

FUNDAMENTALS OF HYDROSOCIOLOGY IN RELATION TO DEVELOPMENTAL ACTIVITIES

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Abstract - The importance of water as a Resource, a Commodity and as an important component of the Environment and Ecological set up is increasing very fast. In fact we are reaching at a point of water crisis. Water encompasses practically all facets of our life and society. Hydro sociology deals with all aspects of interaction between water and society. This paper deals with some of the issues related to vastness of this ever increasing problem.

Key Words: Riparian Rights, Water Poverty Index, Water Footprint, Ethics, Ecology

1. INTRODUCTION

Water is an essential and basic resource for the development of human civilization. Human life or any other form of life would not have been possible without existence of water. When we talk of water we mean fresh water of quality tolerable by human beings and all animal and plant life existing on landmass of mother earth. If we look at the world map we find that human population is concentrated around a river or lake which serves as source of fresh water. All the old civilizations like Egypt (Nile), Iraq (Euphrates), India (Ganges, Sindh) have grown around major rivers. Water is one such item which is connected with all aspects of life and also an integral part of overall environment. Utilization of water for development needs involvement of complete domain of human knowledge. Water is equally essential for rich and poor, educated and uneducated and persons from all strata of the society. Further, water is an essential ingredient for development of industries, agriculture, rural and urban settlement. Although water is a very basic and important resource (much more compared to Gold or, Diamond) till today no norm has been created for fixing the price of water at source. Rather, this absence of logical pricing of this essential resource has caused immense damage and deterioration of our environment through most of our present day developmental activities. The situation is quite complex and should be studied with a holistic approach

2. HYDROSOCIOLOGY DEFINED

HYDROSOCIOLOGY is that branch of science which deals with interaction of community activities, governance, religious actions, health & hazard risks initiated through pollution, flood & drought, international & national politics

and basin economics with climate change, hydro-meteorological factors, hydro-geomorphic parameters and hydrogeological factors keeping in view overall growth plan of the country. The various branches of Hydro sociology are:

1. Hydro legal Stipulations
2. Hydro politics
3. Hydrological Warfare
4. Hydrological Riparian rights
5. Hydrological Governance
6. Water Poverty Index
7. Water Footprint.
8. Hydro religious activities
9. Hydro economics
10. Hydro ethics

Hydro-sociologic System Set Up provides a platform where the joint operations of Man and Water Resources are necessarily involved. Hydro-sociologic system is a set of interacting and independent entities related to society and water resources forming an integrated system with a definite boundary and also certain inputs and outputs with water resources forming the throughput. Man's symbiotic relationship with water is so obvious that Chorley (1969) has suggested that there should be adoption of unified view of earth and social sciences in general and study of hydrology in particular. Hydro-sociologic system operates through the collision of socioeconomics, socio-legal and hydrologic cycle. In order to keep in view the broad platform of Hydro sociology one has to understand and appreciate that race, class, gender, rich, poor, religion, caste, creed, country, continent, plant life, animal life, overall ecological setup are all central elements to the issues of dam construction, bottled water, pricing of water, equitable distribution of water, stream flow, groundwater level, flood, drought, water quality, fisheries development, coastal life, global warming, limits to growth, food and water security, international and national disputes, riparian rights, and water related legal issues.

3. HYDROSOCIOLOGY AND CIVILISATION

If one follows the civilizational history it will be observed that water has been playing a major role in the rise, decline and fall of different civilizations. Nearly all great civilizations of the world have grown around water. The water body has not only supplied fresh water for drinking and sanitation but

also for agriculture, trade, transport and defense. The Indian Civilization, Egyptian Civilization, Omayyad Dynasty (Syria & Iraq), Roman Empire were all founded on their access to water which provided their population with the means to survive and expand. The demand and importance of water is increasing with expansion of civilization. Human progress has always been conditioned on advances in water science and their application through engineering and technology for the benefit of society. The Indus valley civilization such as Harappa and Mahenjodaro represent one of the largest human habitations of the ancient world. The Indus Valley civilization grew on the bank of the Sindhu (Indus) river and extended from Baluchistan to Gujrat. Sindhu River has taken its birth in the mountains of Tibet and flows West ward. Sindhu was very important for India in ancient days. The Indus civilization was a precursor of the later civilization. Saraswati Sindhu civilization flourished during 3000 to 1700 BC on the river valleys of the Indus and Saraswati and after the drying up of the river Saraswati many people migrated to the Ganga Yamuna Doab. The importance of the Nile River in the ancient Egyptian civilization is very high. Flowing into Egypt from an elevation of 1800 m above the sea level the Nile deposited silt, natural fertilizer, along the bank in Lower Egypt. The sacred water of the Nile characterized every important aspect of the Egyptian Civilization. Ancient Egyptians developed highly complex irrigation methods to maximize the effect of the Nile water. The Tigris-Euphrates river system is part of Tigris Euphrates alluvial Salt Marsh eco-region of the Middle East and is characterized by two large rivers, the Tigris and Euphrates. Historically, the area is known as Mesopotamia. As part of the large Fertile Crescent it saw the earliest emergence of literate urban civilization in the Ural period for which reason it is often termed the "Cradle of Civilization". This river system supported the rich agricultural regions of Syria and Iraq which were part of the Omayyad Empire (661 - 750 AD). The development of Roman Empire bear ample evidence of water related devices and structures. The rivers Rhine and Danube are huge streams and they formed the northern border of the Roman Empire. The first Roman aqueduct was built in 312 BC. Connecting cities to water supplies and drainage of waste water through drainage channels was a characteristic of the entire Roman Empire.

4. HYDROSOCIOLOGY AND RELIGION

Water plays a prominent role in all major mythological systems. In Hindu Mythology water has been recognized as a Primordial Spiritual symbol since the Vedic period (Baartmans, F, 1990). Water is considered to have an intrinsic purity and capacity to absorb pollution and carry it away. Water is considered the most common medium of purification. Vedic Philosophy bestows a sacred character on water. The role of Mother Ganga in Hinduism and the significance of the enormous funeral pyres in the sacred city of Varanasi show how important water is in our life and even after death. Neptune was the God of the sea in Roman

Mythology. From the religions of the Scandinavian Vikings to the monotheistic desert religions of the Middle East the importance of water is very clear. In Polynesian mythology a large fish was identified as an island by brother of Mani. In the ancient Egyptian religion ocean was personified as a formless divinity. Ancient Egyptians tried to understand their place in the universe and their mythology centers on nature, the earth, sky, sun moon and the Nile River. It is stated that in the beginning of time everything began with Nu (a description of what the planet was before land appeared). Nu was a vast area of swirling watery chaos. The first God to appear out of the watery mess was Atum. According to Shinto legend the original couple of creation plunged into the primordial ocean and then gave birth to a series of islands including the archipelago of Japan.

5 HYDROSOCIOLOGY AND CULTURE

Water is an integral part of life both for survival and cultural expression. Water has served as a stimulus for many different types of art. Sea, rivers, lakes, cloud, have all served as motive power behind art, music, literature. Leonardo da Vinci described water as "the Vehicle of Nature" just as "blood in a human body". He also observed the destructive power of water in storm and flood. Water in its different form is a source of recreation. Water is a key element in many other recreational and sports activities like swimming, fishing, boating and camping.

6. HYDROSOCIOLOGY AND ASTROLOGY

Astrologically, the water symbolizes emotion. Water moves in deep rivers. It seeks its own level and flows until it finds its own level. The cycle of water is endless with the snows falling in the mountains and melting. The mountain streams join to make great rivers that run to the sea. The tides and currents meet the oceans. Similarly our feelings are flowing as they connect the present with the past experiences.

7. HYDROSOCIOLOGY AND POLITICS

Restructuring of a nation may depend on water. Radcliff award of 1947 regarding boundary between India and erstwhile East Pakistan (Present Bangla Desh) at the time of Indian Independence involving Khulna, Murshidabad, Malda and Nadia districts for partitioning the then Bengal province was primarily based on the consideration of equitable distribution of water resources. Water is a source of conflict among nations and states. Immediately after partition in 1947 India and Pakistan were locked in a dispute over share of water from Indus Basin. However, with the technical backing of World Bank this problem was finally solved through Indus water Treaty. Indus Water Treaty was signed in Karachi on September 19, 1960 by the Indian Prime Minister Pandit Jawaharlal Nehru and President of Pakistan Field Marshal Md. Ayyub Khan. The Farakka Barrage on the Ganges River located in West Bengal roughly 10 Km. From

the border of Bangla Desh was completed in 1974-1975. The Dam was built to divert the Ganges Water into the Hooghly River during dry season to flush out accumulating silt at the major Kolkata Port on the Hooghly River. Bangladesh and India are engaged in a long standing debate on how the construction of Farakka barrage is affecting the agricultural activities in Bangladesh. But presently this dispute has been solved amicably .Nepal and India share one of the biggest Geo-hydrological regions called Ganga Brahmaputra basin. Mahakali Treaty on water sharing was signed between India and Nepal by Prime Minister of India Mr.P.V. Narsimha Rao and Prime Minister of Nepal Mr. Sher Bahadur Deuba. National and International Conflicts are always associated with political implications. As far back as in 1979 to analyze the political developments in relation to the international waters of the Middle East Waterbury (1979) introduced the concept of Hydro politics. Wolf used the terms like Hydro-Conflicts andHydro-Coperation. (Biswas 1994) while dealing with the hydro political history of the river basins of the Nile, Jordan & Euphrates. Hydrological matters represent a critical dimension in the Arab Israeli Conflict. And this dimension is increasing at a fast rate with increase in population. Stephan Libszewski (1995) has presented a detailed account of various aspects of this crisis. The bulk of Syria's water demand is covered by the Euphrates. Lebanon has a number of small rivers in their hill region. Water being a very important resource in this region Water related infrastructures have been a military target of numerous skirmishes and wars throughout the course of Arab Israeli conflict. However, water's role as a catalyst of conflict has not been particularly pronounced. The Southeastern Anatolia Development Project of Turkey plans to utilize a major part of water of the Euphrates and the Tigris rivers with the construction of 22 dams and 19 Hydroelectric Power Plant projects. This project created a great deal of resentment from Syria and Iraq who are the other riparian's of the Euphrates Tigris Basin. In India presently there are several disputes in water sharing between various State Govts. These are briefly presented below: 1) Vansadhara River Water Dispute between Orissa & Andhra Pradech. 2) Mahadayi/ Mandovi River Dispute between Goa, Karnataka & Maharashtra. 3) Krishna River Water Dispute between Maharashtra, Karnataka & Andhra Pradesh. 4) Cauvery Water Dispute between Tamil Nadu, Karnataka, Kerala, Pondicherry. 5) Sharing of Available Water of Ravi & Beas between Punjab, Rajasthan, Jammu & Kashmir & PEPSU. 6) Dispute between Maharashtra and Andhra Pradesh over construction of Babhali Barrage by Govt. of Maharashtra in the reservoir submergence area of Sriram Sagar Project 7) Mulla Periar Dam Issue between Kerala and Tamilnadu. In India most of the disputes are handled through tribunals according to INTER STATE WATER DISPUTES ACT, 1956. This Act had to be amended several times to take care of problems in a comprehensive manner. Even The Sarkaria Commission hot involved in the Water Disputes between different States in India and they have made number of recommendations including preparation of a detailed data

base on Water Resources of different States. Various International Bodies have also been engaged to deal with problems related to sharing of water between different countries. Some of these efforts are presented below : 1) 1966 Helsinki Rules : Adopted by the International Law Association at the 52 nd Conference held at Helsinki in August,1966, the rules govern use of water in an International Drainage Basin except as may be provided otherwise by Convention, Agreement or binding custom among the Basin States. 2) UN Sponsored Conference on Water at Mar Del Plata, Argentina, 1977 3) The Hague Declaration, 1989 4) World Water Council, Montreal, 1995 5) Global Water Partnership, 1996 6) World Water Forum, Morocco, 1999 .The most recent International dispute affects India since China is using Water as a tool for aggression by constructing dams on Brahmaputra River which originates from Tibet. China is also doing the same thing on Mekong River.

7. HYDROSOCIOLOGICAL SET UP & HUMAN ACTIVITIES:

It is a paradox that although human beings have understood and appreciated the value of water resources from the dawn of civilization no effort has been made to protect this very important resource. Even today we are dumping domestic sewage and industrial effluent in rivers and other water bodies. Even today we are feeling up natural water bodies for real estate development. We are over irrigating our land to create salinity alkalinity problem. We are over-pumping our coastal aquifer and initiating sea water intrusion. We are over-pumping our inland aquifer to create arsenic pollution or fluoride pollution. The time has come to include the economics of these damages in our overall socioeconomic planning. Ghosh, (1999) and Ghosh & Mallick (2002) have attempted to study impact of industries and other human activities on Hydro-sociological set-up. Ghosh and Mukherjee (1980) carried out an ecological survey in the three settlements of Ranaghat. An important aspect of this study was evaluation of perception of rural population to factors related to water pollution initiated by human factors. In fact more than 75% reported that they have not seen anybody contaminating water body by bathing or washing clothes. Of course 70 % reported that they do not get clean drinking water. However, presently the situation has improved so far as awareness is concerned but till today in rural India illness and child death due to lack of clean drinking water is a major health problem.

8. WATER POVERTY INDEX

Water Poverty Index: Lawrence, P, Jeremy, Meigh and Caroline Sullivan (2002) have formulated an index termed "WATER POVERTY INDEX "to express an interdisciplinary measure which links household welfare with water availability and indicates the degree to which water scarcity impacts on human population. This index enables National

and International Organizations concerned with Water Provision and Management to monitor both the resources available and Socioeconomic factors which impact on access and use of these resources. The idea of Water Poverty Index is to combine measures of Water availability and access with measures of people’s capacity to access water in holistic way that brings in the diverse aspects and issues that are relevant.

9. VIRTUAL WATER AND WATER FOOTPRINT:

Virtual Water is defined as the volume of water required to produce a commodity or service. The concept was introduced by Allan in 1993, 1994 (Hoekstra Et Al, 2007).The virtual water content of a product can be classified as: 1) Green Virtual Water: Rainwater which evaporates 2) Blue Virtual Water: Surface or Ground Water which evaporates. 3) Grey Virtual Water: The portion which becomes polluted during production. The concept of Virtual Water links a large range of sectors. The concept of Virtual Water links a large range of sectors and issues that revolve around relieving pressure on water sources, ensuring food security, developing global and regional water markets. The Water Footprint Concept was introduced by Hoekstra and Hung in the year 2002. The water footprint concept is closely linked to the virtual water concept. The water foot print is a consumption based indicator of water use that could provide useful information in addition to the traditional production sector based indicators of water use (Hoekstra and Hung, 2002). Virtual Water Trade refers to the transfer of virtual water associated with the transfer of commodities. It has emerged as a new field of Water Management which may be utilized as a strategy to eliminate Water Scarcity and to achieve water and food security .During 1995 to 1999, USA, CANADA, THAILAND, ARGENTINA, INDIA, AUSTRALIA, VIETNAM, FRANCE, GUETEMALA & BRAZIL were the major exporter of Virtual Water and SRI LANKA, JAPAN, NETHERLAND, KOREA, CHINA, SPAIN, INDONESIA, EGYPT, GERMANY, ITALY were the net importer of Virtual Water. The quantum of virtual water in various agricultural and industrial products are presented in Table 1 Below:

PRODUCT	VIRTUAL WATER	PRODUCT	VIRTUAL WATER
WHEAT	1160Cum/T	SOYABEAN	2750Cum/T
RICE	1400Cum/T	PORK	4600Cum?T
PRODUCT	VIRTUAL WATER	PRODUCT	VIRTUAL WATER
Survival Diet	1 cum/day	1 Ton Steel	8000Lit
Veg Diet	2.6cum/day	1 Cup of Coffee	140Lit
NonVeg diet	5.0cum/day	1Pair of Shoes	8000Lit
PORK	4600Cum/T	200gmPotato Crisps	185Lit

10. WATER PRICING AND HYDROSOCIOLOGY.

Prices signal value to customers and help determine whether consumers use waster efficiently. Pricing of water is intimately related to various key Hydro sociological factors like Water Governance, Water Rights and Affordability. Water Pollution Control , Treatment and Reuse of Waste Water are also intimately connected with overall water governance and pricing. Since access to water is intimately connected to a basic social right pricing of water has always met with some resistance particularly from social activists. Considering this economists have long advocated the “Pollutant Pays” principle. OECD Countries have taken positive steps to implement water pricing (Tom Jones, 2003). Till date there is no specific guidance regarding pricing of water at source. However, most of the govt. agencies and municipalities fix some nominal charges to cover part of their expenses towards treatment, pumping and pipework system. And for this several price structures may be followed (EPA, 1998). These are: 1) Increasing Block Rate 2) Time of Day Pricing 3) Water Surcharges 4) Seasonal Rates. One very important hydro sociological factor which affects implementation of uniform pricing policy is the affordability. Since water is intimately connected to basic health system of population at large and since in any society there are needy people the charge must match the level of affordability of different strata of the society. Thus, success of a Water Pricing System for municipalities, irrigation or industries depend on the following factors: 1) Willingness to Pay 2) Capacity to Pay 3) Capacity to Charge 4) Willingness to collect. This aspect has been discussed in detail with reference to Irrigation Reforms in Karnataka by Barton, David, Raju, K.V. And McNeil Desmond .

11.PRIVATIZATION AND HYDROSOCIOLOGY

With the advent of the wave of Liberalization, Privatization and Globalization making the rounds throughout the world the concept of privatization of water has also taken its roots. However, Privatization proposal in this key public service sector like water are strongly opposed by political and social groups throughout the world. The most recent of such protest is seen in protests at 5th World Water Forum in Istanbul on 16th March, 2009. A group of protesters from several Non-Governmental Organizations raised the slogan “ No Commercialization of Water”, “No Privatization of Water Assets” ,”Water is Life it cannot be Sold”. In order to go deep into the problem we have to analyze the problem in various parts: 1) Natural Source of Fresh Water: Rivers, Lakes, Aquifer 2) Structure for Tapping Natural Water: Intake/ Infiltration Well on River/Lake, Bore Well for Underground Water. 3) Storage of Water: Dams/Barrage/Weir/On ground Reservoir/Underground Reservoir/Overhead Reservoir. 4) Pumping and conveyance of Raw Water 5) Treatment of Raw Water 6) Pumping and Conveyance of Treated Water 7) Disinfection of Treated Water 8) Storage and Distribution of treated water. 9) Collection & Treatment of Waste Water 10)

Recirculation of treated waste water for industries and urban settlement. 11) Canal System for Irrigation 12) Operation & Maintenance of Water Assets Thus, it is observed that the most important part of Water is its source in Nature and obviously it being part of overall environment should not be privatized and all citizens of the world should have equal right for this. Whether the Water related assets like pumping system, treatment system, piping system should be under the control of Govt. Sector or participation of private sector should be welcome needs to be debated. However, when it comes to Operation and Maintenance of the system along-with revenue collection it has been observed that private sector works much better than Govt. Sector. However, Private Sector must follow some guiding principles

12. ETHICS AND HYDROSOCIOLOGY

Water is a basic resource and one of the most important part of overall environment where everybody has equal right. Handling, treatment and conveyance of this commodity to every citizen's door step needs efficient handling of the system for which private sector participation may be essential. However, keeping all aspects in view we have to bring the concept of Ethics to the area of Water Resources. Ethics is traditionally regarded as the Science of the rightness and wrongness, goodness and badness of human conduct. Mishra (2004) has characterized Ethics as a normative discipline. Ethics is not concerned with what human beings do but what they ought to do. This brings into focus establishment of a philosophically accepted standard of moral judgment. Here man is the only animal endowed with rationality and man is considered to be the moral agent. Mitra (2004) has observed that the evolution of the human brain is explosive. The skull area of human species has undergone enormous development within last half a million years. Man's journey as an animal species is rather short and curious. Man is late comer in the 500 million years history of life on earth. Yet man has multiplied in such a short time to 80 billion creatures and have invaded a wide range of habitats. In the path of development of lifestyle, human beings did not face any competition from any other species and thus, human beings have developed a concept of civilization where man is supreme and rest of the nature is considered an entity to serve mankind. Till recently man's sphere of morality included only human beings. However, now the time has come for human beings to use their brain and mind to save the mother earth and whole ecological system. The basic principle should be man has not inherited the world resources but they have borrowed it from their future generation. Hassan (2004) has observed that water is one of our enduring human symbols of life, regeneration, purity and hope. It is one of the potent links with the sacred, with nature and with our cultural inheritance. With the water crisis looming large it is our opportunity to bring water forward as a medium for a global hydro-sociological project that unifies humanity in a single cause for peace,

stability, amity and ecological stability and security of this vital international resources which is also a very important and essential component of overall ecological set up.

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