Contribution of integrated water resources management towards the achievement of the Millennium Development Goals (MDGs)

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Abstract

G. Donoso[1], and J. Cancino. 2010. Contribution of integrated water resources management towards the achievement of the Millennium Development Goals (MDGs). This paper analyzes the contribution of water resources to the Millennium Development Goals (MDGs) and describes the conceptual foundations and specific components of the integrated water resources management (IWRM) process so as to illustrate how IWRM is a pre-requisite to achieve the MDGs, and identify the key actions that are required to implement IWRM Plans.

Key words: water and the millennium development goals, Millennium Development Goals, integrated water resources management, water resources and development.

INTRODUCTION

The United Nations World Summit on Sustainable Development, held August 26-September 4 2002 in Johannesburg, South Africa, was the latest in a series of meetings aimed at defining and promoting more sustainable development. In the decade prior to Johannesburg, the major milestone on this path was the UN Conference on Environment and Development, commonly referred to as the Earth Summit, held in Rio de Janeiro, Brazil, in June 1992 and the Resolution adopted by the General Assembly in the year 2000 known as the United Nations Millennium Declaration. Emanating from the Millennium Declaration, the eight Millennium Development Goals (MDGs) bind countries to fight against poverty, illiteracy, hunger, lack of education, gender inequality, child and maternal mortality, disease and environmental degradation. The eighth goal, reaffirmed in Johannesburg, calls on rich countries to relieve debt, increase aid and give poor countries fair access to their markets and their technology. The MDGs offer the world a way to accelerate the pace of development and to measure results.

The MDGs include eighteen numerical targets that should be met by 2015. These goals are mutually reinforcing and interrelated and aim to make important improvements in the lives of the world's poor people, judged, in most cases, against their situation in 1990.

The barriers affecting the achievement of the MDGs are compounded by a limited understanding that the water resources provides goods and services that contribute to sustainable growth and poverty reduction. Thus, for each of the MDGs, water is a key, since it is crucial to all forms of social and economic development and a necessity for nature's processes. The UN has recognized that the MDGs cannot be achieved without adequate and equitable access to water resources (Unesco, 2003). Thus, although the goals and their related targets focus principally

on ends rather than means and therefore do not explicitly recognize the importance of water for food security or environmental sustainability, appropriate water management and development will be essential to meeting the MDGs. Water management is not only a goal itself, but also a necessary requirement to achieve all other goals (Bullock *et al*., 2009). In fact, Hanneman (2006) points out that the source of most problems is that water has a high value which is not explicitly accounted for in water policies, hindering development of effective strategies for solving the water crisis.

The most effective strategy for making steady, sustainable progress on the MDGs is to serve all the goals in an integrated approach. However, each goal will need a well-defined package of technologies and services for success at the field level. Pursuing each goal separately without acknowledging its interlinkages will reduce the complex process of human and economic development to a series of fragmented, conflicting, and unsustainable interventions. Thus synergies must be exploited, but tradeoffs among MDGs are often inevitable and need to be managed.

Successfully achieving the targets established in the MDGs through the management of water depends upon non-structural solutions and a new approach to planning and management. In this context, countries must overcome constraints through appropriate investments and management arrangements. An integrated water resources management (IWRM) is crucial in the quest to achieve all MDGs, in order to maximize the synergies and address the potential tradeoffs (Lenton, 2005). There exists consensus that water policy reforms must move towards integrated water resources management (IWRM), which considers social, political, economic, technical and environmental aspects (Bauer, 2004).

The objectives of this paper are to: analyze the contribution of water resources to the MDGs, describe the conceptual foundations and specific components of the IWRM process so as to illustrate how IWRM is a pre-requisite to achieve the MDGs, and identify the key actions that are required to implement IWRM Plans.

The structure of the paper is as follows. Section 2 illustrates the contribution of water resources to the achievement of the MDGs. Section 3 identifies the contributions of IWRM to the achievement of MDGs and presents the key actions that are required to implement IWRM Plans. Section 4 concludes by presenting the lessons learned.

Water resource management and its contribution to achieving the MDGs

MDG 1: Eradicate extreme hunger and poverty

Of the eight MDGs, eradicating extreme hunger and poverty depends on agriculture the most. Securing people's right to food is crucial to reducing famine conditions, particularly in poor communities. The main source of the world's food supply is agriculture; the United Nations World Water Development Report[1] (Unesco, 2003) points out that unmanaged earth systems can feed some 500 million people and, hence, systematic agriculture is needed for the current world population of 6 billion.

Water availability has been identified as one of the most important restrictions for food production (Yang and Zehnder, 2002; Madulu, 2003; Gerbens-Leenes *et al*., 2008), economic development and growth (Davis *et al*., 2001; Sullivan, 2002; Bates *et al*., 2008) and poverty reduc-

[1]The World Water Development Report is part of an ongoing assessment project to measure progress towards achieving the goal of sustainable development formulated at Rio in 1992, and the targets set down in the UN Millennium Declaration of 2000.

tion (Barker *et al*., 1999; Bhattarai *et al*., 2002; Lawrence *et al*., 2002). Towards the end of the twentieth century, most of the agricultural production increment can be attributed to increases in land productivity. These increments have led to significant reductions in poverty levels and contributed substantially to community development. The more efficient use of irrigation water has been stressed as one of the most important factors to achieve greater productivity in the sector (Pasha, 2002; Rosegrant *et al*., 2003). The increase in irrigation activities has contributed to the substantial growth in agricultural production that enables humanity to feed its growing population. Additionally, drainage projects have significantly contributed to increases in food production, hunger reduction and reducing global food prices (Lenton, *et al.,* 2005).

At the global scale, irrigated land increased from a million hectares in 1900 to approximately 270 million hectares by the year 2000 (Gleick, 2000). This increase has mainly concentrated in developing countries. By 2005, irrigated land accounted for approximately 20 percent of the total cultivated area, but accounts for 40 percent of total food production (Lenton *et al.,* 2005). Developed countries account for about 25 percent of the world's irrigated areas. Since growth rates in developed countries are low, most irrigation development and increases in food production will be necessary in the developing world where population growth is strong (Unesco, 2003; Björklund *et al*., 2009).

However, agricultural food production depends on environmental and resource constraints such as soil erosion, water scarcity, water logging and salinity among others (Ruttan, 2002). Due to large water use, groundwater overdraft and low irrigation efficiency, there exists concerns whether water scarcity will constraint food production growth (Cai *et al*., 2001; Rosegrant and Cai, 2002). Additionally, the competition for limited water resources between agriculture and more highly valued domestic and industrial water uses is rapidly increasing and will likely require the transfer of water out of agriculture. Due to this increasing transfer pressure, Rosegrant and Ringler (2000) conclude that comprehensive reforms are required to mitigate the potentially adverse impacts of water transfers for local communities and to sustain crop yield and output growth to meet rising food demands at the global level.

Thus, the question of whether agriculture will be able to produce the world's food supply in order to eradicate extreme hunger is intricately connected to the question of fresh water scarcity. Decisions made today about water policy will affect whether the target to halve, between 1990 and 2015, the proportion of people who suffer from hunger will be met and, thus, if people will continue to be undernourished (Gleick, 2000).

As pointed out previously, water is crucial to achieve the poverty reduction target. For example, irrigation has historically played a major role in poverty alleviation by providing food security, protection against famine, and expanded opportunities for employment both on and off the farm; irrigated agriculture development has been a major engine for economic growth and poverty reduction (Barker *et al.,* 1999). At an aggregate level, countries with higher income levels tend to show higher water consumption (Sullivan, 2002) while the lack of appropriate and reliable water supply is related to low national income levels (Lawrence *et al*. 2002). Bhattarai *et al.* (2002) conclude that improved irrigation access is a powerful instrument for reducing rural poverty in a given region. This is not so much through the direct impact of increased yield and farm returns per se, but more through indirect impacts like increased rural employment and the feedback and multiplier effects associated with the provision of irrigation infrastructure.

MDG 2. Achieve universal primary education

Water scarcity, poor water quality, and inadequate sanitation negatively impact educational opportunities for poor families across the developing world (Lenton *et al*., 2005). Thus, Pritchett (2001) has found that irrigation infrastructure in India has had a major impact on education.

This is particularly evident with water-related impacts on health because poor families have no social security and being ill means loss of a minimum income, and loss of the ability to supply labor in a productive way so as to overcome poverty. The aforementioned water-related impacts force poor families to take children out of school and give up education in order to replace the sick adults as income earners (Hansen, 1993; Hansen and Bhatia, 2004). Additionally, reducing the incidence of water and excreta-borne diseases among children improves school attendance (Lenton *et al*., 2005). Therefore, water related impacts on health reduce the likelihood of achieving the targets that by the year 2015 children everywhere will be able to complete a full course of primary schooling.

MDG 3. Promote gender equality and empower women

In addition to the relationship between water management and hunger, poverty, and primary education levels, there is an important benefit derived from the time saved in water collection when there is no water supply network. In these situations the collecting water task for domestic use is normally carried out by women or children, who generally must travel long distances to have access to water sources. Thus, water provision is related with gender inequalities. Zwarteveen (1997) points out that current water management policies need to increase responsiveness to specific women's water needs and interests in order to address gender equity concerns.

The time spent collecting water prevents family members from carrying out other important activities like a paid job, studying or domestic chores. According to UNICEF, 50% of girls in sub-Saharan Africa, leave school when they reach puberty because of poor water quality and sanitation services (Bliss, 2009). Whittington *et al*. (1990) estimated the value of the time spent in collecting water in Kenya, showing that the value of the time saved is directly related to the average income and inversely related with the number of women in the household, who are generally the ones in charge of carrying out that task.

With respect to other impacts associated with gender inequalities, Crow (2001) suggests that unfavorable access of women to water may have at least two results. Firstly, lower priority may be given to work taking place in the home, than in the fields and factories. If women's access is worse than men's, provision of water for drinking, cooking and home-based production may be undermined. This may deteriorate the health of the household and the livelihood activities of women. Secondly, women's poor access to water often results in many hours spent collecting water each day. This reduces the time women might otherwise have for other activities.

MDG 4. Reduce child mortality

Water-related diseases are a human tragedy, killing millions of people each year, preventing millions more from having healthy lives, and undermining development efforts. Some 60% of all infant mortality is linked to infectious and parasitic diseases, most of them water-related. Therefore, providing clean supplies of water and ensuring proper sanitation facilities would save millions of lives by reducing the prevalence of water-related diseases.

In this context, several studies have found significant positive effects of access to safe water on

child health (see e.g. Merrick, 1985; Behrman and Wolfe, 1987; Cebu Team, 1991; Esrey *et al*., 1991; Lavy *et al*., 1996; Lee *et al*., 1997; Al-Khatib *et al*., 2003; Kinley, 2003 and Jalan and Ravallion, 2003). However, populations with limited access to a safe water supply may continue to draw water from unimproved sources, thereby increasing their risk of diarrhea. Furthermore, young children who are not breastfed may be even more susceptible to water-borne diarrheal pathogens.

Burstrom *et al*. (2005) studied the impact of improved water and sanitation in Stockholm from 1878 to 1925, by examining the decline in overall and diarrhea mortality among children, both in general and by socioeconomic group. The results indicate a decline in overall morality and of diarrhea mortality and a leveling out of socioeconomic differences in child mortality due to diarrheal diseases, but not of overall mortality.

Plate *et al.* (2004) explored the interactive protective effects against diarrhea of exclusively using improved water sources and breastfeeding among children in rural Mali. Their results indicate that children whose water was drawn exclusively from wells had a significantly lower prevalence of diarrhea as compared with children whose water was drawn from a spring or stream. The exclusive use of improved water sources had no impact on diarrhea prevalence among children who were exclusively breastfed. Similarly, the strongest protective effect was observed among children who were not exclusively breastfed. The results indicate that using surface water as a primary or secondary water source exposes children to greater risk of diarrheal disease than using only improved sources such as wells.

While most countries are committed to increasing access to safe water and thereby reducing child mortality, there is little consensus on how to actually increase access to safe water and sanitation coverage and to improve water service. Some developing countries have implemented a strategy based on the privatization of water provision companies. Galiani *et al.* (2005), using the variation in ownership of water provision across time and space generated by the privatization process in Argentina, found that child mortality fell 8 percent in the areas that privatized their water services; and that the effect was largest (26 percent) in the poorest areas.

MDG 5. Improve maternal health

Access to adequate water in quantity and quality affects maternal health by reducing labor burdens and health problems resulting from water portage; improving nutrition which reduces the susceptibility to anemia and other conditions that affect maternal mortality; and malaria is particularly dangerous to pregnant women, and better water management reduces mosquito habitats (Lenton *et al.* 2005). Thus water available to women affect their health and maternal health problems impacts and prevent the proper care of children, undermining development efforts. Additionally, as von Braun *et al.* (2004) point out, educated women with access to adequate resources are better able to care for themselves. Thus, meeting the MDGs for education and women's empowerment by improving the management of water has a positive impact on maternal health.

Most water related diseases effects, impact negatively maternal health and, thus, must be considered as an integral part of the necessary strategies in order to achieve this goal.

MDG 6. Combat HIV/AIDS, malaria, and other diseases

The importance of adequate water quantity and quality for human health and survival has been recognized for many years (see e.g. Esrey *et al*.,

1991 and Howard and Bartram, 2003) and the improvement in the population's health conditions is a fundamental element and target of economic development. Water related diseases are among the most common causes of illness and death in developing countries. A significant proportion of the population in the developing world have been exposed to one or more of the main diseases associated with an inadequate provision of water supply and sanitation services: diarrhea, ascaris, dracunculiasis (guinea worm), hookworm, schistosomiasis (bilharzias, or snail fever), and trachoma (Lenton *et al.,* 2005).

In the year 2000, for example, water-borne diseases causing gastro-intestinal illness, accounted for an estimated mortality rate of 2,213,000; malaria and other vector-borne diseases, passed on by the insects and snails that breed in aquatic ecosystems, caused an estimated 1 million deaths; and over 2 billion people suffered water/sanitation associated diseases due to infection with schistosomes and soil-transmitted helminthes (Unesco, 2003). Furthermore, estimates indicate that extending the coverage of improved water supply and basic sanitation would reduce infectious diarrheas approximately 20 percent per year (Unesco, 2003).

On the other hand, water related health problems also result from consumption of contaminated water. For example, De Serres *et al*. (1999) associated an outbreak of hepatitis A in a rural river-island community with consumption of contaminated well water. Furthermore, the contamination of groundwater by arsenic in Bangladesh represents one of the largest poisoning episodes of a population in history (Smith *et al*., 2000). Additionally, high concentrations of nitrates in water have been related with methemaglobinaemia (Howard and Bartram, 2003) and gastric cancer (Goodrich *et al*., 1991). The concerns about water quality related health effects has brought increased attention to water quality, and the challenges of controlling point and non-point sources of pollution (Bruns and Meinzen-Dick, 2003).

MDG 7. Ensure environmental sustainability

Ecosystems not only have their own intrinsic value, but also provide humankind with essential services. Falkenmark (2003) presents evidence that ecosystems are water-dependent. Besides human consumption and productive uses, water fulfills a series of environmental functions that are important for society's welfare. Water is essential to preserve the ecosystem and its associated biodiversity; it maintains energy balances and the normal functioning of biogeochemical cycles. Additionally, the importance of minimum water flows for ecological functions has increasingly become a priority in global water management strategies. However, ecological minimum water flows have to be identified based on an understanding of what adequate resilience will require (Falkenmark, 2003).

Water is also important for a series of recreational uses which provides society with increases in welfare through leisure. These recreational functions are also relevant for tourism in different areas. In this respect, Spulber and Sabbaghi (1998) state that over the past few decades, greater attention has been given to the use of water for recreational activities as a result of industrialization and urban development and the growing need for outdoor recreational activities.

Therefore, water presents important non-use values (Gibbons, 1987).

Reduced water quantity and quality have serious negative impacts on ecosystems. The environment has a natural absorptive, self-cleansing capacity; however, if this is exceeded, biodiversity is lost, livelihoods are affected, na-

tural food sources are damaged and high clean-up costs result. Unesco (2003) points out that increased environmental damage has led to a greater occurrence of natural disasters, such as floods where deforestation and soil erosion have prevented natural water attenuation. More specifically, between 1991 and 2000 over 665,000 people died in 2,557 natural disasters— 90% of which were water-related and 97% of the victims were from developing countries. Based on this marked increase, Hideaki (2005) proposes that the target to halve human loss due to water disasters by 2015 be added to the MDGs.

Additionally, unsustainable agricultural activities such as the draining of wetlands for agriculture and land clearance, among others, lead to significant negative impacts on the future availability of water (Unesco, 2003). The reduction and degradation of natural water courses due to deforestation and over-extraction of water have put many wetlands and marine ecosystems at risk. Therefore, ecosystem health, in turn, is critical to the quantity and quality of freshwater supply and, thus, sustainable water resources management requires ecosystem-based management. IWRM Plans do not regard the ecosystem as a user of water in competition with other users, but as the base from which the resource is derived and upon which development is planned (Jewitt, 2001).

Furthermore, water quality is an aspect of freshwater availability that also has a major impact on environmental sustainability (see e.g. Lenton *et al.,* 2005). Water quality currently represents a significant problem in several countries created or aggravated by anthropogenic causes, such as pollution discharges into surface water bodies and leaching of contaminants into underground water sources. Adequate treatment and disposal of waste contributes to reduce the pressure of freshwater resources. Therefore, improved water quality management is a key factor in maintaining ecosystems integrity.

MDG 8. Develop a global partnership for development

The final MDG captures the fact that development and the achievement of the MDGs requires countries to work together closely at both the regional and international levels to address a wide range of issues. Water must be taken into account when addressing all of the targets of this goal. For example, target 12 includes a commitment to good governance, development, and poverty reduction, both nationally and internationally and, poverty reduction strategies (such as those developed under the Heavily Indebted Poor Countries [HIPC] Initiative) are clearly linked to water management.

As pointed out previously, the achievement of all MDGs requires the implementation of integrated water resources management (IWRM). Progress in the implementation of IWRM plans requires partnerships to produce cohesive and usable research and policy recommendations, and to analyze different countries' experiences in the implementation of IWRMs. These partnerships allow for the identification of regional actions or frameworks that can assist countries in the development and implementation of IWRM Plans.

Integrated water resources management and its contribution towards achieving the MDGs

The interface of water resources and development and the achievement of the MDGs is complex and includes many specific linkages. Examples of the linkages between water and achieving the MDGs are emphasized in the previous section. This wide array of important linkages that present many synergies, explains why pursuing each goal separately reduces the complex process of human and economic development to a series of conflicting, and unsustainable interventions. In addition, the interface

of water resources and the achievement of the MDGs occurs at several different institutional levels, explaining why water resource policies in many countries have evolved in a fragmented and piecemeal fashion. Under this framework, policy objectives have been set without consideration of the implications for other water users and without consultation across sectoral and institutional boundaries. This traditional approach to water management has, in general, proven to be an ineffective policy strategy due to the fact that these problems fall outside of the normal purview of the agencies tasked with addressing them and, thus, require cooperation from multiple sectors. In order to optimize water resources for development and the MDGs, countries must overcome constraints through appropriate investments and management arrangements within broad planning and policy iniciatives.

Saleth and Dinar (1999, 2004) also emphasize that institutional changes are needed to improve water management since previous institutions were developed during a water surplus era. Moreover, as Global Water Partnership (2000) points out, water management is usually left to top-down institutions, the legitimacy and effectiveness of which have increasingly been questioned. However, it is important to highlight that the effectiveness of these sectoral improvements will be affected by the country's institutional and macroeconomic environment since many of these reforms depend on economic, ecological, and political constraints (Saleth and Dinar, 2004) and reflect the fact that institutional reform is path dependent (North, 1990).

An IWRM approach, defined as a process that "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" (Global Water Partnership website), provides an opportunity to attack these problems more effectively, identifying root causes and solutions that lie outside of any one specific sectoral area and focusing on investment as well as management issues. IWRM is not a reform whose objective is just to achieve a more efficient management of water as a resource, it considers reforms whose objectives are to improve governance and financial systems at all levels, in order to meet each country's development goals.

Thus, an IWRM approach considers the diverse linkages between water resources and the achievement of the MDGs, ensuring that investments across sectors work together, producing greater returns by exploiting the synergies between the linkages. In addition, the involvement of multiple sectors highlights opportunities that are often hidden by sectoral thinking. For example, examining domestic water and sanitation needs along with food security issues generates opportunities to provide communities with water for domestic and food production purposes at a lower additional cost compared with traditional water planning approaches (Global Water Partnership, 2004a). IWRM also helps reduce the negative consequences of undesired environmental impacts associated with water development and the costs associated to the environmental damage. For example, the annual cost of mitigating the effects of land and water degradation in Asia associated to water development strategies has been estimated at US$35 billion (Global Water Partnership, 2004a). Finally, since IWRM considers in an integrated manner social, economic and environmental goals, it promotes a more strategic and socially efficient water allocation than traditional approaches driven individual sectors interests. The UN Task Force on water and sanitation, based on the advantages of IWRM, is convinced the MDGs as a whole will not be met unless an IWRM Plan, which considers deliberate planning and investment

in sound water resources management and infrastructure, is implemented (Lenton, 2005).

Lenton *et al.* (2005) remark that IWRM builds on three basic pillars: (i) an enabling environment of proper water resources policies and legislation; (ii) an institutional framework of capable institutions at national, local, and river basin levels; and (iii) a set of management instruments for these institutions. Thus, IWRM allows for a more coordinated decision making process across sectors and scales.

Hence, as Global Water Partnership (2000, 2004a) indicates, implementing an IWRM Plan is significantly different from the traditional approach used to develop water plans. Firstly, an IWRM Plan lays down a framework for a continuing and adaptive process of strategic and coordinated action and, thus, is dynamic rather than static. Secondly, implementing an IWRM Plan requires the involvement from multiple sectors. Traditional water plans tend to be concerned exclusively with water supply and demand issues; however, an IWRM Plan looks at water in relation to other ingredients needed to achieve economic development and the MDGs. Lastly, since an IWRM Plan allows for a coordinated decision making process across sectors and scales, it requires more extensive stakeholder participation than traditional approaches.

To stimulate the adoption of this more strategic and sustainable approach to water resources management, one of the main directives of the 2002 World Summit on Sustainable Development (WSSD) called for all countries to develop IWRM Plans by the end of 2005. Global Water Partnership (2004b), in October 2003, conducted a baseline survey on the status of the implementation of IWRM Plans in the various countries of the world. The results of this baseline survey are not very promising; the majority of the surveyed countries (47%) present some steps towards the implementation of IWRM Plans while 40% are at the initial stages of IWRM Plan implementation. Of the total number of countries, only approximately 13% (14 countries) have made good progress in the implementation of IWRM Plans.

In Asia, Malaysia is one of the countries that presented some steps towards IWRM Plan implementation (Global Water Partnership, 2004b). The incentive to move towards a more integrated approach, besides the WSSD directive, was inspired by the urgent need to control flooding and pollution, to protect valuable ecosystems, and to achieve a more effective allocation of water to minimize water use conflicts and to encourage economic growth. At the time of the survey, there were no approved policies with regards to applicable IWRM both at the Federal and State level. Additionally, national level awareness regarding IWRM had not been extended to state, district and local levels; many decision makers in implementing agencies maintained a sectoral and fragmented approach towards water resources planning and development (Global Water Partnership, 2004b). Thus, the advances had not involved the multiple scales necessary for coordinated decision making processes.

The growing recognition of the need to implement IWRM Plans has led to increased stakeholder participation; the creation of a National Water Resources Council that integrates different sectors and decision making scales; the development of national water plans and river basin plans; and the creation, in 2004, of the Ministry of Natural Resources and Environment. A catalyst for the change that has been evidenced is a clear shift from water policies based on supply management towards demand management and the recognition that water represents and economic good (Keizrul, 2005). Thus, contrary to the situation present at the end of 2003, Malaysia today presents evidence of good progress towards the implementation of IWRM Plans.

In October 2003, three Latin American Countries – Costa Rica, Nicaragua and Brazil – presented good progress towards the implementation of IWRM Plans (Global Water Partnership, 2004b). The high cost of flooding, continuing conflicts between water users, and degradation of forests and coastal ecosystems, which threatened Costa Rica's tourist economy, prompted the country to accept the WSSD directive and search for new solutions and adopt the necessary actions in order to implement an IWRM approach.

The stepping stone for Costa Rica's progress in the implementation of IWRM Plans is the development of the National Water Strategy as of 2004, made possible through IADB funding (Global Water Partnership, 2004b; Villalta, 2005).

The National Water Strategy is based on three strategic pillars that establish that the strategy must a) support economic development, social welfare and environmental conditions; b) strengthen water institutionality and secure financial sustainability; and c) incorporate new water policy instruments so as to modernize the instrumental framework.

For each of these strategic pillars Costa Rica authorities defined a specific set of actions.

The main lessons learned from the progress made in developing and implementing IWRM Plans in Costa Rica and Malaysia, as well as the progress of other countries (see e.g. Biswas and Tortajada, 2001; Global Water Partnership, 2004b), indicate that the key actions to ensure significant advances are:

1. increase the awareness of both the political leadership and the society at large about the urgent need to move towards IWRM so as to involve stakeholders;
2. identify the key decision makers and involve them in the process;
3. create a conducive environment for change informing stakeholders that all countries are called to develop IWRM Plans and, thus, they are not alone;
4. build stakeholder partnerships by choosing key partners, creating a cadre of advocates and through capacity building actions;
5. conduct a water resources assessment with a holistic view;
6. agree on goals and targets through a participatory process;
7. set a timetable with clear milestones and targets;
8. constitute strategic global partnerships in order to secure sustainable funding for the change process, that allows for the allocation of sufficient human and financial resources;
9. establish a monitoring and evaluation mechanism that allows for feedback into the process;
10. work with the media to constantly inform society of the advances and short term wins so that society at large maintains its motivation towards the change process; and
11. implement efficient negotiation and conflict management since it will not be able to please everyone.

In summary, in order to advance towards the implementation of IWRM Plans, it is necessary to manage the change process. It is equally important to incorporate water into current national development strategies; that is, water resources must be recognized by policy makers and society as a driving force for development and the achievement of the MDGs.

It is important to highlight, however, that there are no universal models that can be implemented. The specific solution and necessary action plan is country specific. In addition, the experience indicates that IWRM Plans can be developed from scratch or be built on existing

water plans. However, independent of the initial approach, it is clear that the strategies must go beyond the actions needed to solve current problems or to achieve immediate objectives; the implemented strategies should aim at promoting more strategic and coordinated decision-making on a dynamic basis so as to advance towards the development and implement of IWRM Plans (Global Water Partnership, 2004a).

CONCLUDING REMARKS

Sound water resources development and management underpins the attainment of all of the MDGs. In fact, for each of them, water plays a key rol, since it is crucial to all forms of social and economic development and a necessity for nature's processes. Thus, countries must develop and implement coherent water resources development and management strategies that support the achievement of all MDGs.

In order to achieve the MDGs, local and international policy makers and government authorities must design and implement innovative and bold development and poverty reduction strategies. These strategies must take into account not only the intricated effects that water resources management have on poverty alleviation, educational attainment, gender equality, people health, environmental sustainability and economic development, but also the synergies and tradeoffs among the MGDs' interlinkages.

An IWRM plan is crucial in the quest to me*et al*l MDGs. The achievement of the MDGs requires undertaking multi-objective and multi-sectoral development strategies and the IWRM plan provides a way to organize the countries' efforts. In particular, an IWRM plan includes actions related to community and environmental planning, policy and regulation design, economic instrument implementation, information and communication policies execution, and institutional and social adjustments, among others issues.

As discussed previously, in order to develop and implement an IWRM plan, government authorities, policy makers and the society at large must be aware and convinced that better water management practices are in order. This awareness and convincement will make possible the equitable and sustainable development achievement. Another important element to successfully implement an IWRM plan includes the involvement in a organized and participatory way of all stakeholders who are concerned about water resources' use in its management, to conform local and global partnerships in order to ensure sustainable funding for the change process, to design effective negotiation and conflict management strategies, and to work with the media to keep society informed and motivated.

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