A Need for Hydroinformatics for the Water Resource Management in Mauritius

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Abstract

With the ever changing climatic conditions, it is imperative that the water sector of small island states rethinks their strategies and start to lay more and more emphasis on the importance of hydroinformatics. There is need for proper knowledge management in the water sector and this paper attempts to highlight the importance of hydroinformatics in the water sector of Mauritius.

Keywords: hydroinformatics, water, management, strategy, Mauritius.

**For correspondences and reprints*

INTRODUCTION

Water is the most valuable resource on earth. It is an essential utility for enhancing socio-economic development and for supporting the ecosystem. During the last three decades, there has been a rapid growth in demography coupled with an accelerated socio-economic development in various countries, which have led to a substantial increase in water demands, by all stakeholders (Ball, 2006).

This situation has meant that various challenges have had to be met. As such water authorities have placed much emphasis on the development and supply augmentation aspects of water resources management. To satisfy the demands, the focus has been geared towards development of groundwater, installation of desalination plants as well as investment in the sector of wastewater treatment and reuse. Furthermore efforts have been concentrated on dams construction to collect, store, and utilize runoff (El Fadel & Ala, 2005).

The optimal management of water resources warrants that appropriate mechanisms be put in place as well as use of efficient tools to ensure that countries have adequate water supplies. It is therefore essential to come to terms with the fact that water is a scarce commodity and its depletion will have a direct impact upon economic efficiency, social equity, and environmental sustainability around the world. Safe and efficient water resources management depends and will only be achieved through an integrated, cross-sector approach (Ball, 2006).

Efficient and sustainable use of water warrant adequate data and understanding of resources, safe design and operation of hydraulic systems, and a rationale conflict management of riparian rights (Rabinski and Kim, 2006).

According to the WHO, some 460 million people - more than 8% of the world's population - live in countries using so much of their freshwater resources that they can be considered highly water stressed. A further 25% of the population lives in countries approaching a position of serious water stress (2nd United Nations World Water Development Report, 2006).

The ever-changing demography profile compounded with growing water demands are being projected to many countries. By 2050, the number of countries facing water stress or scarcity could rise to 54, with their combined population being 4 billion people - about 40% of the projected global population of 9.4 billion. For African countries, with a population of nearly 200 million people, the threats of being faced with serious water shortages is becoming more and more of a reality (Ruger and Kim,2006).

Water scarcity will definitely have profound environmental and social implications. These will include the degradation of freshwater ecosystems and the loss of the goods and services these ecosystems provide, such as drinking water and biodiversity (2nd United Nations World Water Development Report, 2006).

In view of the situation development agencies, national planners, and policy-makers often need baseline information to address water resource problems.

There is also increasing need for this information from policy makers, water resource managers, NGOs, and the private sector, who are struggling to allocate water to competitive uses, while maintaining functioning ecosystems. However, this information, when it exists, is dispersed among different agencies, not standardized, and usually unavailable to a broad range of stakeholders.

It is therefore evident that the problems of water scarcity as well as serious environmental deterioration in many countries have resulted in growing interest in concepts of sustainable development in water resources planning and management. Furthermore there is agreement that there should be an integrated approach to ensure proper management of optimal use of water resources (Yashui *et al.,* 2006).

The problems of water scarcity and general environmental deterioration in many countries in Asia have resulted in growing interest in concepts of sustainable development in water resources planning and management. In addition, it has been generally accepted that only through an integrated approach to managementcan the use of water resources by different users be optimized. What is more, there is an increasing awareness that better management depends on the way in which information on the aquatic environment,and particularly on urban water based assets, is acquired, analyzed and disseminated. There are important and new hydroinformatics tools and systems becoming available, which facilitate the generation and flow of information in improving the management of such assets as urban water supply and drainage systems (Wolf and Picioreanu, 2007).

The above situation thus warrants a better management that will depend heavily on the way in which information on water-based assets is acquired, analyzed and disseminated especially for small island states such as Mauritius through the use of hydroinformatics.

Hydroinformatics considers water systems from an information point-of-view. Yet very often reference is made to the importance of data and knowledge, Hydroinformatics, planning and management tools thus constitute a critical entity for stakeholders in the water sectors. Such tools will be decisive and also facilitate management of data bases, decision support systems, as well as information management systems, As such monitoring, data acquisition and management using proper hydroinformatics tools will provide the water sector operator(s) with well defined indicators for water resources management and development.

Overview of the water sector in Mauritius

The Central Water Authority (CWA) is a parastatal body and is the apex technical organization in the country for development of water resources. The CWA operates under the aegis of the Ministry of Public Utilities. The CWA is responsible for initiating, coordinating and furthering, in consultation with the State Governments, the schemes for control, conservation, development and utilization of water resources throughout the country. The Act of the CWA stipulates that the Authority is the sole institution mandated for the control, development and conservation of water resources and for the treatment as well as the distribution of potable water to domestic, industrial and commercial consumers (CWA, 2004).

Currently the CWA supplies around 500,000 cubic metres of potable water daily. Of the average daily distribution, 22 % is supplied to non-domestic consumers which include industry, institutions and commercial enterprises whilst the domestic consumers are supplied with 78% of the water.

The water distribution is administratively structured so as to be able to deliver water to six main operational districts.

In line with its mission plan, the CWA has invested massively for the development of potable water supply infrastructures. Such investment goes mainly towards ensuring that water is able to be mobilized from the ground water surface to the surface sources. Furthermore there has been an extension of the distribution network. However this entails increase in water leaks and as such posing a burden in terms of non-revenue due to unaccounted water. As part of its strategy plan, the CWA has laid much emphasis upon reducing Non-Revenue Water (NRW) from 46% to an acceptable 20 - 25 % level throughout the island within reasonable timeframes. The concept of telemetry also forms part of the strategic plan of the CWA. The successful implementation of telemetry technology will ensure automatic measurement and transmission of data by various communication tools such as wire, radio, or other means from remote sources as from space vehicles, to receiving stations for recording and analyses. Such technology will be an important source of incontrovertible empirical balance to counter water distribution controversies and complaints. Adopting appropriate telemetry system will be a positive development in the local context. Telemetry technology will also ensure that water management in Mauritius makes a significant transition from the manual system to a state of art contemporary monitoring of water distribution.

Already there is concern as to the capacity of the CWA to meet the on-growing demand for water. Mauritius being a tourist resort, the water demand will keep on rising. It is expected that 2 million tourists will visit the island by the year 2015 and with the Mauritian population presently around 1.3 million and on the rise, the pressure on the water sector is enormous with new challenges in sight for ensure sustainable development in relevant sectors.

In summary, the distribution system of potable water island-wide will thus depend upon a sound holistic approach to ensure maximum storage capacity as well as the optimum use of water.

DISCUSSION

Hydroinformatics is a branch of information technology which concentrates on the application of information and communication technology (ICTs). This new discipline has an important role in the management of knowledge in the water sector the more so towards addressing the ever increasing problems towards ensuring equitable and efficient use of water for different activities.

The management of knowledge for an organization requires an approach which goes beyond Plato's (427-367 BC) original definition of knowledge as 'justified true belief'. The modern approach to knowledge management should be based upon the notion of the strategic and systematic acquisition as well as the application and dissemination of existing and created knowledge. It is therefore imperative that in the modern age of technology the need to bring together appropriate information and communication technologies (ICT) within the context of suitable methodologies with the creative and innovative capacities of human beings.

Addressing the immense challenges associated with water resources management require daring reforms to existing institutions and policies governing water resources. Far reaching and multi-sartorial approaches will be critical if we are to overcome inefficient use of water resources and make their use sustainable. This will require the establishment of a proper enabling environment that ensures the rights of users and provides the appropriate level of protection for the resource. Policies, legislation, establishment of governing bodies at various levels and knowledge management are all part of ensuring that such objectives of IWRM are met.

There are warning signs that our water supplies are limited both in quantity and quality. The threat is further compounded by the forces of population growth, urbanization and increased water demands for home, industry and agriculture, coupled with an increasingly global economy and culture. These factors will produce in the future spreading, perilous degradation of water quality everywhere, and a continuously widening gap between water needs and the availability of useful water in all too many locations. As a solution a rethinking of strategies is warranted. There is need for to adopt various strategies including: 1) management across political boundaries, 2) optimal and integrated collective management of atmospheric water, surface waters and groundwater, and 3) the proper management of water quality and water quantity.

Currently, in Mauritius, groundwater resources are being heavily exploited to meet water demands especially during the dry season. Among many developing countries, unplanned groundwater mining continues without a clear "exit" strategy. To meet domestic water supply requirement, GCC countries have turned to desalination and have become collectively the world leaders in desalination, with more than 50% of the world capacity. However, desalination remains capital intensive and costly. In terms of wastewater recycling, available treated wastewaters are still not being reused to their potential; planning for full utilization of treated effluent are in the early stages.

The development of quantitative correlations between population settlement patterns and potable water quality will require the integration of: (i) a proper description and definition of remote sensing and geostatistics, (ii) modeling and trend analysis, (iii) selection of water quality indicators as well as water quality data and sensing surface water fluxes to assess the vulnerability of potable water supplies. The use of spatially referenced data to inform uncertainty-based dynamic models to rank watershed-specific stressors and receptors is essential. This will help to guide researchers and policymakers in the development of targeted sensing and monitoring technologies, as well as tailored control measures for risk mitigation of potable water from microbial and chemical environmental contamination. The enabling technologies will encompass amongst others geostatistical integration of monitoring data and geographic information systems (GIS) layers and systems analysis of microbial and chemical proliferation in distribution systems.

As such the implementation of information technology-based monitoring infrastructure development, integration of processes and spatial analysis will undoubtedly maximize economic and public health benefits and would thus have a positive impact on the management of water for Mauritius. A holistic strategy towards the implementation of hydroinformatics in the potable water sector will definitely impact upon the operational framework.

In conclusion an interactive framework for quantitative analysis of the coupling between human and natural systems requires integrating information derived from online and offline point measurements with GIS - based remote sensing imagery analysis is a *sine qua none* for emerging economies with limited financial resources is substantial for proper management and distribution of water to all stakeholders.

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