

## Information and Communication Technology (ICT) Applications in Water Resources Development and Management in India : A Tenth Plan Perspective & Prospective

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### Abstract

The search for socially desirable, economically viable, and ecologically sound pattern of resource use and ways of life, to promote sustainable development, has been going on, ever since its most popular exposition in the well known Brundtland Report entitled “**Our Common Future**” in 1987. Water is a prime natural resource, a basic human need and a precious national asset, and hence planning & development of water resources need to be governed by national perspectives. The National Water Policy (1987) has addressed to the issues related to develop, conserve, utilise and manage this important natural resource in this new millenium. The Hashim Committee Report (1999) dealt with various issues related to “**Integrated Water Resources Development Plan**” in the Country and warrants timely action in respect of : (i) harnessing of the surface flows through major, medium and minor storage, (ii) improving water-use efficiency, and (iii) taking necessary steps for demand & supply . The Nagpur Declaration (2000) on “Natural Resources Planning and Management for Sustainable Development” envisages that for integrated water resources planning and management, both “**river basins management**” at the macro level and “**watershed management**” at the micro level should mutually complement each other.

Emergence of Information Technology on the national agenda and the announcement of IT policies by various State Governments have recognised the “**Convergence of Core Technologies and E-Governance**” as the tool for sustainable development and globalisation of economy. The ongoing World Bank aided “**National Hydrology Information Network**”, thus, needs evaluation, in view of the emerging “**convergence & e-Governance**” paradigm in the Country. This Paper proposes that “**Information and Communication Technology (ICT) Applications in Water Resources Development and Management in India**” should be given adequate attention during the Tenth Plan , facilitating deployment of decision support systems (DSSs) at various levels of planning and management of Water Resources of the Country.

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## **Water Resources Development and Management in India**

1.0 India's achievements in development of its water resources ( .e. irrigation, flood control, hydro-power control, drinking water, industrial use, etc) have been remarkable, since independence. The successive Five Year Plans have witnessed a large number of projects comprising dams, barrages, hydro-power structures, canal networks, etc. Agriculture is the greatest user of water accounting for about 80% of all consumption. Both animal husbandry and fisheries also require abundant water. The Indian Agriculture contributes about 27% of GDP, provides employment to about 65% of the labour force, and accounts for 21% of total exports. Sustainable Agricultural Development depends upon the judicious use of natural resources : soil, water, livestock, plants, fisheries, forests, climate & rainfall, and topography. **Water is a prime natural resource, a basic human need and a precious national asset.** Agricultural development faces resource constraint for "irrigation and drainage" infrastructure, which continues to attract high public investment.

1.1 The search for socially desirable, economically viable, and ecologically sound pattern of resource use and ways of life, to promote sustainable development, has been going on, ever since its most popular exposition in the well known Brundtland Report entitled "**Our Common Future**" in 1987. Developing Countries like India are still to harness their water potential<sup>1</sup>. Against the annual precipitation of 4000 Billion Cubic Metres (BCM) occurring over the Indian landmass, the available run-off is estimated as 1953 BCM (NCIWRDP, 1999). The balance is lost to atmosphere by **immediate evaporation** and also to the ground as soil moisture. Out of this 1953 BCM, the utilisable flow is only 1086 BCM comprising 690 BCM of surface run-off and 396 BCM of replenishable ground water. While the ground water is being over-exploited, it is possible to harness only about 250 BCM of river flows through major, medium and minor storages, allowing the balance flow of more

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<sup>1</sup>Menon, M.S (2001) : "Report of the World Commission on Dams A Framework for Underdevelopment?", published in The Hindu, August 14, 2001

than 400 BCM ( i.e. ~ 60% of the surface run-off) to be wasted to the sea every year. Such an enormous waste of this precious natural resource is going to have a **telling effect** on the lifestyle of the Indian people. (Menon, 2001) estimates that about 10 Million rainwater harvesting structures are to be constructed within a limited time period, to store the 400 BCM of river flows discharged into the sea without being utilised. This would involve acquisition of lakhs hectares of land mostly from small landholders, displacing millions of poor farmers. With the failure of a monsoon, these water bodies get dried up resulting in crop failures, causing large-scale devastation and consequent hardship to people. Developing countries are facing a new threat "eco-colonialism" by the developed countries who insist on pre-implementation conditionalities ( i.e. relating to environment) on dam projects, with a possibility of vested interest to dump their surplus foodgrains and other products, in the guise of protecting the environment.

1.2 The National Water Policy (1987)<sup>2</sup> has addressed to the issues related to develop, conserve, utilise and manage this important natural resource in this new millenium. The Hashim Committee Report (1999)<sup>3</sup> dealt with various issues related to "**Integrated Water Resources Development Plan**" in the Country and **warrants** timely action in respect of (i) **harnessing** of the surface flows through major, medium and minor storages, (ii) **improving** water-use efficiency to the optimum levels, and (iii) **taking** necessary steps for demand & supply management, in order that India have the Water requirement to meet the needs of food grains, drinking and a myriad of uses, of a projected population of 1500 Millions by the year 2050. The Nagpur Declaration (2000)<sup>4</sup> on "Natural Resources Planning and Management for Sustainable Development " also envisaged that for integrated water resources planning and management, both "**river basins management**" at the macro level and "**watershed management**" at the micro level should mutually complement each other.

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<sup>2</sup> Government of India (1987) : "National Water Policy", announced by Ministry of Water Resources, New Delhi.

<sup>3</sup> NCIWRDP (1999) : Report of the National Commission for "Integrated Water Resources Development Plan" , Ministry of Water Resources, New Delhi, September 1999.

<sup>4</sup> 21<sup>st</sup> Indian Geography Congress (January, 2000), National Bureau of Soil Survey and land Use Planning (NBSS&LUP), Indian Council of Agricultural Research, Nagpur, India

1.3 The **existing food security** has been mainly brought about by the increase in irrigated agriculture and the introduction of high-yielding varieties of crops. However, the rainfed areas, which account for 70% of the Net Cultivated Areas of the Country, have not benefited from modern developments in agriculture. Of this 70%, about 30% area is under dryland agriculture, wherein the annual rainfall is up to 400mm only. **The lesser the rain in an area, the greater the trouble for the farmers and villagers there.** Each state of the country is expected to concentrate on agricultural products most suited to its **agro-ecological** and **agro-climatical** conditions, as it is not possible to hope to be self-sufficient in all the essential commodities<sup>5</sup>.

### **Tenth Plan (2002-07) Approach – Convergence & e-Governance**

2.0 Development economy has witnessed industrial revolution, agricultural revolutions (**green**–foodgrain, **white**-milk, **yellow**-edible oil, **blue**-fish, and now **rainbow**), information technology revolution, and bio-technology revolution. Information Technology and Bio-Technology have now become the “**drivers**” of globalisation of the economy, with their complementarities of liberalisation, privatisation and tighter intellectual property rights<sup>6</sup>. The Tenth Plan Approach Paper of the Planning Commission calls for an economic growth target of 8% during the Plan Period, with emphasis on second generation reforms, reduction in subsidies and hard economic decisions to raise resources for increased investment and prune non-plan expenditure. The Approach Paper reiterates faster growth is necessary in order to maintain India’s position in the World Economy and build upon, in the context of the changing global circumstances and growing aspirations of the People.

2. As we entered into the 21<sup>st</sup> century, the realm of electronic communication, which encompasses telecommunication, broadcasting, information technology, and services and industries, is undergoing profound changes, leading to a **Global Information**

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<sup>5</sup> Abdul Kalam, A.P.J & Rajan, Y.S (1998) : “India –2020 : A Vision For The New Millenium – Food, Agriculture and Processing (Chapter-IV)”, Viking Penguin Books India (P) Ltd, New Delhi, India

<sup>6</sup> K.V.Sundaram : “The Small Farmer Development Strategies For The Next Millennium’ presented at National Institute of Rural Development, Hyderabad (India), 2000

**Infrastructure (GII)**, which will be capable of carrying any type of information, be it text, data, voice or video.. Information is now broadly defined to embrace voice in telephony, text in fax and newspapers, images in video and TV broadcasting, and data in computers. All information can be digitised, transported, stored, retrieved, modified, and then distributed. All of these are getting transportable over a common infrastructure – high-speed, broadcast, digital electronic highways. Emerging digital techniques, new network alternatives (Intelligent Networks), high bandwidth communication technology, and state-of-the-art software for network functions and services, are the new technology trends evident in the development of electronic communication systems. The enormous impact of the technological realities (as given by **the Moore's Law, Metcalfe's Law & Guilder's Law**) on convergence and its resultant's impact on the economy, are observable. **People, Procedures, and Technology** have become a multi-threaded operating system to take advantage of desktop revolution, open systems, network systems, database technology, parallel computing, and web technology based services (i.e. business-to-business (B2B), business-to-customer (B2C), customer-to-customer (C2C), government-to-government (G2G), government-to-citizen (G2C), government-to-business (G2B), citizen-to-government (C2G)), Customer Relation Management (CRM), Supply-Chain Management (SCM) and Corporate Knowledge Engineering.

2.2 Convergence describes a **process** change in industry structures (Computer Industry, Information/Content Industry, & Communication Industry) that combines markets through technological and economic dimensions to meet merging consumer needs. Fax revolution was produced by a convergence of telecommunication technology, optical scanning, and printing technology. Since both **the Internet and Broadcasting are digital**, broadcasting is the bridging technology that converge broadcasting and the Internet into a single, seamless digital medium. **The Internet** (i.e. network of networks based on TCP/IP communication protocol) is the driving force of convergence of technologies and services industries. Convergence of technologies will facilitate to network ever increasing number of households ( i.e. to overcome **"The Last Mile problem" - Broadband connections covering the last segment of the data pipeline**) by using the already existing telephone lines, television cables, and the electric power lines. **IPv6** (128-bit address) will

facilitate convergence of technologies i.e., **an Era of IP anywhere**. Software radio is emerging as the pragmatic solution for future mobile systems, holding the key to total convergence. This technological convergence demystify **"Convergence is not an issue in the backbone, but in the edge (last-mile problem)"**.

2.3 The diffusion of Information and Communication Technology (ICT) throughout all industries is **far more important** than the production of ICT industries per se. As an enabling technology, Information Technology (IT) plays an important role in the efficient use of available resources **to maximise** production and productivity. Productivity implies the **effective and efficient** use of **resources** : **labour, capital, land, materials, energy, time, information**, etc. Information concepts and technologies are changing very rapidly and the economic importance of **"information"** has grown steadily. In the era of **globalisation** and **liberalisation** with trans-border free flow of information (**strategic, tactical** and **operational**) through Internet/Intranet, Information Technology (IT) has become an extremely important and increasingly complex component of business and professional organizations. The OpenGIS<sup>®</sup> Model<sup>7</sup> of the Open GIS Consortium Technical Committee [OpenGIS] envisages **to synchronize** geo-processing technology with the emerging Information Technology standards, based on open systems, distributed processing, and componentware frameworks, and to facilitate interoperability through **"common specification"** over Internet/Intranet.

2.4 The **increase in output** was largely facilitated by a wide variety of **computer-based applications** throughout the goods producing and service sectors of the economy. This proves that **Information Systems should be treated as "investments" and not as "expenditures"**. A **shrinking** budget deficit, **low** interest rates, a **stable** macro-economic environment, **expanding** international trade with fewer trade barriers, and **effective** private sector management are all credited for their roles in economic prosperity. Research Studies show that **complementarity** relationship **exists** between Information Technology

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<sup>7</sup> see <http://www.opengis.org>

and Productivity (i.e. good consumption system and information system **reinforces** commitments to productivity)<sup>8</sup>.

2.5 Emergence of Information Technology on the national agenda and the announcement of IT policies by various State Governments have recognised the “**Convergence** of core technologies and **E-Governance**” as the tool for sustainable development and globalisation of economy. In view of its impact on socio and economic development of the Country, the Planning Commission has constituted a Working Group on “**Convergence and E-governance**” to formulate proposals for the Tenth Five Year Plan (2002-07), with the following terms of reference :

- ◆ Measures for promotion of e-governance at various levels of Government
- ◆ Measures for ensuring seamless transition to convergence of IT, Telecommunication and Broadcasting Sector
- ◆ Measures to address the issue of digital divide and taking the benefits of IT to the Masses
- ◆ Infrastructure requirements for faster growth and penetration of internet and convergence of services
- ◆ Integrated view of the development of Telecommunications, IT and Information & Broadcasting Sectors

The **hypothesis**: “diversity of applications and services increases, whenever core technologies converge” holds good.

### **Informatics-led Development Programme – A step towards to overcome “digital divide”**

3.0 In 1975, the Government of India strategically decided to take effective steps for development of information systems and utilization of information resources, and also to

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<sup>8</sup> Tolentine.A : “**Productivity Management for Sustainable Development**”, Enterprise and Management development Working Paper – EMD/11/E, International Labour Organisation; and also see <http://www.ilo.org/public/english/employment/ent/papers/emd11.html>

introduce computer-based decision support system in government ministries and departments to facilitate planning and programme implementation to further the growth of economic development and social development. The Central Government was of the view that "**development within the government administration**" can be used as a "**lever for technical development in society**" (i.e. Informatics-led Development) as a whole. As a result of this, the Central Government nucleated a high priority plan project "**National Informatics Centre (NIC)**" under the Electronics Commission / Department of Electronics, in 1976, with the assistance of the United Nations Development Programme (UNDP). This strategic decision to overcome "**Digital Divide**" in Central Government Departments and Ministries, taken during the Fifth Plan Period (i.e. 1972-77), resulted in launching of the Central Government Informatics Development Programme in various Departments and Ministries through National Informatics Centre (NIC). In view of its relevance for all round socio-economic growth (i.e. employment generation and hence poverty reduction), and also to get benefit of the emerging digital economy, the Central Government has created a new **Ministry of Information Technology (MIT)** by merging the DOE, National Informatics Centre (NIC) and Electronics and Software Export Promotion Council in 1999.

### **National Informatics Centre : An Active catalyst and Facilitator**

4.0 The National Informatics Centre (NIC) is the **nodal S&T organization** in the Ministry of Information Technology (MIT), for informatics development and networking in government, corporate and cooperative sectors for decision support. NIC has been instrumental in **steering** Information and Communication Technology (ICT) applications in Government Departments at Central, State and Districts, facilitating improvement in government services, wider transparency in government functions, and improvement in decentralised planning and management. To facilitate this, NIC has established a nationwide ICT Network - NICNET with gateway nodes at about 55 Central Government Departments, 35 State/UT Secretariats, and 550 District Collectorates, for IT services. In view of its cost effectiveness, NIC had taken a leading step in establishing "**Hub based Wireless Data Network**" in many state capitals (Agarthala, Bangalore, Bhuvaneshwar, Calcutta, Chandigarh, Chennai, Delhi, Hyderabad, Jaipur, Lucknow, Mumbai, and



Shillong) in 1997-99 to facilitate high-speed access, ranging from 64 Kbps to 2 Mbps through NICNET.

4.1 NIC has played an important role of an “active” catalyst and “facilitator” in informatics development programme in Governments at the national, state and district levels, during the last 25 years, and has “reached out into India” during 1985-90, even before the arrival of “Internet” Technology, to 550 districts of the Country, which is a land of diversity with different types of terrain, various Agro-climatic conditions, different levels of socio-economic conditions, and varied levels of regional development, etc. To customize applications for facilitating decision support in development and responsive administration (earlier version of e-governance), NIC had established its Project Centres at NICNET Nodes.

4.2 NICNET links extends to Andaman Islands, Lakshdweep & Minicoy Islands, and Ladakh Region. The NIC provides the state-of-the-art IT solutions to information management, information dissemination, and decision support requirements of the Central as well as State Governments, the Corporate Sector and the Cooperative Sector. The NIC implements Information Technology Projects, in collaboration with the Central and State Governments in the areas of (a) Centrally sponsored schemes and Central sector schemes, (b) State sector and State sponsored projects, (c) District Administration sponsored projects. NIC has been instrumental in adopting INFORMATION TECHNOLOGY AND COMMUNICATION TECHNOLOGY “to reach out into India” (i.e. by implementing IT applications in Social & Public administrations), which are discernible from the following developments:

- (a) Central Government Informatics Development programme A strategic decision to overcome “Digital Divide” in Central Government Departments and Ministries during the Fifth Plan Period (i.e. 1972-77);
- (b) NICNET gateway for Internet/Intranet Access and Resources Sharing in Central Government Ministries and Departments in 1980s and 1990s;
- (c) IT in Social Applications and Public Administrations;

- (d) State Government Informatics Development Programme - A strategic decision to overcome “**Digital Divide**” in Central and State Governments during the Seventh Plan Period (i.e. 1985-1990);
- (e) NICNET - A first of its kind among the developing countries, using the state-of-the-art Ku-band VSAT technology- facilitates (i) decentralised planning, (ii) improvement in government services, (iii) wider transparency of national and local governments and improving their accountability to the people;
- (f) DISNIC – A NICNET Based District Government Informatics Programme  
A strategic decision in 1985 to overcome “**Digital Divide**” in 540 District Administrations;

4.3 As a major step in bringing in **e-governance**, NIC implements the following “**minimum agenda**” of E-Governance, as announced by the Central Government :

Internet/Intranet Infrastructure (PCs, Office Productivity Tools,  
Portals/Portals on Business of Allocation and Office Procedures) up-to  
Section Officers level  
IT Empowerment of Officers /officials (Training)  
IT enabled Services  
G2G - Government -to-Government Portal  
G2B - Government-to-Business Portal  
G2C - Government-to-Citizen Portal : Community Information Centre,  
AGMARKNET Nodes, Passports, Courts, Central Excise & Customs,  
Land Records, Property Registration, etc.  
IT Plans for Sectoral Development  
Business Process Re-engineering  
Video-Conferencing