Application of Information Technology in Sustainable Management of Aquatic Resources

Debdyuti Datta[1], K.S. Das[2] and S.K. Mondal[3]*

Abstract: *Water is a basic human need, a supreme natural resource; hence sustainable management of aquatic resources needs to be governed by national perspectives. Every citizen should be aware that today's water related challenges can't be resolved just by using last century's hydraulic schemes. Groundwater resources can help in overcoming climate variability and meeting needs during extremely dry weather. However there is a huge lack of adequate data on groundwater. We need adequate amount of knowledge about the impacts on water quality and quantity from pollution and excessive ground water and surfacewater withdrawals. Regular Water Resource Assessment needs to be done in all aquifers and water basins regionally and also in whole nations in order to gain social, economic and environmental benefits.*

In today's world it is a necessity to develop an interlinked geospatial framework for underground as well as surface water resources. Development of such web oriented water resource management needs a leadership and management support, technical structure, collecting and compiling water resource data, creation and maintenance of regional water data portals etc. Aquatic resource information integrated with Google, satellite and web GIS will support to plan, manage, design and integrate more efficiently the water resource systems. With the help of Software Engineering and Database Management System we can develop an Information system that can link population, ground water, other water resources, processed water and water supply amount. This system needs to be developed state wise as well as nation wise. By this software system daily water consumption assessment needs to be done. There should be some kind of alertsystem by which threshold crossing moment can be detected and eliminated efficiently. Now-a-days internet is everywhere. We can use social media and World Wide Web (WWW) to spread awareness among the common citizens on scarcity of aquatic resources and aquatic resource management.

In this world inland aquatic resources of developing regions are of great importance in terms of economic growth and food security. Water quality, quantity and temperature are essential elements for all living aquatic resources, fisheries and development of aquaculture. As day by day the amount of freshwater in this World is decreasing, the lives of various aquatic species, floras and faunas are in danger. This is time to keep an eye on this. It is necessary to develop data and tools to analyze the sustained utilization of inland aquatic resources. For this we basically need proper and updated information about the aquatic species that lives in various freshwater as well as natural water parks. We have to gather more accurate data on this, so that we can help them live longer and also to figure out endangered aquatic species. For better management of aquatic species we need a robust software, which will collect all the information and help in updating databases on various aquatic specie's, flora's and fauna's information. Geo-sensors can also help in this regards. These will give a positive direction not only in water technology areas but also on how updating data, information and assessment practices on aquatic resources will give us critical knowledge, which in turn benefit society, human livelihoods and our mother nature.

Key words: *ICT, Aquatic data, Aquaculture, Water resources.*

[1]   Young Professional-II, ICAR-Agricultural Technology Application Research Institute, Salt Lake, Kolkata.

[2]   Senior Scientist, ICAR-Agricultural Technology Application Research Institute, Salt Lake, Kolkata.

[3]   Principal Scientist, ICAR-Agricultural Technology Application Research Institute, Salt Lake, Kolkata.

*   Corresponding author. *E-mail: sk_mondal@yahoo.com*

INTRODUCTION

Water is a basic human need, a supreme natural resource including its contained living resources; hence sustainable management of water including aquatic resources needs to be dealt with national perspectives. There should be awareness that today's water related challenges can't be resolved just by using last century's outdated hydraulic schemes. Groundwater resources can help in overcoming climate variability and meeting needs during extremely dry weather. However, there is a huge lack of adequate data on groundwater. We need adequate amount of knowledge about the impacts on water quality and quantity from pollution and excessive ground water and surface water withdrawals. There is also need of adequate data on the aquatic life/living resources for their harvesting/utilization for human welfare.

Regular Water Resource Assessment alongwith assessing the aquatic resources needs to be done in all aquifers and water basins regionally and also in whole nations in order to gain social, economic and environmental benefits. To harvest these benefits, the use of modern information and communication technology is of utmost importance and a necessity. The application of such sophisticated technologies with proper amalgamation of computer science can go a long way in achieving this goal. Keeping this in view, here is an attempt to document and describe the various facets of applying information technology in sustainable management of water and aquatic resources.

WATER RESOURCES – AQUATIC LIFE

Water, the uses to which it is put and the impacts of those uses and other activitiesupon it, is central to the world development agenda.All human development targets relating to food require significant amounts of water. The growing demand for water for industries, agriculture, generation of hydropower,urban supply and navigation increases competition for this limited resource and often results in declining fisheries and limits to the expansion of aquaculture.

In this world, the aquatic resources of developing regions are of great importance in terms of economic growth and food security. Water quality, quantity and temperature are essential elements for all living aquatic resources, fisheries and development of aquaculture. As day by day the amount of freshwater in this World is decreasing, the lives of various aquatic species, floras and faunas are in danger. This is time to keep an eye on this. It is necessary to develop data and tools to analyze the sustained utilization of inland aquatic resources. For this we basically need proper and updated information about the aquatic species that lives in various freshwater as well as natural water parks. We have to gather more accurate data on this, so that we can help them live longer and also to figure out endangered aquatic species.

For better management of aquatic species we need a robust software, which will collect all the information and help in updating databases on various aquatic specie's, flora's and fauna's information. Geo-sensors can also help in this regards. These will give a positive direction not only in water technology areas but also on how updating data, information and assessment practices on aquatic resources will give us critical knowledge, which in turn benefit society, human livelihoods and our mother nature.

Aquatic resources in various regions around the world are of immensesignificance in terms of food security as well as economic growth and the alleviation ofpoverty. Aquaculture plays an increasingly important role in the global economy andfisheries contribute significantly to poverty alleviation, food security and recreation. However, ever-increasing demand for fish products makes it difficult to maintain thebalance between supply and sustainable production.

In addition to pressure resultingfrom the need to increase the exploitation of aquatic resources, the sustainable useof inland water resources is often put at risk from other human activities such asdeforestation, dam-building, navigation, urbanization, water extraction, pollution andwaste disposal, and the related loss of wetland habitat to arable land. Therefore, themulti-purpose nature of inland water use creates a very distinct set of challenges forresponsible development and management, and hence the promotion of water, foodand environmental security.

INFORMATION TECHNOLOGY TOOLS AND THEIR APPLICATION

Information technology (IT) has emerged as an immensely potential area to change the world agriculture in general and the aquaculture in particular by providing relevant information and services at the time when it is needed the most.With integrated use of various IT tools like Google, GIS, GPS, remote sensing, satellite imagery, internet and intranet etc., we can develop an Information system by judicious application of the disciplines like Software Engineering and Database Management System.It is evident now that the information technology would find broad applications in managing water and aquatic resources including both inlandfisheries and integrated natural resources management by providing managers withtools and data to assess potential impacts of various management alternatives.Some of the specific applications and benefits from the use of these technologies are illustrated in the aspects like

(a) surface waterbodiesinventory;

(b) inventory of fisheries habitats and fisheries productivities;

(c) predictingpotential fish yield;

(d) preliminary hydrological reporting;

(e) invasive and introducedaquatic species; and

(f) production of simple map graphical outputs and base mapping.

The overall aim is to set out some of the issues in aquaticresource management and demonstrate the benefits of using the IT tools to resolve them.

SUSTAINABLE MANAGEMENT OF AQUATIC RESOURCES

For outlining a strategic management of water and aquatic resources for their sustainable use in Indian and/or global context, it is of utmost importance that various dimensions of utilizing these resources are specifically identified. The sustainable management of waterand aquatic resources basically encompasses the restoration/maintenance of water quality and quantity to support the living beings in it as well as to ensure balancing of the biotic and abiotic components of ecosystem in general and

agriculture in particular. While concerns are mounting over the diverse water use in agriculture, the importance of it in maintaining aquatic life resource is also another aspect when managing of this valuable resource sustainably is considered. Most important aspect of agriculture related water in fisheries.

Fisheries are significantly impacted by many alternative uses of river and lake basinresources including: power generation, flood control, navigation, domestic use,agriculture, forestry, industry, mining, water transfers and wildlife conservation. Given this multitude of uses, it should be recognized that inlandaquatic ecosystems and the organisms they support are among the most vulnerable natural systems on the planet. This factor is of particular importance when it is further recognized that almost all natural and human activities taking place within a basinaffect the quality and quantity of the water and of the overall hydrological system.

LINKING IT WITH AQUATIC RESOURCE MANAGEMENT

It is necessary to develop data and tools to analyze the sustained utilization of inland aquatic resources. For this we basically need proper and updated information about the aquatic species that lives in various freshwater as well as natural water parks. We have to gather more accurate data on this, so that we can help them live longer and also to figure out endangered aquatic species. For better management of aquatic species we need a robust software, which will collect all the information and help in updating databases on various aquatic specie's, flora's and fauna's information. Geo-sensors can also help in this regards. These will give a positive direction not only in water technology areas but also on how updating data, information and assessment practices on aquatic resources will give us critical knowledge, which in turn benefit society, human livelihoods and our mother nature.

In today's world it is a necessity to develop an interlinked geospatial framework for underground as well as surface water resources. Development of such web oriented water resource management needs a leadership and management support,

technical structure, collecting and compiling water resource data, creation and maintenance of regional water data portals etc. Aquatic resource information integrated with Google, satellite and web GIS will support to plan, manage, design and integrate more efficiently the water resource systems. With the help of Software Engineering and Database Management System we can develop an Information system that can link population, ground water, other water resources, processed water and water supply amount. This system needs to be developed state wise as well as nation wise. By this software system daily water consumption assessment needs to be done. There should be some kind of alert system by which threshold crossing moment can be detected and eliminated efficiently. Now-a-days internet is everywhere. We can use social media and World Wide Web (WWW) to spread awareness among the common citizens on scarcity of aquatic resources and aquatic resource management.

CONCLUSION

The importance of applying various IT tools in sustainable management of water and aquatic resources is enormous given the current world situation of timely and continuous need of information in this aspect. To sum up, the potential Information Technology provides a solid framework for water and aquatic resource management including inland fisheries and environmental information in both national and global perspectives.

One of the next steps should be to find ways to assist countriesto facilitate the organization of national level fisheries and environmental datacollection, storage, and the manipulation and analysis of data within a version of any designed management tool specifically modified for that purpose. Ultimately, aquatic resources will be sustained only by improvements intwo directions:

(i) better identification and spatial quantification of water quality andwater quantity needs; and

(ii) increasing co-operation and co-ordination with othersectors who share concerns for the quantity and quality of water.

GIS and such other applications provide a tool to help achieve both goals, by estimatingthe importance of each sector's share in ecological, economic and, eventually, politicalterms, and more importantly by identifying areas of overlapping concern and mutualbenefit.

References

Anon. (2007), Conservation of Wetlands in India: A Profile (Approach and Guidelines). Conservation Division-I, Ministry of Environment and Forests, Government of India, New Delhi.

UNESCO. (2006), Changing Natural Systems. The United Nations World Water Development Report 2. www.unesco.org/water/wwap/wwdr2/pdf/wwdr2_ch_4.pdf,Accessed on 26.05.2016.

Web source. (2016), Spatial analysis for inlandaquatic resources management. http://www.fao.org/docrep/010/a1170e/a1170e01.pdf,Accessed on 26.05.2016.