

Management of Water Resources for Economic Development of Modern India

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Abstract

Water is a necessity for human beings. The ancient texts as well as the holy religious books mention water as deity to cite the importance of water in human life. The phrase 'jal hi jeevan hai' indicates that there can be no life without water. The Nation is running through scarcity of water. To imagine for a safe future we have to work hard right from today towards conservation of water. The mechanism to protect and enrich water resources should be two fold namely stress has to be given on securing the safety of available water resources and at the same time measures have to be taken for the protection of nature with strong steps such as more and more plantation of trees, preservation of presently available trees and awareness of general public for not cutting trees and plantation of more trees. The research is of great utility in the present scenario where rising today is necessary to sleep peacefully tomorrow.

To effectively manage it is also necessary that those states or areas of India which regularly suffer with the natural disasters like flood, drought and famine are managed to conserve water in a manner so that the curse becomes a boon for those areas. The research aims at locating the available water resources in different states, their management by the respective states and then to conclude the remedial steps needed in the interest of the society. The research is also of a great value in the manner that a proper and effective management of water resources in the country will ensure a progressive economic development of modern India. Arise, Awake and Stop not till the goal of safe and secure water is achieved.

Keywords: Necessity, importance of water, plantation of trees, flood, drought

Introduction

One of the biggest challenges of the 21st century is to make sure that all people on the Earth have better living conditions while reducing the impact of human activities (anthropogenic impacts) on the natural ecosystems and the global environment. Water is a precious and

scarce natural resource for sustaining life. It's a fundamental need to all living beings and is a non renewable resource. To ensure the availability of sufficient quantity of drinking water for the needs of present and future generations it is our duty to skilfully manage the available resources.

“Water is a blessing for human kind. It is the life blood of farming Nations, cities and civilizations since ancient times have grown near rivers. Our scriptures have praised the life giving quality of water. At the same time, having an excess of water or its complete absence can be a curse too. This year itself many parts of our country have been affected by drought. Farmers are in acute distress. Also, we are having a deluge of water, leading to flash floods and consequent destruction and loss of valuable property in many States of the Union. Once again, farmers in these parts are in distress. In a way, these two phenomena demonstrate the vulnerability of our people to the vagaries of nature. They also demonstrate the importance that irrigation can play role in mitigating the risk arising out of fluctuating rainfall – both when it is in shortage and when it is in excess. Irrigation can ensure that people's suffering from water related disasters is minimized and that they enjoy the benefit of nature's bounty.”- Former Prime Minister of India, at the Inauguration of the National Conference of Irrigation and Water Resources Ministers, November 30, 2005.

In view of the vital importance of water for human and animal life, for maintaining ecological balance and for economic and developmental activities of all kinds, and considering its increasing scarcity, for maintaining the quality of fresh water, water management strategies are required to be evolved and implemented. However, we are facing increasing water quantity and quality problems as a result of population growth, economic development, and climate change and irresponsible usage of water. The quantity problem is closely related to water scarcity (increasing demand and declining supply) for the competing use of water resources or damages from floods in river basins, while the quality problem is related to water pollution, which could be caused by negative externalities. These negative externalities cause negative impacts on water users. Economics has been playing an increasing role in both quantity and quality management. As economics is a science about optimal allocation of scarce resources, economic instruments such as prices can adjust demand and supply and deal with externalities.

Effective and Efficient management of water resources is vital for ensuring sustainable development. India is endowed with a rich and vast diversity of natural resources, water being one of them. Water management is vital for poverty reduction, environmental sustenance and sustainable economic development. Management of water resources in India is of paramount importance to sustain one billion plus population. Water management is a composite area with linkage to various sectors of Indian economy including the agricultural, industrial, domestic and household, hydropower generation, environment, fisheries and transportation sector but also provides ecosystem services such as the maintenance of wetlands, wildlife support, and river flows for aquatic ecosystems. Water has been recognized as an essential economic good for its use in economic activity. The water resources management practices should be based on increasing the water supply and managing the water demand under the stressed water availability conditions.

Decision support systems are required to be developed for planning and management of the water resources project. There is interplay of various factors that govern access and utilization of water resources and in light of the increasing demand for water it becomes important to look for holistic and people-centred approaches for water management. Clearly, drinking water is too fundamental and serious an issue to be left to one institution alone. It needs the combined initiative and action of all. The management of water resource and its optimal, economical and equitable use has become a matter of the utmost urgency.

Water is important for economic development of Modern India. Many parts of India are facing issues of water scarcity. The Current BJP led NDA Government under the leadership of Prime Minister Shri Narendra Modi had inducted following points in their election manifesto to be considered on priority basis:

- i. Water is a critical resource but its management is spread across various departments even at the Central level. We will form a new Ministry of Water unifying the water management functions to approach the issue of water management holistically and ensure better coordination of efforts. The Ministry will expeditedly take forward the ambitious programme, conceptualized by Shri Atal Bihari Vajpayee, for linking rivers from different parts of the country and ensure a solution to the problems of drinking water and irrigation. We will initiate work on this programme by constituting an authority.

- ii. We will launch '**Jal Jivan Mission**' under which we will introduce a special programme, '**Nal se Jal**' to ensure piped water for every household by 2024.
- iii. We will ensure sustainability of water supply through special focus on conservation of rural water bodies and ground water recharge.

The Government of India has formed a new Ministry of Jal Shakti in May 2019. This was formed by merging two ministries namely Ministry of Water Resources, River Development & Ganga Rejuvenation and Ministry of Drinking Water and Sanitation. This Ministry is currently led by Shri Gajendra Singh Shekhawat. The main object of the 'Jal Shakti' ministry is to provide clean drinking and potable water as well as fight India's water woes.

Review of Literature

An attempt has been made to present the literature pertaining to the past research work related to the research. At present, water issue is gaining prominence in cities of India. The fast growing population and expanding urbanization lead to increasing demand for water from various sectors of the Indian economy. This requires an understanding the various sources of water supply and the demand arising from various sectors. Declining water quality, particularly of groundwater, growing financial crunch, inadequate institutional reforms, and enforcement are some of the crucial problems faced by the nations. There are very few studies done on the water resource management. Some of the studies conducted on water resources management have been reviewed and presented below.

R.Roozbahani, et al., (2013) describes an application of linear programming (LP) methods for optimal allocation of water among competing stakeholders that would achieve the highest economic return from water use in the agricultural section of the Sefidrud Basin, northern Iran. In a network presentation of the basin, the nodes stand for the supply and demand points and arcs represent reaches. The constraints of the LP model are the network structure of the basin (flows, stream geography and channel capacity), the available surface and ground water in each node, the environmental demand in different reaches, upper and ground water in each node, the environmental demand in different reaches, upper and lower bands of supply in each node and water balances. Optimal policies are derived for current and future demand.

The optimal policies indicate that, at present, the basin water resources satisfy the demands of all stakeholders.

Although, the results show that there is no conflict for supplying stakeholders' current demands, they indicate that the current proportion of surface water used is not optimal compared with the proportion of ground water used. The results also indicate that some future demands of provinces with lower marginal value of water are unsatisfied and that this could cause conflict between stakeholders.

Senthilkumar, P. (2013) in this study pointed out the water resources of country constitute one of its vital assets. India receives annual precipitation of about 4000 km³. The rainfall in India shows very high spatial and temporal variability and paradox of the situation is that mousinram near Cherrapunji, which receives the highest rainfall in the world. The annual potential natural ground water recharge from rainfall in India is about 342.43 km³ which is 8.56 per cent of total annual rainfall of the country water is one of the most essential rural resources for sustaining life and it is likely to become critically scarce in the coming decades, due to continuous increase in its demand, rapid increase in population and expending economy of the country. Variations in climate characteristics both in space and time are responsible for uneven distribution of precipitation in India. Better and scientific structural and non-structural measures are required for mitigating the floods and droughts. The concept of virtual water transfer requires to be introduced a policy level for food trade, water management and agriculture. The capacity building and awareness programmes may be organized for the users and public for encouraging their effective participation in water management practices and developing ethical concept for making efficient use of water resources. Capacity building is also needed for the water resources managers and developers for updating the knowledge and technology in the area of water resources management.

Angappapillai A.B, and Muthukumaran .C.K,(2012) highlighted the fact that the principal source of water for India is the Southwest monsoon that undergoes wide spatial and inter-annual variations associated with global climate anomalies. Any further extremes in rainfall and changes in the frequency and intensity of source and agriculture, and it will be reflected in all facts of life. More specifically, declining water quality, particularly of groundwater, and unabated flooding Inter-state River disputes, growing financial crunch inadequate institutional reforms, and enforcement are some of the crucial problems faced by the country's water sector. Severe water shortage has already led to a growing number of conflicts between users (agriculture, industry, and domestic) intra-state and inter-state with

the increasing demand for water from various sectors like agriculture, household industries. A pertinent need arises both from the government sector as well as from the private sector on the management of water resources. This requires an understanding of the various sources of water supply and the demand arising from various sectors.

Rajamanickam.M, (2011) in his study stated that water is a unique resource endowed by nature for the survival of all living organisms. There has been a steady increase in the demand for water resources projected to register a much higher level than the availability of water resources. Though India receives rainfall above the world average its distribution is erratic and varies across regions and much of the quantum of rainfall drains in to the seas and oceans. Many parts of our country reel under severe drought while many parts experience floods. Out of the country's total geographical areas of 329 million hectares, about 45 million hectares are flood prone and the area prone to drought is not insignificant. Though India is known for its ancient farsightedness in water conservation knowledge, there has been increasing incidents of excessive, irrational or misuse of these vital resources in recent times. Moreover, Agriculture is the backbone of Indian economy which uses the highest amount of water for irrigation. Development of water resources helps flood control, improves irrigation, ensures adequate drinking water supply, makes possible hydro power generation and helps industrial uses.

Hangaragi.S.S (2011) study revealed that rainwater harvesting systems offer many advantage for water collection. A system can often be adapted to fit locally available Skills, Materials, and Patterns of rainfall and water consumption. The costs of catchment systems are often low relative to other alternatives of catchment systems that can be installed incrementally, reducing high initial costs. The water harvesting structures of various types are known by different names in the country such as farm ponds, small earthen dams, irrigation tanks, stop dams, etc. Rain water harvesting is the only way to solve water scarcity.

Objectives of the Study

Following are the objectives of this study:

- To make a detailed analysis of Availability & uses of water resources.
- To study about the relationship between water resources and economic development.

Research Methodology

Research Methodology is a primary need of any research and plays a pivotal role in it. It is a blue print of the research. Hence planning of a research work in advance is done to carry out the research work systematically.

Research Design

Research design involves use of systematic method and procedures for exploring the required information. It constitutes a blue print of the whole research process. It is expected that the research design must provide an arrangement of conditions for data collection and analysis with optimum scientific accuracy and relevance to the purpose of research, so that the enquiry yields clear and the most unequivocal answer possible in as 'practically resource efficient ways' as possible. The choice of research design depends mainly on the purpose for which the research is conducted. The research design for the present study is descriptive and diagnostic.

Management of Water Resources

The economic wealth can be measured at the national level in term of Gross National Product, as index of the monetary rating of the economy often expressed as GNP per capita. There are also good measures of the water resources of nations. The human development index (HDI) of the United Nations Development Programs attempts to express wealth in a broader context, a ranking involving many social and economic factors. The key role, water plays in human development well accepted by all nations. Human Development however should consider as an important contributor to the adequate management of water resources. The win-win situation can only achieved if the link between the two aspects understood and if this understanding is relates into integrated policies and programs. The term development indicates the progress, but the concept of Human Development used to focus on the ends rather than the means to achieve it. Water is the basic and most important component of Human Development.

The most fundamental role of water in economic development is its use for domestic purpose; use for drinking, personal hygiene and other domestic purposes constitutes a primary component of economic and social welfare for developing country. Improvement in water Supply is the most important individual factor in controlling diseases and improving living conditions. The extent of health benefits is therefore likely to increase when water supply

improvements combined with other programs, including public education designed to modify behavior in such areas hygiene. Domestic water supply serves as a basic component of welfare in its role as a direct consumer commodity, it also functions as an element of economic infrastructure. Existence of an adequate domestic water supply is a factor of community stability than can affect the success of many of the other components of development. The capacity of a city to support its population and economic activity related to adequacy of water supply. The success of all economic activities depends on a variety of other factors as well, but water supply inadequacy can be significant constraint.

In India, the total utilizable water resource is assessed as 1123 BCM. Keeping a provision of about 71 BCM/yr out of 433 BCM of groundwater, 362 BCM/yr of the resource is estimated to be available for irrigation. The net draft of groundwater for irrigation is around 150 BCM/yr. The per capita availability of water at national level has been reduced from about 5177 cubic meters in 1951 to the estimated level of 1,820 cubic meters in 2001 with variation in water availability in different river basins. Given the projected increase in population by the year 2025, the per capita availability is likely to drop to below 1,000 cubic meters, which could be labeled as a situation of water scarcity (GOI, 2006). India has a highly seasonal pattern of rainfall, with 50% of precipitation falling in just 15 days and over 90% of river flows occurring in just four months. A total storage capacity of 212.78 Billion Cum (BCM) has been created in the country through major and medium projects. The projects under construction will contribute to an additional 76.26 BCM, while the contribution expected from projects under consideration is 107.54 BCM. The total availability of water in the 76 major reservoirs was 109.77 BCM at the end of the monsoon of 2005 (GOI, 2006). The irrigation potential of the country has been estimated at around 139.9 mha without inter-basin sharing of water and 175 mha with inter-basin sharing. The Central Ground Water Board (CGWB) has estimated that it is possible to increase the groundwater availability by about 36 BCM, by taking up rainwater harvesting and artificial recharge over an area of 45 mha through surplus monsoon runoff. Thus, the groundwater availability may correspondingly increase. The recent estimates (GOI, 2006) on water demand are made by a) Standing Sub-Committee of the Ministry of Water Resources (MoWR) and b) the National Commission for Integrated Water Resources Development (NCIWRD); their estimates (shown in Table 1) are made till the year 2050. Both of them have triggered warning bells on the intensity of the problem. The estimates by MoWR indicates that, by year 2050, India needs to increase by 5 times more water supplies to industries, and 16 times more for energy production, while its

drinking water demand will double, and irrigation demand will raise by 50 percent.

Table 1. Water Demand (in BCM) for various Sectors:

Table 6.1.1 Projected Water Demand in India (By Different Use)									
Sector	Water Demand in BCM(Billion Cubic Meter)								
	Standing Sub-Committee of MOWR			NCIWRD					
	2010	2025	2050	2010		2025		2050	
				Low	High	Low	High	Low	High
Irrigation	688	910	1072	543	557	561	611	628	807
Drinking Water	56	73	102	42	43	55	62	90	111
Industry	12	23	63	37	37	67	67	81	81
Energy	5	15	130	18	19	31	33	63	70
Other	52	72	80	54	54	70	70	111	111
Total	813	1093	1447	694	710	784	843	973	1180

Source: Basin Planning Directorate, CWC, XI Plan Document.

Report of the Standing Sub-Committee on "Assessment of Availability & requirement of Water for Diverse uses-2000"

Note: NCIWRD: National Commission on Integrated Water

Resources Development BCM: Billion Cubic Meters

MOWR: Ministry of Water Resources.

The water resources are limited in India, but growing demand of water due to increasing population, urbanization and industrialization: India is facing water stress. In water resources, due to contamination of treatment facility it is often difficult to get safe drinking water. India currently stores only 6% of its annual rainfall or 253 cubic meters, while developed nations store 250% of annual rainfall water. Nearly 15% of food production is being produced using ground water resources in India. India's multidimensional water development has contributed significantly to the promotion of the country's economic growth. Rapid growth of irrigation and hydropower generation in last decade accelerates the economic growth of country. In India only 33% population have access to clean drinking water. The problem is mostly contributed to a lack of government planning and extreme amounts of human wants.

Conclusion

The government plays a crucial role in safeguarding access to adequate quantity of acceptable quality water for sustaining livelihoods, human well-being, and economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.

Water resource development as a mechanism for stimulating economic growth arises from that all economic activities requires at least a limited supply. Many nations have employed water development as a primary mechanism to expand frontiers and stimulate economic growth to underdeveloped regions. Water resources development can contribute to economic growth during both construction and operational stages. Since many water projects are large public works under takings, construction create employment opportunities and therefore may be used to address conditions of high unemployment. Project construction may generate significant economic activity through a variety of direct and indirect effects. Expansion of water availability, particularly in the form of reservoirs, has substantial potential to stimulate growth in economic activity associated with recreation due to significant role of water in many recreational activities. Water supply enhancement also stimulates a wide range of industrial activities and growth in agricultural production. Water resources development attracts private investment in economic activity. The potential for water development to stimulate economic growth exists in all nations, the manner in which water resources considerations are incorporated into growth process is different among alternative political system. In case of India, water resource development is owned by public sector, major decisions concerning water resource development and economic growth are made by government.

Efforts towards provision of water for drinking and sanitation, water productivity in agriculture, industry and energy, environment, and reduction of floods and drought should be undertaken by all states and expect their water managers to use the SDGs as objectives in water resources management. This means that our planning and management proposals need to be able to quantify the impacts of possible plans and policies in terms of the SDG targets as well.

The government can address many of these issues and hence “good governance” is necessary for good water management. An insufficient institutional setting and the lack of a sound economic base are the main causes of water resources development project failure, not technical inadequacy of design and construction. This is also the reason why at present much attention is given to institutional developments and governance in both developed and developing regions and countries. Similarly, people should be made aware of their water usage patterns and be asked to optimise their habits so that this process becomes a people’s

movement and their participation is secured. This will ensure that effective water management does not remain a distant dream and is truly realised.

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