselves as separate from the rest of nature and giving priority to human life and recognising the value of other species only as providers of services to humans. Man simply contributes to the process of modification of the functioning of primeval ecosystems. Yet, unnatural as it may be, there is a clear separation in our minds between humans and the remainder of the ecosystem of which we yet are a part.

Water is essential to human life and development. At the *Marcelino Botin Water Forum* in 2004 (Rogers *et al.*, 2006), the point was made that water is required to achieve nearly all of the *Millennium Development Goals*, whether for hunger alleviation, poverty alleviation (economic development), or sanitation. But environmental sustainability is required to assure the availability of this water (Cosgrove, 2006).

One critic of the *World Water Vision* process refers to a meeting at which the preliminary findings on water shortage were presented by a spokesperson for the exercise, who then turned to the nature conservation people present and asked: "How much water would the world have to reserve *for nature*?" She reports: The nature conservation people looked alarmed at the philosophical gulf that yawned between the two sub sectors. "Nature is not a competitor for water" came the response. "Nature is the source of water". The thesis of her book is that: "Nature is the source of water; therefore our ability to support additional human lives on planet Earth depends on the protection of nature and the continued operation of the water cycle" (Hunt, 2004). This doesn't recognize that water was one of the elements of our planet before *nature*, as we define it to-day to include some form of life, existed. Water was the source of this nature. Hunt does go on to say that our only option is that humans recognize that they are a part of nature and must alter their behaviour instead of trying to alter the natural environment (Hunt, 2004: 58). Yet even this approach would continue the separation and imply, moreover, that humans can decide what is good for all nature.

In fact most actions of humans have an impact on the rest of nature, as pointed out in a publication of the *United Nations Economic and Social Council* (UNESCO). Almost all nature and natural resources are managed by humans, either intentionally or unintentionally. The authors call for a "new awareness of how humans are co-managing ecosystems". They point out that "to separate human interventions from a perceived state of nature can be as unrealistic as ignoring human impacts on the ecosystem" (UNESCO, 2003). It is only a small step from that to the recognition of humans as part of nature, all species equally dependent on water.

Some recognize that "focusing on human needs often results in overlooking the basic principles, the assembly of their communities, the organisation of ecosystems and the multiple roles of water

in the biosphere" (García Novo & García Bouzas 2006: 252). However, even here the focus of the authors is on taking full advantage of our knowledge of such water systems to bring them to social uses.

The separation of humans from the rest of nature is perpetuated unconsciously by even by the most devote supporters of the nature movement. Perhaps this is in response to generally held view in society that the human species is of greater value, that the rest of the species exist only for our benefit, and that somehow everything may be given an economic value. This subject is discussed further in the next section of this chapter. The *International Union for the Conservation of Nature and Natural Resources* (IUCN) provides an example of such reasoning. In a recent publication they point out that people use services provided by all elements of society, but also use services provided by the ecosystems around them. Having demonstrated that the ecosystems that provide these services depend on water, they set out to quantify the economic value of the services and hence of water (IUCN, 2006). Reference is often made in other IUCN publications to other ways of valuing water.

Falkenmark & Rockström (2004) make the case that soci-ecohydrological management of catchments is required to balance water for humans and nature. They point out that developing the scientific knowledge required for this will require overcoming a major fragmentation that still exists in science between hydrologists/water managers and ecologists. These two groups will need to meet on an equitable basis. It would seem essential that in coming together the two groups agree on scientific rather than politically defined definitions and indicators.

Climatic variations are an essential part of nature. The planet has known several such variations that exceed those currently forecast. Many aquatic systems depend on seasonal fluctuations in rainfall and river flows. Over the years, escalating withdrawals of water for human use have meant diminishing availability of water to preserve ecosystems. When the effects of intensifying climate extremes are superimposed on increasing water demands for all uses, protecting nature is both more vital and more challenging (Dialogue on Water and Climate, 2000). A global vision would lead us to believe that all that we know or perceive to-day will be changed in the foreseeable future. These changes will vary in different regions of the planet. The management of all our resources must be adapted to take account of these changes. Both the availability and the demand for water will change and force adaptation. The critical period for society will be during this adaptation.

Humans and the other species of the ecosystems of which they form a part do not function in isolation. They constantly evolve due to the interactions of their components. They are united by water. As noted earlier, research into new ways of water management requires a transdisciplinary approach. A UNESCO report tells us that as a consequence, ethics cannot be confined to philosophical discussion (UNESCO, 2004: 11). Ethics and normative values still are visible in a number of indigenous communities and study of their cultures reveals astute ecological cleverness. In these cultures, humans are not regarded as separate from their natural environment. As a consequence, they are empirically aware that human and natural systems are mutually responsive and interactive. They have a special respect for water. Reflecting this, the indigenous residents of the Lake Biwa catchment in Japan called the lake *Mother Lake*.

Fortunately, at the highest level of world government, the *General Assembly of the United Nations* has provided guidance. Box 1 contains extracts of the *World Charter for Nature* (UN, 1982). Surely the natural system that is most important [article (a) of the preamble] is the water system!

2 ECONOMICS REPLACES WATER ETHICS?

It seems certain that our ancestors saw themselves as closely linked to nature, even if they had to fight with it to subsist. Some aboriginal communities still hold this view. It was the case at the time of St. Thomas (died in 1274) who described the *natural law* as a reflection of God's will (Beauchamp, 1993). It was following the Renaissance and Reform periods that this sacred view of nature in Western Christianity was displaced by a new view. Nature now was seen as a factor to be dominated or an enemy to be overcome for the betterment of humankind. In 1924 the economist John Locke, argued that humans could appropriate elements of the environment by mixing their

labour with it in a state of nature, with the proviso that you left *as much and as good* for others (Locke, 1924). With the recognition that this approach was unsustainable, the 1960s and 1970s were characterised by debates over environmental quality *vs.* economic growth.

Box 1. Extracts from the *World Charter for Nature (UN 1982)*

From the preamble:

The General Assembly,

Reaffirming the fundamental purposes of the United Nations, in particular the maintenance of international peace and security, the development of friendly relations among nations and the achievement of international co-operation in solving international problems of an economic, social, cultural, technical, intellectual or humanitarian character,

Aware that:

a. Mankind is a part of nature and life depends on the uninterrupted functioning of natural systems which ensure the supply of energy and nutrients.
b. Civilization is rooted in nature, which has shaped human culture and influenced all artistic and scientific achievement, and living in harmony with nature gives man the best opportunities for the development of his creativity, and for rest and recreation.

Convinced that:

a. Every form of life is unique, warranting respect regardless of its worth to man, and, to accord other organisms such recognition, man must be guided by a moral code of action.
b. Man can alter nature and exhaust natural resources by his action or its consequences and, therefore, must fully recognize the urgency of maintaining the stability and quality of nature and of conserving natural resources.

And from the principles:

1. Nature shall be respected and its essential processes shall not be impaired.
2. The genetic viability on the Earth shall not be compromised; the population levels of all life forms, wild and domesticated, must be at least sufficient for their survival, and to this end necessary habitats shall be safeguarded.
3. All areas of the Earth, both land and sea, shall be subject to these principles of conservation; special protection shall be given to unique areas, to representative samples of all the different types of ecosystems and to the habitats of rare or endangered species.
4. Ecosystems and organisms, as well as the land, marine and atmospheric resources that are utilized by man, shall be managed to achieve and maintain optimum sustainable productivity, but not in such a way as to endanger the integrity of those other ecosystems or species with which they coexist.

In 1978, Henderson argued that economics of the 1980s would incorporate the knowledge of how to design regenerative production systems based on human resources and the almost unlimited potential of human beings as our greatest natural resource, in which our investments will yield the largest returns (Henderson, 1981). This point of view is supported by Fogel (2000) who writes: "Our grandchildren will discover and implement new scientific principles and technologies that will greatly enhance the capacity of humankind to control its environment and to alter its fundamental genetic makeup". It is interesting to note that the concept of risk-based decision making and the *precautionary principle* also evolved over the same time period (and continues to evolve).

Pearce and Warford argue that since the late 1980s or early 1990s with the recognition that it is impossible to convince the rich not to get even richer, the focus changed to how growth can be achieved in an environmentally friendly way, and the solution lies according to them in technological

change. "We must provide incentives for individuals, communities and nations to look after the natural world" (Pearce & Warford, 1993). But do we know how? Lena Klevena points out that the richest billion on the planet have left ecological footprints that are too big. She questions whether we can keep our standard of living just by using energy and other resources more effectively, or whether we will not have to make significant decreases in our consumption. Moreover, she questions: "How can we keep growing economically and at the same time reduce the gap between us and the poorest billion?" (Klevena, 1999).

Not long ago there was concern that *deep ecology* would be the new religion. In Québec just recently a major daily newspaper carried a front page store with the heading "Will the Greens be our new priests?" My concern is that misused economics has become the new God. The IUCN publication *Pay* referred to earlier (IUCN, 2006) proceeds from quantifying the economic value of services to proposing payment schemes for the provision of ecosystem services.

Bergkamp suggested that economic valuation of the benefits from ecosystems can be a powerful tool to be used in judging ecosystem use along with use of water by other economic sectors and activities. Financing for sustainable management of our water resources will require economic and financial justification (Bergkamp, 2006). The *Executive Directors of the United Nations Environment Program* (UNEP) are oriented in this direction. Toepfer (2006) talked of a better return on nature's capital. His successor Achim Steiner refers to capital being run down, but sees hope in *sustainable trade*—trade that is not extractive in nature but sustainable for current and future generations (Steiner, 2006). The latest *UN World Water Development Report* also largely tries to give an economic value to the environmental and social importance of ecosystems (UN, 2006). On the positive side, the *UN Committee on Economic, Social and cultural Rights* (2002) in adopting a statement on human rights to water adequate for human dignity, life and health goes on to say that water should be treated as a social and cultural good, not solely as an economic good. Beauchamp argues that without critical input from ecologists, economic logic would limit analysis to the exigencies of the marketplace (Beauchamp, 1997).

There is a danger that economics might be misused to justify decisions on questions of principle. The saying is that you can only manage what you can measure. How do you measure dignity? At least in the French culture, until the 19th Century the word *value* was limited to the concept that the value of anything was *in the eye of the beholder*. In this sense, nature has value only in the eyes of someone who contemplates and appreciates it. In the absence of such a person or persons, it would have no value. Around this time the sense of value was adapted to include an economic sense, beginning with a value in its use or for exchange, ultimately expressed in monetary terms. But the economic sense of the word fails to express all the values that we perceive, for example those philosophical or human values that give sense to our lives (Cosgrove, 2003). When trying to describe these values, one has the sense of moving from the quantitative to the qualitative. Having made nature purely utilitarian or an instrument of our development, it should be normal now that we recognize that it is more than a simple condition for our existence. Nature (including water) is the milieu that we inhabit, and which is part of us. By its very existence, it has a meaning or value (Beauchamp, 1997). Yet some indicator is needed if decisions are to be made on the wise use of resources.

Johnson (1991) says that apart from repercussions to humans, where there are repercussions, our behaviour is wrong just because of what it does to the animals, species and ecosystems themselves. But natural events beyond the influence of man can also have such repercussions. Are they *wrong*? Is the issue not that humans are capable of avoiding or mitigating such consequences of their actions?

Acreman (2003) has looked at the issue by comparing a *natural* ecosystem with one highly managed by humans. He notes that human intervention is now so widespread that one can hardly any longer speak of a *natural* ecosystem. However, it is essential that the costs and benefits to society of allocating water alternatively to maintain ecosystems and to support direct use in the form of agricultural, industrial and domestic uses are quantified. He points out that relying on economic security for decision-making ignores *social and ethical security*. But he concludes by asking whether this matters "since perhaps ethical security is merely a luxury that can only be afforded by those who have already achieved economic and social security". It is worth recalling

that separated from nature in our thinking, the industrialised world took note of the repercussions of its activities only when it became wealthy.

Can humans do better than the rest of nature, thus contributing to the overall efficiency of the natural process? It is not unusual that nature does not make optimum use of resources. Consider, for example, the enormous reserves of coal, oil and natural gas, biologically stagnant for thousands of years. The human species has put them to our good use, and can continue to do so until they are exhausted. While various predictions of when this will happen have all proven wrong, it is certain that if we continue to consume them as we do, one day they will be exhausted.

Delli Priscoli (2005) suggests that we move towards a utilitarian approach, in which it is assumed that nature is changing and human efforts need to use the resources in ways that do not disrupt their viability. We would co-create with nature, adding value and benefits, and thus making more available for all. Thus instead of impending conflict over limited resources there would be new forms of evolution, including that of humans.

3 HUMANS ARE DIFFERENT

As water has a special place in nature, so humans have a special place among the species of life on Earth. The specificity of humans comes from biological evolution: walking upright, hands that grasp, development of our nervous system (our brains have grown on the average from 400 cm^3 to 1,350 cm^3 in the past three million years), social life and ability to communicate through language. The last three of these qualities have been what give humans to quickly store, retrieve and process information that we receive not only from their own senses but also from others. This in turn resulted for each human in awareness of self and of relationships with their own culture and other human cultures—from whence probably the term *cultural man*.

Individuals and their immediate family or society learned by observation and sharing experiences that out of self-interest certain behaviours were to be avoided or encouraged. Codes of behaviour were passed on from parents to children and generalised through society in the forms of myths, stories, traditions and rites (Beauchamp, 1993). Thus behaviours came to be characterised among others as good or bad, pure or impure, just or unjust, life or death. It has been observed that from this has developed a set of human values shared by most, if not all societies. These include truth, love, peace, right conduct and non-violence (Cosgrove, 2003). Humans became an ethical animal. To our knowledge we are the only moral agents on the planet. According to this set of human values or ethics, corruption is evil, because it is contrary to the good of society. Transparency is a good practice because it helps to discourage corruption and increase trust and cooperation. Delli Priscoli (2004) says that the way we exercise control over water reveals what we value.

But this doesn't seem to be the end of the story. Instinct, discipline and group learning no longer satisfy. Humans want to refer to principles and values, to analyse causes, consequences, and even when there is conflict of opinion, to seek means of arbitration—always in a search for definition of what is right or wrong and the nature of their responsibilities.

It is in this context that we examine the issue of sustainable development and human management of the planet's water. While humans may strive for a balance between all species of nature, it is in the nature of things that each species acts in its own interest, and thus that humans give priority to their own interest. It is for this reason that the *World Water Vision* states, for example, that while further efforts are needed to raise living standards and improve the quality of life for humans and all living things "People come first. . . " (Cosgrove & Rijsberman, 2000: 49). If we examine sustainable development from the perspective of humans without relationship to the rest of nature, we face the issues of equity and justice referred to earlier. These are a challenge in themselves, perhaps the greatest.

Having developed their own culture does not mean that humans have ended their relationship to other species from which they evolved. Humans must make an alliance with nature to recreate the Earth, in a spirit that transcends both. Dooge, Delli-Priscoli and Llamas support this concept: "Somehow water forces us to go deeper than the familiar adversarial positions and acknowledge

what we really share—a respect for life and well-being. Water can be a superordinate value, the appeal to which is capable of coalescing conflicting interests and facilitating consensus building within and among societies . . . In a sense, negotiations over water use, itself, could be seen as a secular and ecumenical ritual of reconciliation and creativity" (UNESCO, 2003). Falkenmark & Rockström (2004) point out that the water cycle links humans and landscapes, on the scale of individual species, local ecosystems and the global ecosystem.

The distinctive nature of humans has resulted in their having no natural predators and learning to defend themselves against parasites and epidemic illness. In a sense, the only source of danger for humans is from themselves. They are their own worst enemy. Stapledon was one of the first to point out that considerable unbalance exists in the human way of life, and that human adaptability was at once the key to human progress and could allow humans to create a world that would swallow them up. He argued that single individuals could not be exposed to all of the stimuli that would enable them to enjoy a full life in a biological sense. Therefore humans can only perfect themselves by integrating first within the individual, then within the family, and finally, the family within society. Moreover, this cannot happen unless they realise that the environment is part of them, and that they are part of the environment (Stapledon, 1964). It is interesting to note that this soil British conservationist was writing his reflections at about the same as the American Rachel Carson (1962) was describing in *The Silent Spring* the impacts of human pollution on watercourses, and within less than a decade of Barbara Ward's *Spaceship Earth* (1966) and the *Limits to Growth* of the *Club of Rome* (1972). Some, recognising that technology has fundamentally changed society, hold that the *status quo* is unacceptable, and on a human level may lead to the *underclass* revolting and replacing politics by terrorism.

A changing world requires new ideas, and the more new ideas there are, the more we shall get used to them. Individuals left to their devices, outside the institutions of society, will become more and more selfish. We need more *unreasonable* people who through organisations, including government, take responsibility for survival of our species. This approach by Handy (1990) only tangentially takes into consideration the relationship of the human species to the rest of nature.

This is also the thesis of Dixon who after surveying the history of development of man, has concluded that humans are biologically incapable of surviving the way of life driven by technology and systems of governance that they themselves have created. He rejects as improbable one possible solution: that technology advances to the point that it can be used to modify the human genetic make-up in time to avoid disaster. However he notes that several examples demonstrate that females are biophilous (interested and concerned with preserving life) while males are necrophilous (more concerned with the inanimate and destroying life). This leads to his second proposal that humans should, as rapidly as possible, increase the number of women in decision-making positions (Dixon, 1987). He concludes with the rather pessimistic reminder that humanity existed for millions of years before the current generations, without their knowledge, and that when they are dead it won't matter what happens because they won't be there to see the result.

This last observation resonates with the conclusion of another scientist, Susan Blackmore. She builds on the work of Dawkins (1976) who concluded his work *The Selfish Gene* by noting that there could be another Darwinian replicator contributing to the evolution of the human species. He coined the term *meme* to describe this factor. A replicator by Dawkins definition is anything of which copies can be made, including *active replicators* whose nature affects the chances of their being copied. The familiar active replicator now is defined by science as DNA. Blackmore develops this concept of another active replicator (Blackmore, 1999). Her thesis is that this *meme* has co-determined the evolution of humans. She notes that when a being imitates another, something is passed on. This *something* can be passed on again, and again, and again, and so take on a life of its own. Everything that is passed from person to person in this way is a *meme*. *Memes* spread themselves around indiscriminately, as do genes, whether they are useful, neutral or harmful to us. The successful *memes* get copied, the unsuccessful ones do not. This leads her to state that while humans think of their ideas as their own creations and working for them, they should be thinking of them as selfish *memes*, the product of other selfish *memes*, working only to be copied. Since this would also apply to the concept of self, conscious humans in fact do not exist, only human bodies

serving as hosts for *memes*. There is therefore no role for humans but to be passive participants in an evolutionary process in which genes and *memes* play themselves out.

The last jump in her hypothesis is undoubtedly too much for most humans to accept, and will only be proven or disproved, like all hypothesis, by experience over time. But her book does make a good case for the foundations of her hypothesis. If we accept the validity of the mechanism she describes for the transmission of *memes*, then we can intervene in the process to increase the probability of the recognition and spread of successful (desirable?) *memes*. This could be done by ensuring that as many individuals as possible of all elements of society (the source of *memes*) participate in a process in which brings them together and maximizes the opportunity for exchange.

4 HOPE LIES WITH HUMANS

As seen, several authors have concluded that the way out of the perceived crisis created by humans also lies with humans and have suggested ways in which this could happen. Thus for them, hope lies with humans. In this context, hope is defined as by Fromm (1968) "a psychic commitment to life and growth". Most of our political institutions, domestic and international are not well-suited to giving high priority to the complex issues of *sustainable development*. A *World Energy Council* publication proposed a number of measures, among them:

- A readiness to live in greater harmony both with each other, including the poorest and most deprived in world society, and with our natural environment and the other species that inhabit it; and
- Advance of the ethical basis of governance, economic transactions and human interaction especially in respect of open governance; publicly available and independent audits of economic transactions and their environmental impacts; and common rules for best business practices, safety and environmental performance (World Energy Council, 2001).

The *World Commission on Environment and Development* (1987) (*Brundtland Commission*), concerned by the marginalisation of the poor, suggested that political systems that guarantee public participation in decision affecting them would permit the more equitable development of resources. This suggestion was reinforced in January 1992 in Dublin (Box 2).

Box 2. ***Dublin Principle No. 2***

Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.
The participatory approach involves raising awareness of the importance of water among policymakers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of users in the planning and implementation of water projects.

Participants in the *World Water Vision* exercise did not limit their vision to questions of the physical management of the resource. They went beyond this to say that accomplishment of the *Vision* could be achieved only if empowered individuals and communities participated at all levels of decision-making related to water resource management. It is doubtful that this conclusion was reached based on the ethical considerations discussed earlier. Rather, their concern was more pragmatic and driven by considerations of systems of governance. Thus the *Vision* report concluded that:

"Both public and private management of water will improve through greater accountability, transparency, and rule of law. Incentives must improve for all stakeholders. More community

participation will provide a sense of ownership and empowerment to local stakeholders. The role of education in making this process possible cannot be overestimated. Public access to information will provide an incentive to elected officials and private operators, who will be held responsible for results, including maximising social welfare. It will also reduce opportunities for corruption and for the capture of the system by powerful elite" (Cosgrove & Rijsberman, 2000).

If it is not be acceptable that one person or limited group of persons decide for all citizens, this leaves open two options: that all participate in the making of decisions or that they delegate the responsibility to others, together with a clear indication of their preoccupations and desirable solutions. The concepts of dispersed and democratic leadership are not contradictory (Global Governance, 1995). However, given the complexity of the issues and the number of persons involved, participation by all in the actual making of the decision for most issues to-day would seem to be difficult. Manners of reaching this objective may one day become practical through advances in technology and governance processes.

Delegation to elected officials of decision-making on all issues might not be an acceptable approach to some either, as those elected could not be expected to know citizen's positions on each and every issue that would come forward during a period of office. In the near term it would seem that this is nevertheless best approach, provided that decision-makers are well informed on the concerns of those affected by a decision and of their preferences, and that the eventual decision does not restrict fundamental individual rights. An essential first step in such a process is that affected citizens be informed of impending decisions affecting their lives or quality of life as soon as possible, and that all information concerning the decision be made available to all. Most practitioners of public participation see feedback from the citizens as part of a consultation process.

It is a principle of the classical notion of democracy that citizens should have a say in decisions that affect their lives. For success, the conditions of participation and the procedures must be established. Most countries of the European Union follow a process agreed to in the *Aarhus Convention* (UNECE, 1998). The *Organisation of American States* (*Inter-American Council for Integrated Development*) in April, 2000 adopted the *Inter-American Strategy for the Promotion of Public Participation in Decision-making for Sustainable Development* (OAS, 2000). Delli Priscoli (2004) sees that the participatory process fosters deliberation, encourages social learning and may create new alternatives, thus building or enhancing civic infrastructure. The legitimacy of the process will depend on whether the decision-makers are seen to be responding to the concerns and opinions that arise from the consultations.

One suggested weakness of consultation processes is that they may not result in a consensus, but rather accentuate conflicts between interested parties (Beauchamp, 1993). Another concern is that an explosion of participative processes may ultimately lead to no one being accountable for decisions (Hamel-Dufour, 2004).

In the preface to their report the *COMEST Sub-Commission on the Ethics of Freshwater Use* (UNESCO, 2004) listed several essential components to the ethical management of water. These include:

- Respect for human dignity,
- Participation of all affected individuals,
- Solidarity through integrated water resources management,
- Treating water as a common good,
- Transparency and universal access to information,
- Stewardship,
- Inclusiveness, and
- Empowerment.

The Sub-Commission refers also to equity and fairness across and between generations, with an emphasis on the role that women can play here, and to the need to recognize that human and natural systems are mutually responsive and interactive. They emphasize focus at the local level and the responsibility of all stakeholders to consider how their practices compare to these ethical practices. In the end though, who is accountable and to whom?

5 EXPERIENCE OF THE BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT

The *Bureau d'Audiences Publiques sur l'Environnement* (BAPE) is a permanent organisation with powers of enquiry. Its mission is to inform and consult the public on questions related to the quality of the environment that are referred to it by the government so as to inform the government so that it may make decisions in the framework of sustainable development. The definition of sustainable development, used by the government of Québec is that of the *Brundtland Commission* of 1987: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The values that drive the BAPE are independence, impartiality, transparency and political neutrality. Québec society seeks a balance through trade-offs between biophysical, social, economic and cultural objectives. Citizens who participate in BAPE hearings are motivated by a desire to improve and/or maintain their quality of life. Balancing the achievement of the multiple objectives is not easy.

The BAPE was created in 1978, when the *Québec National Assembly* passed the Act to amend the *Environment Quality Act* (S.Q., 1978, c. 64) which established its composition and role and provided an environmental impact assessment and review procedure calling for public participation for certain projects. There are various types of projects subject to this procedure such as waste elimination sites (R.S.Q., c. E-13.1) and major industrial projects including the construction of a gas pipelines, gasification works, pulp and paper mills, rendering plants, and aluminum smelters. Whether a project is subject or not depends not only on its nature (all waste disposal sites or nuclear facilities for example) but also its location. For example, in fields related to water, the regulation respecting environmental impact assessment and review, subjects the following types of projects (among others) to the procedure:

- The construction and subsequent operation of a dam or dyke located at the outflow point of a lake whose total surface area exceeds or will exceed 200,000 m^2, or a dam or dyke intended to create a reservoir whose total surface area exceeds 50,000 m^2;
- Any programme or project involving the dredging, digging, filling, levelling off or backfilling of a watercourse . . . or of a lake, within the 2-year flood line, over a distance of 300 m or more, or an area of 5,000 m^2 or more, and any programme or project involving dredging, digging, filling, levelling off or backfilling, for any purpose whatsoever, cumulatively equalling or exceeding the above limits for the same watercourse. . . ;
- The rerouting or diverting of a river;
- The construction or extension of a port or wharf, or a modification in the use of a port or wharf, except in the case of a port or wharf intended for fewer than 100 pleasure or fishing craft;
- The construction, reconstruction and subsequent operation of a hydroelectric generating station or fossil fuel-fired generating station with a capacity that exceeds 5 MW;
- Any programme or project for aerial pesticide spraying for non-agricultural purposes over an area of 600 ha or more. . .
- The establishment or enlargement of an engineered landfill. . .

The BAPE carries out its role through various public interventions such as public information and consultation periods, public inquiries and hearings. Through these means the BAPE also helps people to better understand the environment in which they live.

Over the last decade, the BAPE also has been entrusted with several mediations on the acceptability of projects. Mediation is "an amicable dispute resolution method in which an impartial third party helps the parties to find a solution to their dispute". This approach is exercised on a voluntary basis and does not deprive applicants of the right to a public hearing.

The BAPE also holds *generic* inquiries and hearings. These hearings deal with a subject of general interest related to a specific environmental question like the management of water, the management of hazardous waste, the management of residual materials or the sustainable development of hog production.

Under the *Natural Heritage Conservation Act* (R.S.Q., c. C-61.01) of December 2002, the BAPE may be called upon to hold a public consultation before a proposal is made to the government on permanent protection status for land set aside to create a protected area (section 39).

A look at the various steps in the procedure will make it possible to better understand how the BAPE intervenes.

First, an impact study is produced by the proponent of a project. It contains the description of the project and its anticipated impacts. It is an important tool for choosing a solution or an option with the least important negative repercussions on the biophysical and human environment.

Once the impact study satisfies the requirements of the directive he has issued, the Minister mandates the BAPE to make public the documents describing the project. For a period of 45 days, the public can consult all the documents on the project on the BAPE's website, in the permanent consultation centers in Québec city and Montréal, and also in local consultation centers opened in communities directly affected by the project. In most cases, a public information session is held in the region of the project where citizens may ask questions about the project and the approval process.

During the 45-day period, citizens, groups or municipalities can request the holding of a public hearing so that the project may be discussed and evaluated publicly. The application for a hearing must be sent to the Minister and list the grounds for the request and the interest in relation to the environment affected by the project. If the Minister doesn't find the applications frivolous, he entrusts the BAPE with the mandate of holding a public hearing and of informing him of its findings and its analysis.

The President of the BAPE appoints one or more commissioners to proceed with its inquiry, hold a public hearing and submit a report in the time period located of four months in the case of projects subject to this procedure.

Each commission is supported by analysts, a communication consultant and a coordinator. In addition, the members of the commission must help the public understand projects and encourage them to express their opinions freely. Consequently, the commissions make sure that the answers given and the information provided during the public sessions are in terms that are easy to understand. Every document a commission uses for its work is made public, including transcripts of the sessions. Members of the commission have the duty to listen with the same attentiveness to all those who intervene in the debates. It is a matter of allowing people to voice their opinion, whatever their positions may be.

Members are required to take an oath in the presence of a *Superior Court* judge. When conducting their inquiries, the members of the BAPE have the powers and immunity of commissioners appointed under the Act respecting public inquiry commissions (R.S.Q., c. C-37). They act in accordance with the rules that the organization has adopted. These rules are straightforward and specify, among other things, that the hearing has two parts, that every hearing is public and that it must be held in a place to which the public has access.

The rules adopted by the BAPE pertain to the procedure but are also of an ethical nature. Thus, BAPE members are required, among other things:

- To fulfill their role in the public interest, with integrity, dignity, honour and impartiality;
- To serve in an irreproachable manner and to the best of their ability, and
- To consider any attempt to interfere with their work unacceptable and intolerable.

In addition, there are specific provisions relating to the holding of inquiries, public hearings and mediations on the environment. As such, the members are required, among other things:

- To observe the rules of procedural fairness and to act at all times with the greatest transparency;
- To avoid all private meetings with proponents or applicants, except in the cases provided for in the rules of procedure of the Bureau;
- To show reserve, courtesy, composure and consideration towards all participants in inquiries, public hearings and mediations on the environment;
- To foster mutual respect among the persons attending or taking part in the commission's proceedings;

– To encourage the full participation of the interested parties, and
– To help the public understand projects and encourage them to express their opinions freely.

Hearings are divided into two parts. The first allows the participants to grasp a better understanding of the project by addressing questions to the commission to which the promoter or specialists from government ministries are asked by the commission to provide answers. The project promoters and representatives of government departments concerned are present to answer questions from the participants. BAPE commissions insist that experts express themselves so that lay people can understand them, and how what they are saying is relevant and significant (Stilgoe *et al*., 2006). Through this non-confrontational process citizen's concerns are better understood by the project promoters who may respond with appropriate compensatory or mitigation measures even while the commission is at work. Similarly, responses of promoters or resource persons may eliminate or reduce citizen concerns.

The second part follows about a month later when citizens express opinions based on a better knowledge of the facts obtained during the first part. This approach ensures better quality of the interventions. All participants have an equal chance of being heard, not just organized special interest groups.

Once the public hearing has ended, the commission continues its analysis of the project by reviewing all of the documents submitted during the public hearing, including the briefs tabled by participants and the transcriptions of the exchanges that took place during both parts of the public hearing. It takes account not only of impacts on the present generation but also on those to come. The commission's report contains a statement of the concerns of participants, and an analysis thereof based on their justification, not on the numbers of people for or against a project. It notes the beneficial and negative impacts of the project, and provides the opinions of the commission on the acceptability of the project and/or means to compensate for or mitigate impacts, always focusing on the main issues so as to assist the decision maker. The report is sent to the *Minister of Développement durable, de l'Environnement et des Parcs* not later than the day on which the mandate of the BAPE ends. At that moment, the commission is dissolved.

Proponents, ministries, academics, experts, citizens, municipalities, groups and associations all offer a multitude of perceptions and knowledge. The commission must take the best of each and reflect this in its report. Although the commission has no decisional powers, it attempts to find points of convergence and divergence in order to guide decision-makers in the preservation and the improvement of the quality of life for citizens. Once he has the report in his hands, the Minister has 60 days to make it public. This report provides the Minister with input that is useful to help him make his recommendation to the Cabinet which takes the decision.

Although the BAPE is there for them, it never takes people's participation for granted and thrives on ensuring that people concerned or interested in a project can be informed and have the possibility to participate in a public hearing taken under their responsibility. Full participation of those who will have to live with the positive or negative consequences of a project is necessary to get the whole picture of the evaluation and impact assessment of a project. Citizens who live where the project will exist and whose environment will be affected or modified by a project can provide a type of information that cannot be obtained in the impact assessment studies that are prepared by firms of specialists. These citizens are, in a way, specialists of their immediate environment. Furthermore, how could one define the concept of quality of life, consider it, study it, measure it, and improve it without those who will benefit from a project or without those who will, on an everyday basis, have to live with its impacts whatever they may be?

People from host communities have an expertise of their own, and they can provide the BAPE with knowledge and experience which are essential to the improvement of a project. Socially constructed knowledge comes about only when individuals can engage with one another, never when they are alone (Kettering Foundation, 2003). Every opinion is important because they can all ultimately improve projects for the better and for all.

In the end, people must understand their environment and decide, as individuals or as a community, what they want the world to become for them and for their successors. Public consultation may improve the social acceptability of a project. The public hearing offers a place

where dialogue is possible. It is sometimes through public participation that proponents realize the importance of impacts on host communities. Thus opinions from the public enrich and legitimize the whole process surrounding a project, a process that goes beyond the intervention of the BAPE.

A recent independent survey and study of responses of nearly 450 participants in the BAPE processes including citizens, resource persons and project promoters confirmed these statements (Léger Marketing, 2006). Among the results for those giving at least a rating of 6 (on a scale of Low 1–Max 7):

– 95% of participants reported they had been treated with respect.
– 89% felt they had been treated equitably and without favouritism.
– 82% were satisfied that they had been able to express their point of view.

With an average rating of 5.4, 61% felt it had been a useful exercise and would enable decision makers understand the viewpoints of all. This percentage was about the same for the project promoters as for the citizens. Most convincing, when asked if they would recommend to their friends or family to participate in the BAPE hearing process if there was a project that affected them, 94% responded in the affirmative!

Because of their credibility, the opinions of the BAPE clearly have an impact on the thinking and decisions of the government. In his analysis of the functioning of the BAPE, Baril (2006) concludes that the BAPE process has become *incontournable* (inescapable, inevitable) in Québec.

In an ideal world, there would not be a need for the BAPE, for proponents and hosting communities would hold an ongoing dialogue from the first steps of a project which would lead to solutions that are beneficial for both parties. Elected decision-makers would be fully informed by this process. But reality is different and the BAPE's role is to offer a forum for anyone who wishes to be better informed and voice his/her opinion.

There are ways to improve the present public participation process. Some avenues worth exploring:

a. One of the concerns expressed by participants in BAPE hearings is that the proposal arrives before them too late to have significant impact on the choice of options. A public consultation should be initiated earlier in the stages of a project, before the BAPE hearing starts. This way, it could be possible for proponents to take into account or at least better target the concerns of the population, especially those who live in the host communities. Also, if this is followed, some project proponents might possibly avoid a public hearing.
b. Another concern was regarding the follow-up on projects. Once the BAPE tables its report to the Minister and once this report is made public, citizens need a way to stay informed about the elements that lead to the authorization or the refusal of a project by the government. It would be appropriate that the information relating to the monitoring and follow-up be provided to the public in a timely manner. It would also be useful that periodic follow-up assessments are readily accessible to the public after the project has been implemented.
c. The participation of youth needs to be encouraged, as they often have a different perspective on issues. Only a few participants from younger cohorts participate in BAPE hearings, although they will live with the consequences of decisions taken today. As a public consultation organization, the BAPE realizes it must put greater effort to reach them and to let them know of the importance of their participation and contribution to the debate.
d. The participation of the public in the strategic environmental assessment as well as the elaboration of government plans, programs and policies is increasingly important. Québec has relevant experience on the subject of public participation when it comes to plans, programs and policies, several of which have been carried out by the BAPE at the specific request of a Minister. These include, the management of hazardous waste, water management or the hog farming industry. It would be useful if provisions were made for a formal and uniform mechanism, making it possible to better guarantee public participation and to bank on the expertise acquired by the BAPE. This would also help to ensure equity between urban and rural communities and among the regions.

The year 2008 will mark the 30th anniversary of the creation of the BAPE. Québec society has evolved considerably over this period. The law and procedures for the functioning of the BAPE have changed little. Changes are now being considered which among others might take into account some of the points listed above.

6 THE BAPE CONSULTATION ON WATER RESOURCES MANAGEMENT

Falkenmark & Rockström (2004) believe that freshwater offers an opportunity for comprehensive linkage of human and ecological security. The process involved in achieving social consensus, included in the concept of governance, would provide for participation of the main interested parties. This would require the development of institutions capable of addressing the complexity of the issues. Similarly Rogers (2006) believes that concepts and ideas about water, could, if understood in a holistic way, not only significantly improve the sustainability of water as a resource and as a pillar of the ecosystem within which we all live.

Home to 3% of the planet's fresh water reserves, Québec is the custodian of a portion of the common heritage of humanity and in this capacity, has adopted an approach to ensure that these water reserves are managed responsibly.

In 1998, the *Minister of the Environment* entrusted the BAPE with a mandate of holding a public consultation on water management in Québec. The consultation mandate with which the BAPE was entrusted with consisted of:

- Receiving written comments from the public and interested groups, holding public hearings, holding discussions with participants, and analyzing the briefs received.
- Preparing for Québec recommendations that aim to improve water management and to promote water use in keeping with the principles of sustainable development.
- Distinguishing those elements that are specific to each of the regions from those elements that concern water management as a whole in Québec.
- Reporting on each of the themes addressed during the public consultation.

From March 15, 1999 to May 1, 2000 the commission held 142 public meetings in the 17 administrative regions of Québec. The hearing was divided into two parts. In the first, *Building Knowledge*, public meetings dealing with the proposed management orientations were first held in Montréal. The commission then toured the regions and went on to organize theme-oriented meetings. To complete *Part One*, a specific consultation was held with the Inuit and Cree nations on the territories of Northern Québec subject to the agreements. At the end of Part One, more than 1,000 documents were made public. In the second, *Giving Public Opinion Centre Stage*, the commission heard 379 briefs. The BAPE report entitled *Water: a resource to be protected, shared and enhanced* was submitted to the *Minister of the Environment* on May 1, 2000.

In its report, the commission placed special emphasis on three main aspects:

- Improved governance through water management at the river basin level;
- The preparation of the portrait of each region with the public's expectations concerning the management of water and aquatic ecosystems; and
- A reform of the legislation and institutions is necessary to implement an integrated water and aquatic ecosystem policy.

Specifically, the report addresses 16 themes, among them agricultural pollution abatement, hydroelectricity, the integrated management of water and aquatic ecosystems at the watershed level, exporting water and the special case of the St. Lawrence River.

The commission made 13 main recommendations broken down over the short, medium and long terms. In addition, the commission identified numerous findings and observations that guided the government's reflection. It should be noted that the process and report of the BAPE respected all of the principles proposed by the *COMEST Sub-Commission on the Ethics of Freshwater Use* to

which earlier reference was made (UNESCO, 2004). In 2002, the *Government of Québec* released the *Québec Water Policy* entitled *Water: Our Life, Our Future*.

This policy seeks to:

- Ensure the protection of this unique resource of our collective heritage;
- Manage water in an integrated manner, in a sustainable development perspective; and
- Better protect public health and the health of ecosystems.

Most of the recommendations of the BAPE commission are adopted in the Policy. It reaffirms that water is an essential element of the collective heritage of Quebecers and presents the measures intended to:

- Implement integrated river basin management;
- Implement this form of management in the St. Lawrence River, by granting a special status to this major waterway;
- Protect water quality and aquatic ecosystems;
- Continue water clean-up efforts and improve the management of water services; and
- Promote water-related recreation and ecotourism activities.

Petrella holds up the Québec policy as an example for the world, although he suggests that water being a common heritage of Quebecers, it is also to be shared with the world when Quebecers have satisfied there needs (Petrella, 2001). The BAPE consultation process led to a policy that reflects the values of citizens as expressed in the hearings. It would be desirable that its success be reflected in a requirement the river basin organisations conduct similar consultations on a local level. Today's technology could permit them to see in real time the information being collected by monitoring stations, or through interactive models to see the impacts resulting from various options for water management that they might imagine.

It is unlikely that the BAPE and its processes could be directly applied in another state or culture. As the OAS (2000) states in their strategy: "Such forces as existing legal and regulatory structures, the tradition of philanthropy, and the relevant strength of government institutions at the national and sub national levels, all affect the implementation program that may be adopted". The BAPE might however provide valuable assistance to those interested in establishing similar mechanisms.

7 CONCLUSION

Public consultation fulfills a need that follows the trend of the genetic and mimetic evolution of humans. Decision-making by elected representatives is the best form of governance to date, but the decision-makers should be better informed by public debate. There is a range of ways that this can be done. The BAPE has followed one approach and has been successful. Nevertheless there are various ways to improve upon it further. Decentralisation of the process following the principle of subsidiarity is one of these, but may be resisted by those in power (politicians and civil servants). In the water sector a process similar to that of the BAPE could improve decision-making in water basins. It has certainly raised public awareness, intensified research and evaluation to provide answers, and has led to a sector-specific policy debate—all of which according to *Transparency International* are steps forward in containing corruption (O'Leary, 2006). Transparency that is essential to the process also increases the efficiency of decision-making and eliminates opportunities for corruptive practices. The *World Bank* (2007), having conducted an extensive consultation of stakeholders at all levels, concluded: "One of the strongest messages from consultations across stakeholders is the importance of disclosure, participation and monitoring to preventing corruption".

In the end humans will learn to transcend themselves and to live in an alliance with each other and other species of Earth. Water may provide the vehicle that facilitates our efforts.

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I have not conducted a systematic search of documents related to this subject. Rather the references listed below come from a heuristic selection of material from shelves of my personal library. I have been particularly influenced by the works of André Beauchamp, one of the early presidents of the BAPE and of Jerome Delli Priscoli. Both agreed to provide comments on an earlier draft of this document, for which I thank them. I note in concluding the writing of this chapter that I am acting as a facilitator for the work of a number of *memes*!

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VIII
Ethical aspects of unforeseen and extreme events management: Floods and droughts

CHAPTER 18

Water disasters and ethics

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ABSTRACT: The contemporary issue of unsustainable human behaviour and activity pertaining to water related disasters has frequently provoked international debate. The major question arising as a result of this discourse is whether *we have comprehensive and common ethics to cope with disasters?* This chapter serves as an attempt—rather than a general guidance—to advance various answers to this question and to incite future research in order to thrive towards the *ethics of water disasters management*. Further, the author aims at exploring ethics in the water disaster context and enabling a practical guide in water resources management. The results indicate that different ethical scales do exist, though they are frequently practiced subconsciously. Eventually, this essay illustrates that till date a coherent water ethics is almost nonexistent or is in its nascent stage. Hence, the author strongly encourages further and more in-depth research in this field with the intention that a universal water ethics could emerge and water issues would thus be treated in a truly integrated way including the specific ethics of management of water related disasters.

Keywords: Water ethics; Practical principles of water disaster management; Floods and droughts; Cultural history of water disasters management; Ethical traps

1 INTRODUCTION

Helping people in emergency situations is one of the noblest manifestations of human solidarity. As human life may be also at risk it seems to be beyond dispute that whatever interventions are needed they are justified even without considering their financial implications. Bad luck, threat or whatever undefined enemy threatens people may trigger heroic responses of which we may remember with pride and gratitude. Yet, these highly commendable, heart-warming situations are not only simplified, they can even be false. *Bad luck* is seldom brought upon man alone by forces beyond his control. Neglecting preparedness and responsibility or even acting against nature can not only have fatal consequences, they may also undermine the very foundations of human solidarity. In the recent international professional discourse the role of unsustainable human behavior and actions in relation to water related disasters are frequently emphasized. This highlight on our errors and neglect may help to rectify the course, but it also weakens the feeling of obligation to assist those in calamity. The question is intriguing whether a so controversial behavior, i.e. to deny the outmost help for those in need just because the harm caused is (potentially) self-inflicted is ethically justifiable? But if this question is asked, then the underlying one is even more urgent to be answered first. Do we have comprehensive and common ethics to deal with disasters? Answering this question in its general form is beyond the scope of this chapter. However the attempt will be made to find at least elements of an answer or to trace the path which should be taken to achieve what may be called the ethics of water disasters management.

2 WHY IS WATER SPECIAL?

Water as a renewable, yet fragile resource is indispensable for life. This statement is valid at all scales of human existence from the individual one, through communities, civilizations, states and

up to the level of humanity as a whole. Distribution of available (feasibly usable) water resources determines the location of human settlements and economic activities. Yet, water is not only the basis of human existence. It could also become a source of threat through both its quantitative and qualitative characteristics. Waterborne diseases and deteriorating water quality kill more people than wars, accidents or other diseases do. Uncontrolled abundance (floods), or long lasting shortage of water (droughts), can become the source of social stress, loss of property, destruction of physical and political infrastructures and loss of lives. Among all natural hazards which may trigger disasters floods and droughts are prominent agents of destruction, suffering and death. Due to their almost universal distribution of occurrence world wide it is fair to say that we are menaced more by water than by any other potential hazard carrier. It is estimated (Bogardi, 2004) that very soon a quarter of the world population will reside in acutely flood prone areas. Already today one third of humanity inhabit drylands where droughts are frequently occurring (UN, 2005).

While floods and droughts are parts and features of the natural cycle of the movement of water through the terrestrial, marine and atmospheric *compartments*, they may become the cause of disasters. High flow or extended dry spells alone do not represent a disaster. Nature does not know *natural disasters*. Disasters are social constructs (O'Keefe *et al.*, 1976). They need as reference humans, their property and built environment. As floods and droughts usually threaten communities or states rather than mere individuals, disasters of natural origin like floods or famine occur if the affected community can not cope with or/and recover from the consequences of the extreme hazard event without external help (ISDR, 2004). At this stage it is justified to decide at what scale a disaster can be identified as a social rather than an individual event. Floods and droughts, if for nothing else but their spatial extents, are *social* disasters. On the contrary, a lightening killing a person constitutes an individual, rather than social disaster. The 2002 flood of the Elbe River in Germany, while creating well over 10,003 million € losses, can not be classified as a disaster on the national scale. At the federal level, the country dealt with this emergency by simply postponing the income tax reform by a year. On the other hand, individual, small businesses may claim the 2002 Elbe flood as a disaster since their respective livelihoods were destroyed. Hence, while the 2002 Elbe flood clearly qualifies as a disaster at household and community and may be at regional levels, its scope and extent remained fortunately limited to these scales due to the financial coping capacity of the nation it has impacted.

3 WHAT IS ETHICS?

Ethics is one of the frequent terms used in the international water debate. As in the case of many overused *buzzwords* it is worth to recall what the definition of the term is, in order to distinguish between its meaning and colloquial use should a discrepancy be traced.

The *Encyclopaedia Britannica* (1988, Vol. 18: 627), defines ethics as "the study of fundamental issues of practical decision making". It concerns and attempts to define the ultimate value and standards by which actions can be judged right or wrong. This applied nature of ethics as the practical philosophy which provides the moral framework for human aspirations and actions is also underlined by the *Großе Duden* (1960), where ethics is defined as the social science reflecting and analyzing society's beliefs and basic values in seeking answers to important questions.

This very short summary, based on the wisdom of encyclopedias indicates the aim of the author to search for and explore ethics as a practical guide in water resources management in general and in water disaster context in particular rather than to engage in lengthy and scholarly discussion on the definition and scope of ethics, or to draw clear distinction lines between *ethos*, ethics and moral.

4 THE ETHICAL DIMENSION OF WATER RESOURCES MANAGEMENT

The role of ethics as a kind of practical guidance in decision making fits well with the development, building and management oriented mindset of engineers and water resources managers.

This relative value of ethics as an *applied science* to study *ethos* of a society has however the *drawback* from the point of view of an engineer. There are no ethical universals as declared by the *Encyclopaedia Britannica* (1988, Vol. 18: 629). As society changes, so changes its *ethos* and consequently its ethics, a fact that can also be very well observed in the different and evolving principles and practices of *management* of the hydrological cycle. In the time of the so-called early civilizations, water and other natural resources were acknowledged as basic service providers, gift of the gods, or gods themselves and worshipped which contributed to their sustainable use. Starting *development* millennia ago we reached the peaks of a single minded industrial production around 1960s and 1970s and water began to be looked as a mere means of production. Ever since, a strong environmental consciousness is on the rise. Rehabilitation of many water bodies—mainly in the developed countries—illustrates this trend. However, it has to be added that this positive trend also brought about a gradual neglect of maintenance of dykes, abandonment of dredging and other hydraulic works, including the control of aquatic weeds and the slowdown or outright ban on the construction of large hydraulic structures like dams. As far as flood control capacities are concerned, there is a clear deterioration since the 1970s and 1980s. The consequences could be seen in the case of Dresden in 2002. The lack of river channel maintenance clearly aggravated the inundations of the city.

Besides this chronological evolution different paradigms can easily be observed simultaneously. As far as flood management is concerned the two extremes: *living with floods* or *fighting floods* may even coexist during the same epoch in different societies. It has been analysed by Shen (2007) in comparing flood risk perception, concepts and subsequent flood preparedness in Cologne, Germany and Wuhan, China. The following Table 1 juxtaposes the most characteristic features of the two flood control philosophies and practice, which compares the flood control paradigms between Germany and China.

Whereas the pluralistic decision making in Germany seems to impair the efficiency of flood protection due to long decision-making processes, the Chinese try to ensure human security by fighting floods almost in a military style.

Her comparative study clearly indicates that both concepts have strengths, but none of them is *perfect*, irrespective of the viewpoint of the analysis. The applied principles and techniques as shown in Table 1 reflect also the differences in value judgements as well. But even if a global ethics existed, universal approval may not make a choice automatically right.

Dealing with water as a vital resource endowed with economic, cultural and even with spiritual value has manifold ethical ramifications. It is even very likely that approaching water problems from different professional backgrounds implies automatically the involvement of different ethical principles, standards and beliefs. Professional ethics of a medical doctor attempting to control a waterborne epidemic outburst does not only call for different actions than required from the point of view of a provincial administrator. Helping humans unconditionally is different than being dedicated to secure human health while keeping the budget balanced.

Table 1. Flood Risk Management in comparison: Cologne, Germany—Wuhan, China.

Cologne (integrated)	Wuhan (engineered)
Land use planning	Dams & dykes
Awareness raising activities	Reservoirs
Flood insurance	Retention areas
Participation of stakeholders	Dyke defence and protection
Horizontal co-operation	
Risk communication	
Structural measures such as dyke, mobile flood walls	

Source: Shen (2007).

When a water resources expert is asked to address the ethical aspects of water resources management in general, and flood control and drought alleviation in particular, she/he first requires an interdisciplinary *excursion* and collection of different ethical views and approaches in order to avoid treating the subject entirely along his/her professional ethical standards or/and by his/her individual value judgements. Various flood control and drought management activities should be juxtaposed within a broader social ethical framework representing how societies (or several stakeholder groups) *perceive* the issue rather than impose the moral codes of a specific professional group in decision making.

This requirement implies a number of questions:

- Do we have different professional ethics?

  The answer is definitely *yes*. These are developed, sometimes over millennia parallel and with very little interactions. To a great deal, differing ethics are responsible for the failure to introduce truly interdisciplinary, integrated approaches for example in water resources management.
- Do we have different ethical scales? Do people behave according to different rules in their private life, within their immediate social environment, at regional, national and global scales?

  While there are certainly global values, the author believes that there are different ethical scales, at least they are practiced sometimes subconsciously. As an example one may recall the case of competing/conflicting nations. One may not have any problem with any individual of the other country but still finds it appropriate to harbour grievances against the other nation as a whole. Similar examples may be found also in water resources management.
- Do we have different problem-related ethics?

  The answer again tends to be affirmative. There are dozens of publications on social or environmental ethics, though a coherent water ethics still seems to be nonexistent or not yet out of its embryonic development stage. It is strongly felt that water issues can only be addressed in a truly integrated way when a universal water ethics would emerge and be adopted by all stakeholders involved.

This mapping of the ethical field has some important conclusions for the *triangle* water—disasters—ethics. There is no particular reason to believe that the scale effect of ethics just mentioned above would not exist within a yet to be developed (synthesized) water ethics. We may go so far to expect that beyond the spatial scale there could be a temporal dimension, implying that we may consider different ethical principles and values during different phases of the confrontation with floods or droughts.

What is an interesting academic debate for a theoretician whether ethics is absolute or is a practical social science which may change as the value scale and preference structure of society varies, has for a practically minded engineer or water resources manager serious practical consequences. Past, present and future actions may not and should not be comparable by the same ethical standards as they reflect different problem perceptions, aspirations and of course technical means to seek and to find a solution.

During the late 20th century, the so-called engineering approach to manage the hydrological cycle came under considerable criticism. Not only the construction of large reservoirs was stopped almost completely worldwide as the consequence of the massive actions by global environmental (grass roots) NGOs but also the historical achievements of river training works of the 19th century started to be questioned and were (and are) criticized retrospectively as the start of the man-made environmental deterioration of wetlands, floodplains and other aquatic ecosystems due to these engineering interventions. Judging decisions dominated by the then prevailing ethical concerns like securing agricultural land and harvest to alleviate famines and enhancing public health by reducing mosquito breeding places in floodplains can not be done by relying on our present emphasis on environmental values. Disregarding those drivers as the then ethically justified reasons to interfere with the course of nature proves rather to be the sign of historical ignorance than the existence of an eternal, ethical truth.

No doubt that until recently water resources management was almost exclusively an engineering domain. The well developed engineering ethics, which was documented in the texts of solemn graduation oaths, in the strict observation of professional guidelines and standards dominated hence water resources management and hydraulic (river) engineering, one of its major and certainly most visible components. These times are by now gone. Ever since the *World Water Vision* (Cosgrove & Rijsberman, 2000) picked up the slogan "water is everybody's business" we have a multiple stakeholder concern—and a multidisciplinary action field in water resources management matters. The water visioning process 1998–2000 catapulted water to a high position in the political agenda list. This is certainly the first step to address and to solve the plethora of urgent water problems. Yet, instead of seeing in the same time a common water ethics to emerge we rather witness that the international water debate is similar to an ideological battlefield where the different interest groups try to secure the supremacy of their respective ethical principles and practices. Water is a unique substance with stunning physical, chemical but also social and ecological features. Integrated approaches in managing, sharing, protecting of water are expected to bring more sustainable solutions. However this may only happen if we succeed to synthesize a common consensus-based water ethics.

In 2004, W. Cosgrove has shown the strong correlation between the *per capita* storage volume for water, the GDP and water security at the scale of nations. Indicators of human development strongly and positively correlate with well developed water infrastructure and storage facilities. If we project these findings into a global scenario expected to characterize the 21st century (climate change, desertification, increasing frequency and magnitude of the extremes as *predicted* by the IPCC report in 2007), then it seems almost unethical to deny developing countries the right and means to build reservoirs. Ironically during the last decade of the 20th century dam building came to a virtual halt at least in countries which would have needed international financial assistance to construct them.

Ethics was once defined in the triangular context of God, man, and the *object* upon which an ethical *judgement* was sought (Abbott, 2000). In recent years, in the secular discourse God is often replaced by *nature*. Hence, if the object of the ethical discourse is environment related, the human (societal) dimensions are almost automatically disadvantaged. This view led during the debates of the *2nd World Water Forum* in The Hague in 2000 to such odd statements that 100,000 years ago all water belonged to ecosystems which are now *stolen* by humans. Humans are actually part of ecosystems. We should have a vital interest to keep ecosystems as intact and sustainable as possible but featuring man per definition as an adversary of nature is neither true nor productive as far as an *ethical* approach in water resources management is concerned. This relatively recent snapshot of the state-of-the-art of the development of a common water ethics shows that we are still far from achieving the ethical basis of what may be called integrated water resources management.

What is true for water resources development and management as a whole is also valid for floods, droughts and for our approaches to deal with them. Depending on the level of development and social activities—we may visualize societal approaches towards water events as the spectrum stretching from one extreme: *living with risks* (floods, droughts, etc.) to the other radical end of opportunities, the attempt to *fight and eliminate risks*. Most likely a mixture of these extreme postures is desirable, yet humans have considerable difficulty in shifting paradigms pragmatically both between the different decision making scales and at the right moment.

For example, in the early riverine civilizations floods might have been expected to fertilize the land (Nile floods). Subsistence (recession) agriculture along major African rivers like the Zambezi implies the social attribute is to live with floods, rather than to combat them. Moving settlements, infrastructure, industries into floodplains exposed them to the hazard of flooding. Gradually *living with floods* was replaced by *fearing floods*. Clearly the emergence of fear of something calls for fighting it.

5 FLOODS AND DROUGHTS

Floods and droughts are not unique as extreme events in the hydrological cycle. Heavy rainstorms, storms surges and tsunamis or even waterborne diseases are among the most frequent

or/and devastating water-related disasters. Yet this chapter will concentrate on these two types of phenomena due to several reasons:

- They are basically natural phenomena.
- They usually affect many people simultaneously.
- They are more frequent than extreme tsunamis or storm surges, the coastal forms of severe inundations.
- They are closely related to and threaten socioeconomic activities at different scales.
- Their occurrence and severity has been and is being influenced by human activities.
- Floods and droughts are closely linked to security and development all along human history.
- Human societies may engage in precautionary measures before and also respond during the course of those extreme events in order to mitigate losses. These activities may enable to review the ethical aspects of both hazard preparedness and that of the (humanitarian) response.

These attributes of floods and droughts and the inherent opportunity to manage them warrant an exploration of the ethical dimension of the interaction between these extremes of the hydrological cycle and society.

6 INTUITION, INDIVIDUALITY, IRRATIONALITY: EXAMPLES OF THE CULTURAL HISTORY OF WATER DISASTERS MANAGEMENT

Extreme events are (still) triggering human solidarity. Help may be forthcoming from far away places, yet there are several distinct *models* that can be observed. These are summarized under this Section. Three *typical* stages are selected to illustrate different contexts within which floods have been or are being dealt with.

6.1 *Intuition*

Living with floods and droughts implies a high degree of social organisation, both in the formal and informal sense. The existence of water boards (*waterschappen*) in the Netherlands spans over a longer period than that of statehood. Fostering cooperation and assistance among those threatened to get their *feet wet* strengthened solidarity, while also fulfilled the principles of subsidiarity. Help (solidarity), could be expected proportional to the joint responsibilities and actions of the affected people themselves. This inherent feeling of responsibility and strength derived from common actions led to the creation of the above cited water boards (waterings, *Wasserwirtschaftsverbände*, *waterschappen*) and other associative approaches, for example in the Netherlands, from 8th century onwards, North-Rhine Westphalia (19th–20th century), Hungary (19th–20th century). It is fair to say that in many parts of the world, stakeholder participation and participative management, at least for water-related emergencies came into being intuitively; decades and even centuries earlier than these *principles* have been formulated as innovative features of integrated water resources management in recent global meetings and world water fora.

6.2 *Individuality*

This duality of solidarity and subsidiarity (responsibility) changed drastically as society and its primary wealth generating activities became less directly reliant on the natural *pulsation* of the hydrological cycle. In fact natural changes like floods and low flow or even drought are disturbing factors of industrial production with its requirement of steady flow of materials, among them prominently water as a production factor, energy source, cooling agent or transport route. The emerging competitive society projected—most likely subconsciously—its new principles and rules into the area of flood control. Dykes, bypass canals and other engineering measures to create flood-protected, inundation-free zones provided individual local, rather than integrated solutions. Shifting the inundation problems downstream in narrow dyked and regulated rivers—besides having its impact on

ecosystems—might have even aggravated the problem elsewhere. Solidarity of people along the river, irrespective whether within the same country or in a trans-boundary context clearly suffered.

An example of this uncoordinated (individual) flood management is the case of the 1970 flood in the Tisza Valley (covering Romania and Hungary). After breaking the dykes on the Upper Tisza and its tributaries the outflowing floodwater propagated through the hitherto protected area and inundated downstream villages, while the inhabitants of these villages were still strengthening the dykes in front of their villages. Upstream (Romanian) authorities did not alarm their downstream (Hungarian) counterparts about the dyke-breaks thus the floods became literally trans-boundary, sweeping through wide stripes of landscape.

Similar trans-boundary flooding hit the city of Jasa Tomic close to the Romanian border in Serbia in 2005. In this case, the affected people claimed that the local authorities did not provide early warning. Only the accounts by school children solicited in a sociological study following the event revealed that sirens have warned the population. Regrettably for the adults, sirens were still associated with the 1999 bombing of Serbia by NATO forces rather than with an approaching environmental calamity (Vuksanovic & Radivojevic, 2007).

Engineering flood control measures during the 19th and 20th century did alleviate or at least drastically reduced the frequency of loss-generating floods. As a consequence, people grew accustomed to protection and their indigenous knowledge—how to cope with floods has degenerated. The 2002 Elbe flood in Germany has aptly demonstrated how far the (post) industrial society has departed from the concept and practice of *living with floods*. While solidarity and spontaneous help was provided, neither the experience, nor the skills were available to optimally use the capacity and enthusiasm of the spontaneous helpers. Next to the outpour of solidarity and social cohesion, the Elbe flood 2002 revealed a number of unethical aspects or/and cases of greediness and ignorance. Former river beds and flood plains have been allocated as residential/industrial areas. As new settlements in some places were built on landfills, they were not flooded in 2002. Inhabitants of older, lower lying and inundated areas threatened to destroy the property of those people who remained unaffected by flooding by claiming that their malaise was the consequence of the landfills and new residential development. It was one of the rare examples where a disaster triggered, at least at local scale, a conflict rather than solidarity (Schröter, 2007, pers. comm.).

While in the prevailing individualistic societies, solidarity and help are fortunately still forthcoming and that there are clear signs that this solidarity is case and people-specific. The 1997 Oder flood in Poland and Germany triggered sizable private contributions from Western Germany to the area of former Eastern Germany, but not to Poland. Being the first disaster in that part of the country after German reunification in 1990, it was reported that the value of donations and individual help exceeded the total damage. Ironically the 1993 and 1995 floods of the Rhine river did not trigger as much civic support within Western Germany. *Neighbours* were acknowledged as part of the individualistic society while in 1997, a patronizing attitude was there to help the *new fellow citizens*. While after the 2002 Elbe flood donations were forthcoming, they were by no means close to match the losses. Similar donation—fatigue could be observed after the 2005 earthquake in Northeast Pakistan, while the preceding 2004 tsunami triggered a phenomenal global response. Based on these experienced cases it is to be expected that the increasing number and magnitude of extreme events as documented by *Munich Re* (2006) and *predicted* by IPCC's 4th assessment report in 2007 would further erode human solidarity to help. In the same time it is to be seen, whether the deteriorating situation would trigger the other ethical principle *subsidiarity* responsibility driven (local actions initiated at the corresponding scale by the affected people and their administrations) to emerge and trigger better risk awareness and hazard preparedness. This has been already happening in parts of semi-arid India where people having suffered successive years of drought are coming together and investing in water harvesting structures (van Steenbergen & Shah, 2003).

6.3 *Irrationality*

Ironically, *lessons were not learned* could be proven again in the Elbe Valley. The 2006 flood, while distinctly smaller than the 2002 one yielded higher peaks downstream than the 2002 flood.

In 2006 the dykes contained the flood in Saxony and Saxony-Anhalt, thus the unabated flood inundated the small town Hitzacker downstream in Lower Saxony. A flood wall might have protected the city, but as it was revealed the implementation of the integrated flood control/preparedness plan which foresaw this wall was hampered by legal procedures initiated by inhabitants who did not want to relinquish their *view* to the river by a permanent flood control structure. By misusing the procedures (like hearings or court cases) of participatory water resources management against the benefits of many, and even causing harm for self, the irrationality of well meant instruments and rights in face of emergency situations and potential disasters is well demonstrated in this case. Principles and practice of a regular mode management may produce detrimental results in emergency mode. This is a further hint why the ethics of water disasters management should be different special subset of water ethics.

7 PRINCIPLES AND PITFALLS OF THE ETHICS OF WATER DISASTER MANAGEMENT

Examples and the theoretical discussion in the preceding Sections seem to support the hypothesis that:

- There is no common water ethics (yet).
- Consequently one can not speak of a consolidated water disasters management ethics.

This perceived state of matters clearly emphasizes the timeliness of the workshop convened by the *Foundation Marcelino Botín* (June 2007). By claiming that water and water disasters management ethics are missing does not imply that we cannot observe ethical behaviour in either. Rather, it highlights the fact that we may consider certain deeds ethical if it corresponds with our value judgement derived from an other (usually higher) or special ethical levels (like the professional or social ethics). Likewise we may condemn acts which can be judged even highly ethical by other groups.

The intricacy what a special water disasters management ethics may imply and why it is needed can be seen in the dilemma posed by the ethical trap of the elective political systems. By approaching the question of disaster management at a higher theoretical-humanistic ethical level, virtually no consistent answer can be given.

7.1 *The ethical traps of elective political systems*

Extreme water-related events, while their frequency and magnitude are increasing are fortunately still relatively rare events. The recent *grouped events* like the 1993 and 1995 floods of the Rhine River, the 2002 and 2006 Elbe floods or the 2001, 2005, 2006 floods in the Danube valley notwithstanding damaging floods may not occur for decades. Besides loosing fear and respect from the river but also the competencies to deal with a flood resolutely, the long flood (or drought) free spells also strongly diminish the political readiness to invest into precautionary measures. For an elected office-holder or representative investing into a scheme where the rewards could be measured in mitigated potential future losses which may not materialize for decades, is certainly not as attractive as to allocate resources to development activities with tangible improvement of income or quality of life of those who might elect him/her again. In case an extreme event causes a disaster the explanation is frequently a that this could not have been expected to happen.

The question at this juncture is whether ignorance is excusable or it is unethical? Natural history should be compulsory subject to be examined before a city mayor, for example, will be sworn in. Selling land in flood plains for housing development, an often explored source of income for communities, if happens knowingly is more than unethical, it is criminal. The reluctance of community leaders of cities along rivers to commission hazard maps and risk assessments is on the other hand well documented. It might help if in a swearing-in ceremony the mayor puts his/her hand next to a holy book, the constitution and also on the risk assessment report of his/her community.

Consensus and civic liberty-based pluralistic societies are certainly among the most coveted political systems to live in. However the German proverb:

> "*In Gefahr und höchster Not führt der Mittelweg zum Tod*" [In danger and highest need the midway to death it leads].

is capturing well the comparative advantage of less libertine societies in responding to emergency situations.

Curtailing civic freedom, like lifting the right to resist evacuation orders does not only facilitate rescue operations but actively saves lives. Comparison of hurricane casualty statistics of Cuba and USA underlines the above statements. Confronting floods like a military challenge is very much in the mentality of centralistic (one party) states which take pride (and responsibility) to protect their citizens. The proverb attributed to Mao Zedong, "Endless is the joy to defy nature!" (Shen, 2007) reflects this philosophy. The practice in Hungary till very recently was to appoint the head of the national water authority as flood-commissar and put the army and other resources at his disposal (experience of the author in 1970), proved to be very effective. The state rallying to help its citizens resonates well with the population, creates a *popular front* versus the common enemy, the water-related hazard event (usually flood or storm as swift events are more dramatic than creeping ones).

This *paramilitary* feature of flood-defence or even flood fighting does not fit as well with civil society. In the recent decades floods and droughts are seen there less and less as a hazard, a natural inevitable extreme event impacting society. On the contrary, floods and droughts are seen as the manifestation of the failure of the human stewardship of nature, or outright nature's vengeance to punish humans for their unsustainable land use practices.

Turbocapitalism, climate change, unsustainable land use, sealing the surface for infrastructure and even canalisation are seen as contributing factors of increasing yields and *acceleration* of the hydrological cycle. No doubt that human interference has substantially contributed to aggravate extreme events. Wittenberg (1974) has proven that in small industrialized catchments in North Rhine-Westphalia flood peaks increased threefold during the post-war period of economic miracle.

This mental (and ethical) disposition seeing ourselves as the (partial, and ever increasingly the main) reason of our problems with extreme events make disaster preparedness, the organisation and implementation of flood defence more difficult than in a political climate where confronting floods is still regarded as a patriotic duty.

Can an ethical posture of acknowledging human faults and sins towards nature lead to an ultimately *unethical* behaviour where the ability of saving humans could even be compromised? Could the contrary, *unethical* limitation of human rights and freedoms lead to ethically desirable outcomes like more effective protection against hazards? Answers are difficult to give which satisfy all individual value systems. The reference to changing ethics, standards and values is a hint but there is no assurance whatsoever that a consensus water disasters management ethics would emerge. We may experience changes in *ethos* at different time scales, decades and development phases. Changes in political systems might have been seen as the shortest cycles associated with ethical changes. However apparently normal mode and emergency mode view and operations or water resources systems could—and probably should—be explored as an even shorter time scale within which *water ethics* may change.

8 CONCLUSIONS

This chapter has opened the Pandora box of questions related to ethics in water management with the particular emphasis on water related disasters. The analysis revealed the lack of consolidation in this area. Consequently the summary should rather be the recommendations of how to proceed further than the presentation of results.

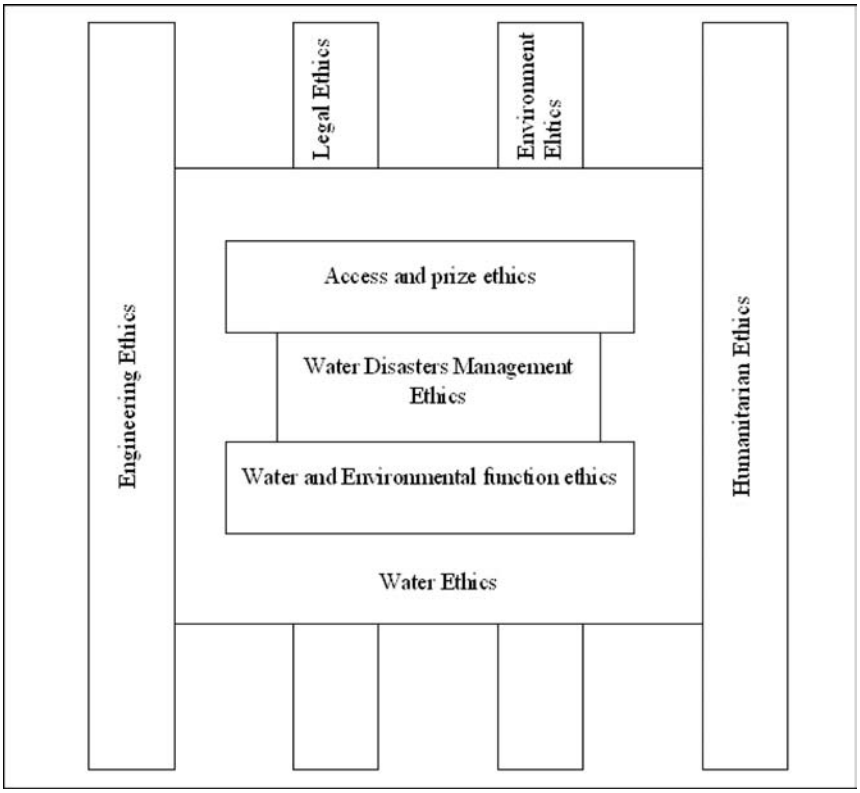

Figure 1. Embedded ethics.

Water ethics can only be conceived as a special set of agreed upon principles and values embedded in professional and social ethics (Figure 1).

As part of water ethics, water disasters management ethics must be embedded within water ethics, while it is also a subset of the ethics of disasters. In order to cover the entire scope of water disasters management it is recommended to devise a structure with the following key elements:

– *Ethics of Preparedness* (invest into awareness, trained human capacity, but also infrastructure and institutions).
– *Ethics of (Early) Warning* (tell people the truth in a timely matter, even if it reveals institutional weakness).
– *Ethics of Disaster Response* (save lives, shift into an emergency mode of operation with possibly different ethical principles and standards than in *regular mode*).
– *Ethics of Recovery* (provide help for self help and to strengthen preparedness, also honour local habits of solidarity).

The other dimension of development reflects human behaviour and related ethical principles. Here three major aspects can be mentioned:

– *Ethics of Solidarity* (as its reflection the example the introduction of national solidarity based obligatory risk insurance of flood losses could be mentioned).
– *Ethics of Subsidiarity* (which could practically imply the strengthening of the responsibility and response capacity of the threatened people and their direct administrative organs at the lowest possible administrative level).

– *Ethics of use the* window of opportunity. By their nature extreme events are still relatively rare. Floods and droughts open certain *windows of opportunity* which should be wisely used to strengthen water disasters management. Contrary to many situations where exploring these type of opportunities are considered highly problematic the long history of water resources and disasters management proves that without the use of the *windows of opportunity* many more people would still be exposed to risks and would suffer in case an extreme event occurs. The ethical approval of using the window of opportunity emanates simply from the fact that the person or group exploring the window of opportunity is not identical with the beneficiary group of this approach. This simple example proves again the distinct differences and ethical principles which might be applied in emergency operations and disaster management.

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CHAPTER 19

Identifying actions to reduce drought impacts

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ABSTRACT: Within the framework of the *National Drought Observatory*, the *Ministry of the Environment of Spain* set up an *Expert Committee* in September 2005. The ultimate goal of this initiative was to produce a document that would serve as a useful reference tool in the near future and that could contribute, in some ways, to adapting Spanish water policy to the present circumstances. Eighteen months later, the work undertaken by the Expert Committee was published in a document titled "*La Sequía en España. Directrices para Minimizar su Impacto*" (Drought in Spain: Guidelines for Minimizing Impact) [http://www.forosequia.com]. The document is comprised of 12 papers signed individually by members of the Committee and 28 conclusions agreed upon unanimously by all of them. These conclusions also appear in full at the end of this chapter. The authors of this chapter—both of whom were part of the Expert Committee—share their own reflections on drought and drought management. Different aspects such as the development of drought impact matrixes, drought impact assessment and strategies designed to mitigate drought have been discussed here.

Keywords: Drought; Drought management; Drought impacts; Spain

1 INTRODUCTION

Within the framework of the *National Drought Observatory*, the Ministry of the Environment of Spain had set up an *Expert Committee* in September 2005 (Expert Committee on Droughts, 2007). Its initial mission was to:

- Advise the Ministry of the Environment on the contents of the Observatory website
- Contribute to the development of social and educational measures aimed at fostering sustainable use of water
- Provide advice on aspects related to drought planning

In light of such ambitious objectives, especially when understood within the broader context, the range of actions that the Expert Committee could propose was practically endless. Because adequate drought management at the national level requires engagement in the sphere of current water policy and given its multiple facets, the work entrusted to the committee seemed to have no bounds. On the contrary, if the necessary economic resources and required time were not dedicated to this initiative, there was the danger that Committee's efforts would become a mere statement of intentions.

The ultimate goal of this initiative was to produce a document that would serve as a useful reference tool in the near future and that could contribute, in some way, to adapting Spanish water policy to the present circumstances. Yet given the history of water policy in Spain, this was a complex task. It was finally decided that the work commissioned by the Ministry should comprise a series of proposals aimed at tackling future droughts in the best possible manner.

Eighteen months later, the work undertaken by the Expert Committee was published in a document titled "*La Sequía en España. Directrices para Minimizar su Impacto*" (Drought in Spain: Guidelines for Minimizing Impact) (http://www.forosequia.com). The document is comprised of 12 papers signed individually by members of the Committee and 28 conclusions agreed upon unanimously by all of them. Conclusions appear in full at the end of this chapter.

In this chapter, the authors, both of whom were part of the Expert Committee, share their own reflections on drought and drought management which, to a certain degree, overlap with the Committee's work. In addition, other aspects such as the development of drought impact matrixes, drought impact assessment and strategies designed to mitigate drought too have been discussed.

2 AIM OF THE CHAPTER

The aim of the present chapter is to aid in identifying additional tasks that could be undertaken by the Expert Committee in the future. To accomplish this objective, there is nothing better than to recall the principal issues which, according to the *National Drought Policy Commission* (NDPC, 2000), all droughts raise, namely, "How much damage is inflicted by drought?", "Who is most affected by drought?" and "Where is damage inflicted most?" With this aim, this chapter is structured in such a way as to bring to light certain initiatives whose results have provided adequate answers to these three questions.

The answer to the first question requires having discussed and tested what have come to be known as *impact matrixes*. These matrixes have been developed to facilitate decision-making process during periods of drought (WDCC, 1998; Rossi *et al.*, 2005). The answer to the second question can be found in the *Drought Management Plans* that have been developed for this purpose (Wilhite *et al.*, 2005), while the third can be answered from our knowledge about available water resources, the uses that must be satisfied, the possibilities for saving water, and finally, the flexibility of the system. All of this, albeit in a brief manner, will be dealt with in this chapter.

However, given that it is not in our interest to present the full range of possible actions in a disorderly manner, let us first structure them accordingly. This task is especially important as the literature dealing with the problem that concerns us here is very especially if we take into account the literature in the USA. Indeed, a quick look at the website of the country's main point of reference, the *National Drought Mitigation Center* (http://www.drought.unl.edu), serves to confirm the substantial interest that strategies aimed at rational drought planning and management have raised. However, this should not surprise us due to the severity of the problem in that country. Furthermore, as most of the documents have been prepared by different administrations, almost all are available to the general public. There are also numerous publications dedicated to drought management that have been produced by professional associations (AWWA, 2002) which place great importance on the presentation of practical cases. Due to the availability of so much and such relevant information, it is necessary to filter it, put it in order and above all, adapt it to Spanish circumstances.

A vast amount of information can also be found in Europe, albeit much less than the number of documents produced in the USA. The majority of European documents (Cabrera & García-Serra, 1999; EA, 2003; Cubillo & Ibáñez, 2003) deal with drought management within the urban framework, although others treat the issue in a broader context. Some of the most prominent studies include an overview of the work carried out by the *International Commission on Irrigation and Drainage* (ICID) from 1995 to 1998, which was summarized (DVWK, 1998) by the *German National Committee* of the ICID and is available in Spanish. Another publication that merits our attention and is much more specific (its fundamental objective was to characterize droughts) is the result of a European research project (Hisdal & Tallaksen, 2000). Other works (Vogt & Somma, 2000) draw together specific papers structured around aspects which are typically addressed in the study of droughts. These include among other things, the definition of drought, strategies for assessing them, mitigating their impacts and monitoring measures.

Although the present chapter is adapted to Spanish circumstances, it also contemplates the above aspects.

Of all these documents, the most innovative for the Spanish case is one in which the impact of droughts is assessed by means of matrixes constructed for the three components that lead to sustainable water policy: social, economic and environmental. It is necessary to continue in this line as it is the first step towards designing strategies that will permit droughts to be managed in a rational manner, that is, in such a way as to mitigate their impact. Given the restrictive framework of current water policy, this is an action that merits our interest, particularly in the mid and long term. However, this adds a third element that must be taken account when choosing a course of action. Not only do we require the necessary resources and time to carry an action, but must also consider if such an action can be applied immediately or not; an essential step towards defining whether actions are direct or indirect. At the same, direct actions can be either of a long term (or proactive) nature or short term (or reactive) nature; a classification that, as we will see, adapts well to the Spanish case.

Let us first refer to direct long term or proactive actions. These are actions whose results become evident particularly in the mid and long term. Ultimately, they are actions which will permit water policy to be adapted to the current circumstances; a vital step if we are to successfully deal with extreme situations such as those that occur in times of drought. Secondly, there are short term or reactive actions which are implemented during a drought and follow the pace of its evolution. To a large degree their efficacy will depend on the proactive actions that have been implemented in advance. Thirdly, there are the so-called supplementary or indirect actions. This type of action is aimed at facilitating the implementation and development of the other groups of measures (proactive or reactive) with which drought is managed in a direct manner. The vision of drought management presented here is broader than that proposed by other authors (Bouvette, 2004) who have classified actions into two large blocks.

3 GENERAL CONSIDERATIONS

Drawing a comparison with the world of sports in which an athlete prepares for an Olympic marathon, direct proactive measures would correspond to four years of hard training, while direct reactive actions would be the athlete's final preparation in the days leading up to the competition or his strategy during the race. While both phases are of utmost importance to winning the competition, it is evident that the tactics the athlete uses will be of little help if he is not in optimum physical shape after training. Finally, the complementary details of the indirect actions include how the athlete adapts to the track, his mental state, self-esteem, equipment, diet, and so on.

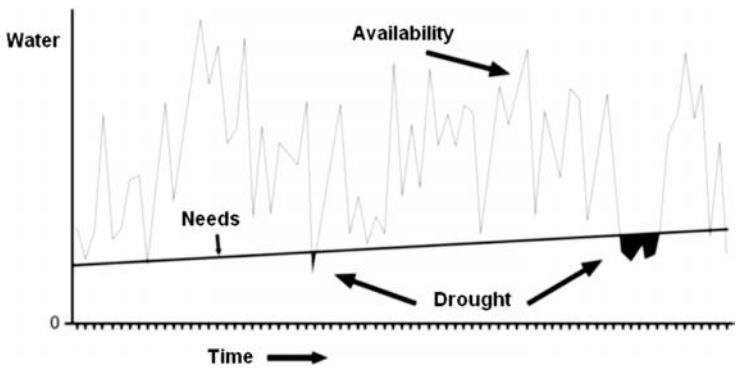

Figure 1. Drought definition from a hydrologic point of view (USACE, 1994).

But returning to drought in general and to what we have termed proactive measures in particular, let us take a look at the Figure 1 (USACE, 1994), which defines drought from a hydrologic viewpoint. While water availability largely depends on the hydrologic year, consumption follows a more uniform pattern. Although the possibilities of increasing water supply are limited in developed countries (including Spain), as the graph shows, the margin of action concerning consumption is much larger and continues to widen. In any case, proactive measures are understood as any action that either contributes to increasing resources (for example, reutilization) or permits water use to be reduced (for example by improving water network performance).

Measures of a proactive nature require time. In addition, how and to what degree they should be implemented necessitates discussion and negotiation in times of abundance. We should not forget that, in addition to time, all measures require funding and on many occasions, legal reforms. Indeed, it is a much more complex or even impossible task to reach long-term agreements in an atmosphere of tension and discord. Periods of drought clearly do not favor the proper state of mind needed to introduce the far-reaching proactive measures that Spanish water policy requires.

On the other hand, reactive measures are measures which are implemented to reduce impact when in the midst of a drought. In other words, these are strategies which are taken during periods of scarcity, but which should be negotiated by all of the parties involved when the situation is *normal*. To reduce the impact of water shortage it is useful to previously develop an impact matrix that classifies the consequences of drought and allows decisions to be made in a reasonable manner. One example of an impact matrix for drought management (there are many other proposals) has been developed in detail by the *Western Drought Coordination Council* (WDCC, 1998) (Table 1).

In short, drought impact decision matrixes are little more than assessment tools that account for a variety of criteria (those in the table are some of the most obvious, but not the only ones) concerning the damage that can be inflicted as a result of restrictions. Based on the final ranking in the matrix analysis, it is possible to establish how to ration water in the most convenient way from the viewpoint of the general public. It is not surprising that of the ten stages into which the *Drought Management Plan* is normally divided, the most important step is to establish the impact ranking (Wilhite *et al.*, 2005).

It is common to group impacts according to a variety of criteria (economic, environmental and social) that should be envisaged in all sustainable water management plans. The first of these, albeit not necessarily the most important, are the most evident. Thus, for example, the loss of crops or livestock or the costs incurred when water is restricted are perfectly quantifiable. On the other hand, environmental impacts include, among many other consequences, the loss of animal and plant diversity or the disappearance of wetlands and natural springs. Finally, droughts produce numerous social impacts. An example of this type of impact is the numerous conflicts that arise among users who compete for water in times of drought. A detailed list of such impacts appears in the report titled *How to reduce drought risk* by the *Western Drought Coordination Council* (WDCC, 1998). This report also includes tree diagrams to analyze and follow-up on impacts in terms of the different uses.

Yet of all these criteria, the economic criterion is the most *measurable* (that which is most quantifiable) and obvious of all. It should come as no surprise, then, that researchers and institutions (Jenkins *et al.*, 2003; USACE, 1994) propose methods to analyze the economic losses deriving from water shortages. There is no question that mitigating the economic impact is an essential part of proper drought management. It is precisely in this line that Spain can and must work; an undertaking that, incidentally, is closely linked to the creation of water banks and markets.

Table 1. Example of an impact matrix for drought management.

Impact	Cost	Equally distributed?	Growing?	Public priority?	Equitable recovery?	Impact rank
?	?	?	?	?	?	?

But the fact that these concepts can may at times contradict the complex *Water Law* of 1985—whose final text was revised in 2001 (BOE, 2001b)—should escape no one. Article 60 of the text ranks priorities for water use with "irrigation and agricultural uses" falling into second place followed by "industrial uses for the production of electric energy". According to this ranking, a historical irrigated area located in the Júcar River basin should be given higher priority than the industrial use of the *Cofrentes Nuclear Power Plant*, which is cooled by water from the same river. Regardless of whether or not the basin's Hydrologic Plan—and of course a *Drought Decree*—would permit this ranking to be modified, it is evident that water legislation in Spain needs to be updated. It should be said, however, that the *Special Plans for Action in Emergency Situations and Eventual Drought* for the various basins have been developed (as to be expected) in accordance with current legislation. It is for this reason that an impact matrix which considers water use from a present-day viewpoint is difficult to envisage at this point in time.

But little can be done to change the existing framework and background of water policy. Consequently, the reactive measures that have been taken thus far are conditioned by both current legislation and actions instituted by the state, which has, for many years, overlooked the importance of certain proactive reforms during years of good rainfall (since the end of the last drought in early 1996 until today, more than a decade has elapsed). It is not surprising, then, that one of the compulsory measures contained in the current plans to reduce demand (point 2.4) is to "systematically cut off supply"; a regressive measure (as it is both unhealthy and deteriorates the system) that is used as a last resort due to the high number of losses in most distribution networks. Indeed, these losses are the only factor that justifies cutting off supply. The networks that do perform well (there are fewer but not a negligible amount) are also obliged to follow this system in order not to give rise to comparative grievances.

In fact, measures are considered reactive precisely because of the fact that they are provisional. But their development, discussion and implementation are conditioned not only by the physical and legal framework which encompasses them, but by the serenity that they demand. When the necessary calm is lacking, it is almost impossible to discuss priorities. Just as the well-prepared athlete will be able to respond satisfactorily to the harsh demands of the competition, when restricting consumption the arrangement will be more efficient the more robust the system.

Finally, there is a wide range of actions aimed at minimizing the impact of drought. However, as they do not directly affect the water balance, they should not be considered direct measures. Instead, these are measures that serve to complement direct actions as their ultimate objective is none other than to smooth the way for the latter. Thus, for example, a new economic water policy oriented towards promoting efficiency and therefore giving meaning to a large number of direct actions, indirectly contributes to achieving a balance between resources and uses; an especially difficult balance to reach in times of drought.

In what follows we will review the most important measures of each group. Our intention here is not to rank them by any criteria, but rather to draw up an initial list to guide the Committee's work in the future. On the other hand, how many of these measures should be developed at the initial stage will depend on their importance, opportunity cost, economic expense, political viability and, also the time required for each of them. Without doubt, there are many factors that must be taken into consideration before reaching a decision, but in any case the Ministry of the Environment will have the final word.

4 DIRECT PROACTIVE ACTIONS: AN OVERVIEW

The wide array of actions designed to either increase supply capacity or rationalize and control present demand represent a range of possibilities encompassed within what are known as proactive measures. Because these measures are incompatible with improvised actions, they should be implemented in a progressive manner. Although not an exhaustive list, the principle measures are outlined below according to how they contribute to increasing resources or rationalizing consumption.

4.1 *Increasing and diversifying supply*

Most of these actions appear in the Guide for developing special plans of action in emergency situations and eventual drought published by the Ministry of the Environment (MMA, 2005), particularly in point 4.5.4: "Classification of measures: strategic, tactical and emergency". The most notable of these include:

- New storage facilities.
- New surface water extractions, generally through transfers between basins.
- Centers for the exchange of water rights.
- Desalination.
- New groundwater extractions.
- Recharging aquifers, a simple and efficient way to conjunctively use surface waters and groundwater that should be highlighted in an explicit manner.
- Reutilization.
- Optimize resources through better hydrologic planning and monitoring. Make better use of the enormous possibilities that the conjunctive use of surface waters and groundwater affords, especially in times of drought.
- Finally, regarding management strategies, it is fundamental to manage a system's resources in preparation for episodes of drought. To do so, it is essential to have an adequate early warning system and drought characterization system (by means of indicators) as well as using mathematical models that aid in decision-making processes for the management of reservoirs in real time according to the risk of drought (Sánchez Quispe *et al.*, 2001; Rossi *et al.*, 2005). The *AQUATOOL Decision Support System* (Andreu *et al.*, 1996) has already been used for this purpose to manage certain basins in real time (e.g. Tajo, Júcar).

As indicated in the above Guide, many of these actions "require an extended period of implementation, large budgets, political negotiation, social acceptation and when appropriate, modifications to the legislation" (MMA, 2005: 42). This is of foremost importance given that these are works which, in addition to affecting hundred of thousands of people, will be carried out over several terms of office from the time they are conceived until they become operational. Indeed, given the recent experiences in Spain which have been the subject of enormous controversy regarding new (Ebro and Júcar-Vinalopó) or already existing (Tajo-Segura) transfers, in no way can these measures be considered atypical (USACE, 1994).

The actions above were ranked beginning with the most difficult to develop and concluding with the easiest to implement. Nevertheless, and as regards their execution, the final decision should, as always, be based on economic, environmental and social criteria. Logically, the work undertaken by the Expert Committee concerning these actions should be oriented towards analyzing the minimum requisites demanded by each of them and from there, assessing their possibilities for development and ultimately, their feasibility. Finally, a comparative analysis of the possibilities afforded by each and every one of the strategies would be of great utility.

4.2 *Managing demand*

This second option, which began to be explored in detail in the developed world some decades ago, has only recently begun to be explored in Spain. Thanks to this new line of study the margin of possible water savings that is possible is now quite large. A recent survey (Pacific Institute, 2003), which serves as a point of reflection, estimates the potential savings in urban and residential water use in California (where for some years programs have been set up to encourage efficiency) at a minimum of 33%. This is a significant percentage in spite of the fact that it does not take into account water loss in distribution systems. Although precaution should be taken when drawing conclusions, the California study demonstrates the high potential for water savings in Spain.

While potential savings in urban and residential water use is notable in Spain, it only accounts for a quarter of the demand in the country and in fact, much greater savings can be achieved in

irrigation. Indeed, there are clear indications to this effect. When assuming the energy costs for extraction, groundwater irrigation is five times more productive than surface water irrigation in economic terms; although this figure drops to three when comparing the number of jobs that are created to a reference water volume (Corominas, 2000). The above conclusions were obtained in Andalusia and are therefore fairly representative given that this Autonomous Community has the largest extension of irrigated land in the country. As regards water efficiency at the national level (Llamas, 2003); it is a well-known fact that 30% of the surface area is irrigated with less than 20% of the total annual volume. Such significant increases in efficiency, which are simply a result of assuming extraction costs, demonstrate the wide margin of water savings that may be feasible. The interest in further specifying these values is therefore not a matter of debate. In this line, and according to the provisions set out by the *Ministry of Agriculture, Fisheries and Foods of Spain* (2002) in the *National Irrigation Plan*, more than 5,000 Mm^3 of irrigation water can be saved in Spain through programs to improve water consumption in irrigated areas and reduce excess supply.

For all of these reasons, a study that quantifies the potential savings in water use in Spain—especially when taking into account the importance given to water savings in irrigation as a result of the implementation of mechanisms to manage demand—would contribute to identifying water deficits in the hydrographic basins with greater precision. Indeed, due to the important role of irrigation, numerous studies have been dedicated to optimizing water use in the countryside (Pereira *et al*., 2002). In short, knowing how much water can be saved through efficient management is information of great relevance; information, which in a global context such as the one we propose here, is lacking in Spain. This knowledge is essential for managing droughts in a rational manner given that is illogical to penalize those who use water efficiently in the same way as those who do not when restrictions apply.

Numerous publications (WDCC, 1998; NCDENR, 2003) refer to specific actions that contribute to reducing demand. These are actions to save water which on many occasions (EPA, 2005) need to be adapted to the different uses to which water is put (urban, residential, commercial, agricultural and industrial). They include:

- Measuring all of the uses and resources (including groundwater wells).
- Improving the performance of water transport systems (canals, irrigation channels, transport and distribution pipelines and even installations inside buildings).
- Using rainfall (water harvesting).
- Reutilization of gray waters in homes and industries. This also includes industrial recirculation.

5 DIRECT REACTIVE ACTIONS

In this second group, we must refer to the decision tree diagram that sets out how to manage a drought according to its evolution based on the established protocol and taking into consideration risk matrixes. These are decision trees or protocols that, in accordance with current legislation (BOE, 2001a) and logic, should take into account at least two levels: that of the hydrographic basins and that of the city. However, we should not overlook the fact that from time to time it is necessary to consider more complex cases (i.e. the case of the *Isabel II Canal* which supplies water to Madrid city) due to the added difficulty arising from having to coordinate the actions of a variety of administrations.

Having reached this point, it is important to highlight that after consulting the vast information that is available on this issue, especially in the USA (drought management plans for thirty different states can be found at http://drought.unl.edu/plan/stateplans.htm), we have come to the conclusion that the *Drought Management Plans* developed in Spain must not only be improved, but follow similar criteria. Thus, another of the tasks that could be proposed by the Committee is to revise the state of the art of these Plans, and based on their findings and the circumstances of the case, develop specific guidelines for the development of future plans. This is an undertaking that is even more necessary when dealing with drought management in small towns. Let us

not forget that many towns have only one general technician to deal with all of these problems. This task ties in well with the indirect measure of *technical assistance* that will be discussed below.

In Spain, we are all, in some way or another, following in the wake of the *Isabel II Canal* (general water supply system to Madrid) that has recently updated its plan (Cubillo & Ibáñez, 2003); a plan that is, without a doubt, a first-rate document. But, as we have already said, due to its singular characteristics, the *Isabel II Canal* is not an example that can be followed by the majority of Spanish cities, although their sense of preparedness would merit such a step. In fact, the number of towns that have a plan at this very moment can be counted on the fingers of just one hand. These include towns supplied by the *Taibilla Canals* (with Alicante at the head) and few more.

This is not the case of UK where the *Environment Agency* (EA, 2003) has recently published the second revision of the drought management plans developed by water companies in the country. Prior to these plans, the EA had provided clear guidelines for drought management. It is a document that also indicates which companies have made their plans public (either a summary or the complete text) on their respective websites. All of these companies have made their plans available to the public with the exception of the *Thames Water Company* which, interestingly, has declared its plan to be *confidential*.

Many other urban contingency plans are available on water company websites, especially those which are publicly owned. This is the case for example of *Melbourne Water* in Australia (MWC, 2001) or *Denver Water* in the USA (DW, 2004). The *Water Conservation Committee* of the American Water Works Association (WCC, 2002) has developed a model drought management plan with similar goals to those contained in one of the Committee's assignments. This plan serves as a support tool for the development of drought plans that will facilitate the work of managers in water companies. An analysis of all of these documents can be very useful, even when considering the Spanish reality and, in particular, that of its cities and towns. As we said before, translations can be risky.

Considering the above, and concerning what have come to be called reactive measures, the excellent and thorough work *Managing Water for Drought* (USACE, 1994) merits particular attention as it is the result of a thorough study carried out by more than one hundred professionals. The study was conducted in the early 1990s in response to the report titled *National Study of Water Management during Drought*. As is often the case, the project was the administration's reaction to the low rainfall recorded in the western USA at the end of the 1980s. Structured into 10 chapters and 14 annexes, the report summarizes and discusses all of the factors that must be taken into consideration in the event of a drought. It includes such issues as the makeup of the teams in charge of developing a drought management plan, how to reconcile conflicting interests, methods of measurement that must be taken into account with a view to making objective decisions as well the negative impact of outdated legislation on drought management.

Following in this line, it would be desirable for the Committee to develop a similar report to the one mentioned above, albeit adapted to the Spanish case. Indeed, the report was commissioned in the USA under very similar circumstances to those occurring today in Spain. A well-documented report would certainly be a very useful tool in the future.

6 SUPPLEMENTARY OR INDIRECT SUPPORT ACTIONS

In the above Section we stressed the difference between actions that permit drought to be managed in a rational manner and are therefore indispensable, and others that support the implementation of the former. Given that the second type of actions do not directly mitigate the effects of drought—even when they lead to the success of direct actions of both an reactive and proactive kind—we will considered them separately by structuring them into two different blocks according to the type of direct actions that they influence.

6.1 *Measures that support proactive actions*

These measures facilitate the implementation of complex, but necessary direct proactive actions. Among others, these include:

- Citizen awareness. If people do not understand what is at stake, it is impossible for them to support a series of measures that will always be rejected a priori due to their lack of popularity.
- The participation of sociologists and communicators that aid in transmitting the message so that it will reach citizens in a better and faster manner.
- Media involvement. Changing such a firmly rooted culture in a short period of time cannot be achieved without the support of the media.
- Foster citizen participation. The Ministry website is an example of this type of action.
- Adequate economic policies that foment efficiency and flexibility of water use.
- Proactive water policies that monitor both water use and water resources. In Spain, water extracted from aquifers is not measured, in spite of this measure being provided for under current legislation. In fact, the administration does not have the capacity to regulate the volume of water that is extracted from the country's aquifers. Water use measurement, including urban use, leaves much to be desired.
- Adapt the legislation to the current context. Revise historical water rights.
- Adaptation of the administration. Water management and monitoring needs to be coordinated.
- Centers for the exchange of water rights.
- Provide technical assistance to towns and irrigation communities which do not have technicians with a sufficient level of expertise as they are lacking an adequate economy of scale.

The importance of the first four actions in the above list should be underscored. Although they may seem to have largely been conceived due to their public appeal, nothing could be farther from the truth. These are actions that are essential to achieving the viability of the other actions. At least these are the conclusions that can be drawn following a brief look at the *National Drought Mitigation Center* website (http://www.drought.unl.edu). Indeed, this website provides everything from educational material to specific information for the media. We must bear in mind that Mediterranean water culture has very strong roots and the necessary changes can only come about with ample support from society.

The remaining actions are those that directly contribute to mitigating the impact of drought. However, it is clear that if we do not prepare the ground beforehand, it will be unfeasible to implement them. All of these actions appear in detail in the documents studied and it is surprising that for an issue that would initially seem to be a very delicate one in Spain—historical water rights—specific guidelines already exist in other countries (AWWA, 1995) to redirect the situation in a manner coherent with today's needs.

6.2 *Measures to support reactive actions*

A *Drought Management Plan* resembles a decision tree diagram which, depending on the circumstances, guides planners in one direction or another. Unlike the Plan, which can and must be drawn up with the time and calm that the issue requires, decision-making is a dynamic process. If the Plan is good, it will be even better if we have the appropriate information to guide us along the right paths within the tree. It is therefore essential to have reliable forecasts in order to take sensible decisions. Indeed, the importance of drought monitoring is supported by the fact that one of the five thematic areas included in the above-mentioned website is dedicated specifically to this issue.

In short, all of the actions that permit us to remain one step ahead of the problem are included in this Section, as well as supplementary actions. Forecasting and characterizing droughts is a research topic that has gone hand in hand with the stochastic analysis of hydrologic series; a topic that began to awaken the interest of researchers some decades ago when extensive and reliable rainfall records first became available (Dracup *et al.*, 1980). In fact, Yevjevich was the first to

propose the *theory of runs* to characterize drought back in 1967. For this reason, and rightly so, today he is considered the father of the hydrologic study of droughts (Yevjevich, 1967).

Due to the growing impact of water shortages, research continues to be conducted in this line (Fernández Larrañaga, 1998; Salas *et al.*, 2005). However, in order to manage drought in such a way as to mitigate its impact before a drought occurs, and from the viewpoint of needs that must be satisfied, we must assess the water deficit. The balance between availability and need is the origin of other indicators; indicators which activate the various stages of a *Drought Management Plan* (Fisher & Palmer, 1997) and which English speakers refer to as *triggers*.

To sum up, when reliable information is available, it is possible to foresee the events and properly manage reactive actions that have been designed in advance for this purpose. The remaining strategies and actions either facilitate the development of drought management plans (conflict management) or promote both the acquisition and dissemination of knowledge. All of these actions would therefore include:

- Meteorological accurate follow-up and adequate data treatment.
- Meteorological drought indicators.
- Drought management indicators.
- Activation thresholds for the different phases of a plan.
- Conflict resolution.
- International relations.
- Technical assistance in similar terms to those described above.

7 CONCLUSIONS

The main conclusion that can be drawn from the above is that a drought cannot be managed efficiently without a plan that has been properly developed beforehand. A plan that takes into account both proactive and reactive measures will permit exceptional measures to be reduced to a minimum; measures which until now have been applied in a systematic manner and characterize the actions implemented by water administrations in Spain in times of drought. Thus, the final goal is to ensure that planning, rather than improvisation, prevails in the event of a drought.

The economic, social and environmental impacts caused by the increasingly frequent water shortages occurring in the 21st century will continue to worsen. Although it has not been mentioned explicitly in this chapter, we should not forget the looming threat of climate change, making rational drought management of vital importance to the future. To achieve such an aim, however, we must travel down a very long road that should not demoralize those who walk upon it. Remember that Rome was not made in a day. Instead recall Machado's brilliant verses: "*Caminante no hay camino, se hace camino al andar*" ("Traveler there is no road, the road is made by walking").

In what follows is a list of the conclusions reached by the Expert Committee, which as we mentioned in the introduction to this chapter, were agreed upon unanimously by all of its members:

1. Droughts can be managed in a much more rational manner than they have been so far. Prevention would substantially mitigate the impacts inflicted by drought. In this sense it is important to reduce the lack of prior planning to the greatest degree possible. *Prevention is better than cure* should be the aim of all good drought management.
2. The integrated management of all the resources (surface and groundwater as well as conventional and non-conventional waters) is an essential part of all water policy and takes on special relevance in times of drought.
3. Water planning, and in particular *Hydrologic Basin Plans* pending revision in compliance with the *Water Framework Directive* (WFD), should use years of scarcity as a baseline reference and at the same time fully update hydrologic series.
4. The maximalist use of regulated resources in years with average rainfall and the systematic contamination of rivers and aquifers are factors that weaken our capacity to manage droughts.

5. Given the current context of climate change, the WFD has underscored the need to manage risks through the rigorous application of the principle of precaution. For this reason, hydrologic planning should envisage restrictions deriving from climate change which point to more frequent and more intensive droughts.
6. Drought planning should be integrated into *Hydrologic Basin Plans* in a harmonious fashion. The coherency, efficacy and efficiency of the plan must be assessed before, during and after the drought and developed and applied in accordance with the notion of transparency of environmental democracy established under the *Aarhus Convention*. If this recommendation is followed, we can achieve greater efficiency, social consensus and the legitimacy of this public policy.
7. Water resources must be managed within the framework of the hydrographic basin and in compliance with the plans developed in the corresponding hydrographic area. These organizational structures are essential to managing drought rationally.
8. The system to grant water rights must be revised so that private water rights comply with the objectives of the plan established in the WFD in a more intensive and dynamic manner.
9. The reform of the water rights system should facilitate and foment the creation of exchange centers, as well as improve the regulation of these centers and the grant contract. In this way, they will comply more closely with the new objectives of planning, transparency and active public participation.
10. Coordination between the administrations involved in water planning and management is always necessary, but is particularly important in times of drought.
11. Emergency plans in cities cannot be independent of *Special Basin Plans*, but should form part of them. In order to achieve this aim, and in line with the above, it is necessary that the administrations involved work together in a coordinated manner.
12. Emergency plans in cities with over 20,000 inhabitants should not be viewed merely as a legal requirement. They are also a response to the need to improve, if not implement, good practices in the daily management of the city's water supply.
13. The adequate management of water resources, and in particular drought management, requires a sufficiently precise system of indicators that permits droughts to be characterized, forecasted and followed-up, as well as allowing them to be managed efficiently from the start.
14. Furthermore, in compliance with article 4 of the WFD, this system of indicators should respond specifically to unusual circumstances of scarcity and drought, as well as defining the circumstances in which drought may be considered an exceptional or reasonably unforeseeable event. To do so, the system of indicators must clearly differentiate and characterize episodes according to meteorological factors, excluding for this purpose the indicators linked to the planning and operation of water systems.
15. In normal climatological conditions, groundwater satisfies the needs of a third of the population and of the irrigated surface. In times of drought, groundwater use increases notably, constituting a strategic resource for the resolution of conflicts that arise in these situations due to the lack of water. For actions to be efficient, groundwater and aquifers must be included in the hydrologic plan. However, for historical reasons this has not been the case and has come to be one of the most noteworthy shortcomings of water policy in Spain. This is a deficiency that comes to light during times of drought due to the vital role that these resources could play if they were included in the plan. To include them it is necessary to determine their possibilities in detail. This would involve quantifying the available resources as well as their quality, spatial distribution and the storage capacity of the aquifers.
16. The planned reutilization of water is an essential component of integrated water management. This is especially true in coastal areas where reutilization can lead to a significant net increase in local resources for both agricultural irrigation and gardening and for infiltration and storage in aquifers, thus guaranteeing a larger supply than that provided by conventional resources.
17. In spite of the considerable progress that desalination has undergone in recent years, it continues to be a non-conventional source of water, except in regions with a high standard of living

and with significant water deficits. Today, this technique is still too expensive to become the principal source of drinking water, in addition to a series of social, environmental and technological challenges that are yet to be overcome.

18. The WFD establishes a "framework for the protection of groundwater, surface waters, transitional waters and coastal waters" where the natural environment is an essential element that should always be taken into account. Hence, *River Basin Plans* should provide for environmental riverflows to sustain river ecosystems and reinforce their resilience: a very important factor during periods of drought.
19. Knowledge about reservoir dynamics and the natural flow regimes of rivers, as well as the composition and characteristics of river ecosystems, is essential to ensure the sustainability of the good ecological status of waters as well as to adequately guarantee established uses.
20. According to the latest official data corresponding to 2003, 77% of water consumption in Spain is devoted to irrigation, by far exceeding other water uses. This continues to be the case in spite of the fact that the strategic value of irrigation in both economic and social terms has diminished in recent years. As a result, the potential for irrigation water savings is very high. The water that can be saved through improved management would increase supply guarantee in irrigation and for other uses, among other aspects. However, it is essential to determine in advance the actual situation of irrigation in all the river basins and in all the irrigation districts.
21. Given that irrigation is one of the uses that is most affected by restrictions in periods of drought, it is necessary to characterize the economic, social and environmental impact of water shortages on the production of specific crops. This is the only way that impacts can be mitigated. Furthermore, in order to make proper decisions regarding the irrigation preferences of each basin, we must first know the irrigation demand curves and the water productivity for each type of crop. This information should be integrated, with all its consequences, into the *Special River Basin Plans*.
22. The establishment of a water rate policy that is coherent with the WFD, including environmental costs when the protection of affected waters so requires it, will contribute to rationalizing use and very likely encourage the use of non-conventional resources.
23. Cutting off water supplies, which is the last resort for limiting demand in cities, constitute an inadequate measure that should be abolished. The only reason for implementing this measure is to save water that is lost through leaks in pipelines. Cutting off cause numerous inconveniences that could be resolved through good management. Normally, when water supply is cut off, water is no longer drinkable (as it permits the intrusion of pathogens) and what is worse, the number of breakages in the system pipelines increases significantly, thereby worsening instead of solving the problem.
24. The amount of water saved with the above strategies (regeneration processes, reutilization of flows and the modernization of both irrigation and urban networks) should aid in improving the status of aquatic ecosystems and aquifers and guaranteeing supply in times of drought.
25. An aspect of growing interest in water resource management concerns the close relationship between water and energy. This relationship should always be taken into account in conventional processes of water purification and treatment, in savings initiatives, in the new proposals to allocate conventional water resources to users, in the creation of new resources with advanced techniques such as desalination and in processes to develop plant biomass for the generation of biofuels.
26. The above measures involve substantial changes to the water culture of our society. For this reason, and bearing in mind that political action is only possible when it receives the support of citizens, the media should play a more prominent role as educators.
27. A detailed study of the news about the environment that appeared in the media in August 2006 clearly indicates that the messages reaching citizens lack objectivity and the technical rigor that these issues demand. On-going training in environmental journalism would be useful to improve the quality, rigor and objectivity of the news that reaches the public regarding these issues.

28. Awareness campaigns among citizens are an essential element to promote the sustainable management of water resources, especially in periods of drought. A greater commitment by the media through informants having special expertise in this field would foment a culture of participation and consensus, thereby fostering citizens' support for political action.

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