Muhammad Qumrul Hassan
University of Dhaka, Department of Geology, Ramna, Dhaka, 1000, Bangladesh.
Mir F. Karim
Geocomp Corporation, Geotesting Express Inc., 125, Nagog Park, Acton, MA 01720, USA
Nazrul I. Khandaker
Earth and Physical Sciences, York College (CUNY), Geology Discipline, 94-20 Guy R. Brewer Blvd, Jamaica, NY 11451, USA.
Jowaher Raza
University of Dhaka, Department of Geology, Ramna, Dhaka, 1000, Bangladesh.

Geological Society of America Abstracts with Programs. Vol. 50, No. 6, ISSN 0016-7592. doi: 10.1130/abs/2018AM-321139 https://gsa.confex.com/gsa/2018AM/meetingapp.cgi/Paper/321139

AN OVERVIEW OF SMARTWATER MANAGEMENT SYSTEM: STRATEGIC POTENTIAL IN BANGLADESH

Abstract

Water loss management is becoming an increasingly important as supplies are stressed by population growth or water scarcity. A SmartWater system ensures optimum consumption and prediction of future water use. Bangladesh is one of the most vulnerable countries due to global climate change considering its rapid urbanization, unequitable land use, low income and greater reliance on climate sensitive sectors, particularly agriculture. Agricultural lands used for cropping and livestock rearing are more susceptible to degradation than non-agricultural lands. Most farmers irrigate through flooding, losing up to 75% of water to evaporation and creating a substantial drawdown of much needed water for the sustainability of seasonal crops. As a result, these traditional irrigation systems take four times the water they need to produce one ton of grain. In order to achieve a comprehensive SmartWater network solution, water systems require measurement and installation of sensing devices (Smart meters, sensors, and actuators), real-time communication channels, basic data management software, real-time data analysis and modeling software, and automation and control tools to conduct network management tasks remotely and automatically. Presently, the usable water quality and amount is constrained due to surficial contamination that takes places from various sources including anthropogenic reasons. Contemplation of any new or upgrading existing facilities for agricultural and urban needs, local Water Budget estimation should be taken into account and expanded to accommodate regional needs. To ensure an overall quality of water involving every sector, application of SmartWater Management warrants greater attention before initiating any new plan or upgrading facilities. Furthermore, an effective implementation of SmartWater concept should incorporate a comprehensive management structure at regional or city level, based on sustainability and self-reliance by adopting more intelligent solutions and technologies. It should also consider water recycling, water treatment technologies, and monitoring on regular bases.

A water stress ranking project to quantify the impacts of potential future climate and socio-economic changes on water resources projected that by 2040 under Business-as-Usual Scenario many countries will have very significant regional variations in water demand and supply that may be over- or underrepresented when aggregated to the national level (Luo et.al. 2015). The weighted aggregation methodology ranked Bangladesh 139, with all sectors water stress level at 0.32 and agricultural stress also at 32.

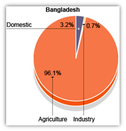
Bangladesh is one of the most vulnerable countries to climate change because of geographic exposure, low income and greater reliance on climate sensitive sectors, particularly agriculture. Almost 85% of rural population is directly or indirectly involved in agriculture. Agricultural crops are influenced by seasonal characteristics and different variables of climate such as temperature, rainfall, humidity, day-length etc.

It is urgent that a proper and effective smart water system (SWS) is established. SWS will help in managing end-to-end distribution, from reservoirs to pumping stations to smart pipes to holding tanks to intelligent metering at the user site. Intelligent water solutions will help usage and re-usage of water. It will also help us to accurately monitor, assess and forecast the availability, condition and use of water.

A smart water system ensures that the consumption and forecasting of water use is accurate. Monitoring and managing technologies can assist for optimizing the availability, delivery, use, and quality of water as well as related systems including energy and treatment. Water loss management is becoming increasingly important as supplies are stressed by population growth or water scarcity. Many regions are experiencing record droughts, and others are depleting aquifers faster than they are being replenished.

Composition of the water footprint for Bangladesh during 1997—2001
Modified after Chapagain and Hoekstra (2004)

Population			X1000	12,9942
Use of Domestic Water Resources	Domestic water withdrawal		Gm^3/yr	2.12
	Crop Evapotranspiration	For national consumption	Gm^3/yr	109,98
		For export	Gm^3/yr	1.38
	Industrial Water Withdrawal	For national consumption	Gm^3/yr	0.344
		For export	Gm^3/yr	0.08
Use of Foreign Water Resources	For National Consumption	Agricultural Goods	Gm^3/yr	3.71
		Industrial Goods	Gm^3/yr	0.34
	For re-export of imported products		Gm^3/yr	0.13
Water Footprint	Total		Gm^3/yr	116.49
	Per Capita		$M^3/cap/yr$	896
Water Footprint by Consumption Category	Domestic Waver	Internal Water Footprint	$M^3/cap/yr$	16
	Agricultural Goods	Internal Water Footprint	$M^3/cap/yr$	846
		External Water Footprint	$M^3/cap/yr$	29
	Industrial Goods	Internal Water Footprint	$M^3/cap/yr$	3
		External water footprint	$M^3/cap/yr$	3



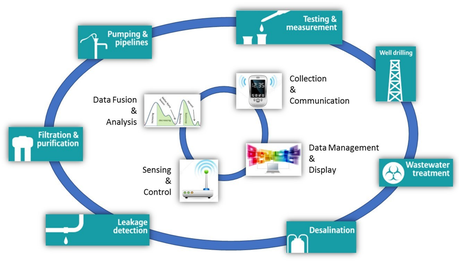
Bangladesh has a high population density, 2 million added annually. Poverty has been successfully reduced from 38.7% (2005) to 31.5% (2010). Food security is of utmost importance with decreasing cultivable area - small and marginal farms are dominating, while medium and large farms are declining. Increasing water scarcity is threatening the sustainability of rice production, let alone the ability to increase production in pace with demand as a result of population increase. However, merely reducing water use for rice by a small percentage can free up large volumes of this vital resource for increasing rice production and other uses.

CASE STUDY

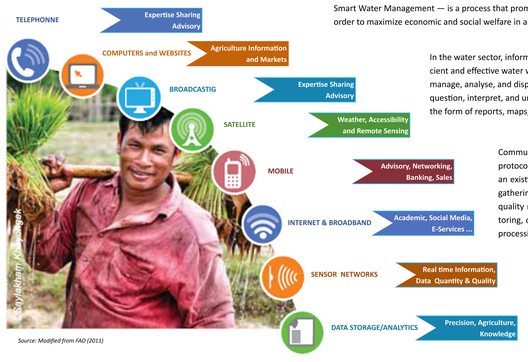
Growing rice with less water

Direct seeding of rice	less labor is needed and water use can be reduced by up to 30 percent.
Modified System of Rice Intensification (MSRI)	reduces labor demand due to improved mechanization. improves water utilization by about 10-15 percent.
Alternate Wetting and Drying	increases aeration to the plant roots and improves nutrient supply.

What & How Can it be done



Smart Water Management — is a process that promotes a coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.



Source: Modified from FAO (2011)

In the water sector, information system and knowledge management are recognized as important attributes for efficient and effective water works. GIS: technology that integrates hardware, software, and data required to capture, manage, analyse, and display all forms of geographically referenced information. GIS allows the user to view, visualize, question, interpret, and understand data in different circumstances that clarify patterns, trends, and relationships in the form of reports, maps, and charts.

Communication Infrastructure: Traditional water management systems mainly depend on protocols, industrial control systems, and adopted registered structures. Opportunity to adopt an existing infrastructure into a more flexible IP-based monitoring system will improve alarm gathering, leakage detection and prevention, demand prediction, energy reduction, water quality monitoring, and billing activities. The system control unit performs centralized monitoring, control long distance communication network including monitoring the status of data processing and alarms.

Smart Metering (SM): Meters and sensors are currently being intensively applied to regulate different activities of water distribution systems such as hydraulic pressure and flow, water quality, head losses, and water and energy consumptions. SM ensures prompt, reliable, and information-secured water metered information to avoid any potential damages, foresee expected disasters, detect leakages and provide accountability. SM influences real-time decision making at the measurement and monitoring location.

Conclusion

The production, processing, and marketing of agricultural goods are central to food security and economic growth. The overall efficiency, resilience, adaptive capacity and mitigation potential of the production systems can be enhanced through improving its various components. The expansion of efficient management technologies and methods, especially those relevant to local users is fundamental. Studies have shown that improved water usage techniques increase farmers' income by 17% in Vietnam, 32% in the Philippines and 38% in Bangladesh. Only 38% less water causes significant changes to crop management.

Controlled use of groundwater for Irrigation in Barind Tract , SW Bangladesh.

References

- *Chapagain, A. K. and Hoekstra, A. Y. (2004) Water foot prints of Nations. Main Report Volume 1 Research Report Series No. 16, Value of Water, UNESCO-IHE.*
- *Mallick, D., Amin, A. and Rahmon, A. (2012) Climate Compatible Development (CCD) in Agriculture for Food Security in Bangladesh. Report for the project: Advancing Climate Compatible Development for Food Security through the Implementation of National Climate Change Strategies by BCAS. publication funded by The Climate and Development Knowledge Network*
- *Mandal, M. (2011) Design and Implementation of Agriculture and Food Security Strategies: Reflections on Bangladesh Experience. Presented at the International Workshop and Conference on 'Knowledge, Tools and Lessons for Informing the Design and Implementation of Food security Strategies' held in Kathmandu, Nepal, 14-16 November 2011*
- *Luo, T., Young, R., and Reig, P. (2015) Aqueduct Projected Water Stress Country Rankings, Technical Note, World Resources Institute.*
- *FAO (2011) Climate change, water and food security. FAO publications 36. Food and Agriculture Organization of the United Nations Viale delle Terme di Caracalla 00100 Rome, Italy*