

Water Management and Sustainable Ecosystem

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KEYWORDS

Water, Scarc Resource, Sustainable Development, Efficient and Eco Friendly Management

WATER MANAGEMENT AND SUSTAINABLE ECOSYSTEM

1. Water is an important resource for the development and growth of society.
2. Increasing need due to population growth, urbanization and industrialization create water crisis in the country.
3. Effective and Efficient management of water is emerging as an important tool to resolve various issues.
4. Water is a natural, inevitable and scarce resource. It is not possible to increase or produce but can be well managed by various methodology and approach.
5. Sustainable development means, "The development that meets the needs of the present without compromising the abilities of future generation to meet their own needs".
6. Water management is the process of determining the need of water for various purposes and planning efficiently with available source and also balancing ecosystem.
7. Objectives and Methodology of water management
8. Various alternatives for better planning and to minimize the use of water resources
9. Challenges ahead
10. Use of SWOT analysis to find out final methodology
11. Conclusion

INTRODUCTION

Sustainable development and efficient management of water is an increasingly complex challenge in India. Increasing population, growing urbanization, and rapid industrialization combined with the need for raising agricultural production generates competing claims for water. There is a growing perception of a sense of an impending water crisis in the country.

Water is the key to development and substance of all communities. Under conditions of increasing stress on this essential renewable but scarce natural resource, "Effective and Efficient Management" of water is emerging as an urgent contemporary issue.

Water has been called the bloodstream of the biosphere because of the way it connects distant places. In our human dominated world, water also connects people who live in different places, and these connections bring opportunities and conflicts. In many densely settled agricultural watersheds, water quantity is a point of conflict.

HISTORY OF WATER MANAGEMENT

Pre-Independence era:

Access to water for all people was considered a primary need and given priority in governance during the pre-colonial days. Wells, tanks and other water bodies were created and managed by people themselves with their traditional knowledge.

The present sovereign power over water bodies and rivers is a concept introduced by British rulers and it prevented communities from participating in preserving the water bodies for their proper use.

More than 32 Central Acts enacted by Parliament and two national water policies, 1987 and 2002, have been drafted. Consequently, a natural resource has become a legal subject resulting in the common public expecting schemes and projects from the Central and State governments for maintenance, renovation and reconstruction of tanks, ponds.

Post-Independence:

The planned development of irrigation sector started in a big way since the First Five Year Plan and implemented till Eleventh Five Year Plan. The Twelfth Five Year Plan (2012-17) focus on inclusive growth. It also Expected to meet the development of India's Agriculture, Education, Health and Social Welfare. Thus, it also emphasis on efficient water management and making efforts for Sustainable Ecosystem by facilitate the judicious supply of clean drinking water and to meet the Agriculture demand and as a whole social welfare of the people.

WATER – A NATURAL RESOURCE

World's Water resources – Some important facts

- ❖ 97% of the World's water resources are present in oceans. The remaining 3% of the water resources are present on land.
- ❖ Out of the 3 % of water available on land, 2% is on ice caps which cannot be utilized. The remaining 1 % is only the available usable water on land.
- ❖ 97% of the available fresh water on earth is groundwater.
- ❖ India has 16% of world's population while having only 2% of land and 4% of fresh water resources.

Agricultural Water Use

- ❖ 43% for irrigation to net sown area
- ❖ 23 to 50% overall efficiencies of irrigation projects
- ❖ Inequity in availability of irrigation water
- ❖ Water logging problems in about 10% canal irrigated area
- ❖ Low average crop yields due to improper use

WATER NEEDS AND PRESENT SCENARIO

Urban:

The urban water supply and sanitation sector in the country is suffering from inadequate levels of service, an increasing demand-supply gap, poor sanitary conditions and deteriorating financial and technical performance.

Transmission and distribution networks are old and poorly maintained, and generally of a poor quality. Water is typically available for only 2-8 hours a day in most Indian cities. The situation is even worse in summer.

Rural:

In the rural localities, irrespective of the existing social diversities, water is regarded as a gift of nature made available to mankind for fulfilling the basic needs for survival.

The resources are further classified into categories such as surface water, ground water, rainwater etc., further identified via their sources such as river, lake/pond, well and others.

The main issues are availability of potable water, purification of water, cleanliness of water bodies and effective water distribution network.

USES OF WATER

Agriculture and Irrigation are related to each other whereas growth of agriculture is always needed to build a strong, self sufficient and economically develop nation and to achieve maximum growth of an agriculture, irrigation is absolutely necessary.

In the ancient civilization during the growth of mankind, men had started growing food grains with the help of naturally available resource. i.e. land, rain water, pond, etc...Further, men had invented various techniques and methodology to increase the production of food grains, vegetables, etc... to suffice the growing need of population. For the country having about 1.23 billion population, it would be a great task to provide clean drinking water and to mitigate other demands.

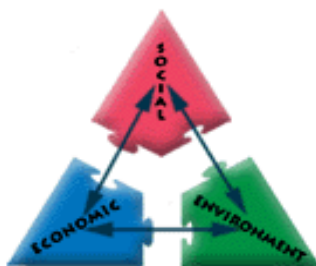
For effective growth of agriculture efficient water management is absolutely necessary. Further to achieve sustainable ecosystem, we have to plan in such a manner that, the growth of agriculture will not affect the surrounding environment and at the same time one has to keep in mind that the growth will be sustainable along with sustainable ecosystem.

SUSTAINABLE DEVELOPMENT

The term sustainable development (SD) means a pattern of resource use that aims to meet the current human needs, while preserving natural resources and ecosystems on which the current and future generations depend.

Further it can be defined as *"The development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*

People concerned about sustainable development suggest that meeting the needs of the future depends on how well we balance social, economic, and environmental objectives or needs when making decisions today.



Services Household Needs Industrial Growth Agricultural Growth Efficient Use of Labor	Equity Participation Empowerment Social Mobility Cultural Preservation	<u>Biodiversity</u> <u>Natural Resources</u> <u>Carrying Capacity</u> <u>Ecosystem Integrity</u> <u>Clean Air and Water</u>
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Many of these objectives may seem to conflict with each other in the short term. For example, industrial growth might conflict with preserving natural resources.

Although many definitions of the term sustainable development (SD) are in use, in simple terms, SD is a pattern of resource use that aims to meet the current human needs, while preserving natural resources and ecosystems on which the current and future generations depend.

WATER MANAGEMENT – WHY?

Irrigation Water Management is the process of determining and controlling the volume, frequency, and application rate of irrigation water in a planned, efficient manner. Water management can be obtained by:

- Provide equitable irrigation water for optimum growth
- Manage soil moisture to promote desired crop response.
- Optimize the use of available water supplies.
- Minimize irrigation induced erosion.
- Decrease sources of pollution of surface and groundwater resources.
- Decrease salts in the crop root zone.

For any kind of system to run efficient management is required at micro & macro level. Irrigation management consist of working out the crop water requirement of the command area assuming availability of water and evolving the schedule of resulting water in such a manner that equitable distribution up to tail end of canal can be achieved.

Before planning, one has to think about land use pattern, type of majority crops, probable average rainfall in the catchment area, overlapping season and other important use such as drinking water supply, industrial supply, etc...

Water management is nothing but using water resource efficiently with available sources and also balancing ecosystem without disturbing natural resources.

FUTURE WATER REQUIREMENTS

To build a strong, self sufficient and economically developed nation and to achieve maximum growth from agriculture - irrigation is absolutely necessary. Further to achieve sustainable ecosystem, we have to plan it without affecting the surrounding environment.

Table – 1. Future water requirements for various sectors. (Billion cubic metres)

Use	Year		
	2000	2010	2025
Domestic	34	66	101
Irrigation	605	675	637
Industry	42	92	161
Total (BCM)	681	833	899

(Source: Ministry of Water Resources, Government of India, 2003)

OBJECTIVES

The objective of “Water Management In India-2013” conference to help understand new policies, and updates on National Water policy, increasing water use efficiency by 20% bring policymakers and stakeholders on a single platform, understand existing and potential opportunities under PPP and other possible solutions.

- ❖ To encourage citizens to save water by organizing awareness campaigns.
- ❖ To encourage people's participation at micro level.
- ❖ To encourage people to promote traditional storage of water and helping them financially.
- ❖ To make Mega plans to harvest rainwater by adopting the latest technology and by enacting certain policy decisions.
- ❖ To assess the scope of privatization to manage resource professionally and to avoid local hindrance.
- ❖ To encourage citizens to save water by organizing awareness campaigns.
- ❖ To encourage people to promote traditional storage of water and providing financial help.

METHODOLOGY

- ❖ Irrigation improvement
- ❖ Introduction of RWS (Warabandhi)
- ❖ Changing the crop pattern, alternative crops, cash crops
- ❖ Use of soil health card and find out soil efficiency
- ❖ Using additives for improving soil health and efficiency
- ❖ Technology up-gradation in agriculture including Micro-Irrigation
- ❖ Reuse of drainage water
- ❖ Mandatory Rainwater Harvesting
- ❖ Exploitation of saline waters
- ❖ Separation of grey/black waters

Agricultural practices to match with lower water availability while maintaining productivity.

Soil and water management practices

- ❖ Rainwater harvesting and storage
- ❖ Water harvesting - direct collection of rainwater which can be stored for use or can be recharged into the groundwater.
- ❖ Re-cycling of drainage water
- ❖ Use of effluent and waste water
- ❖ Soil and water conservation systems

Increased use of drip and sprinkler irrigation

- ❖ Uniform water distribution
- ❖ Efficient water use
- ❖ Easy installation, operation and maintenance
- ❖ Decreases risk to drought

Other conservation techniques

- ❖ Re-cycling of water
- ❖ Dry land farming techniques
- ❖ Improved watershed management

Irrigation improvement:-

Suggestion on modernization of existing Irrigation systems with better operation and maintenance, rationalization of water rates, techniques for equitable water distribution, night irrigation, dynamic regulation through decision support system, computer use, information technology and advanced methods of communication have emerged at various forums. Inadequacy and uncertainty is being tackled through inter-basin transfer of water. It is slowly becoming a reality. Participatory Irrigation Management (PIM) could play a very effective role in irrigation management.

Green-blue water integration:-

Green water (water stored in soil) constitutes about 50 % of the total water resource. While too much emphasis is placed on the development and use of blue water (fresh water), not much attention has been paid to green water. The increased efficiency of green water in itself can raise the productivity of irrigated lands.

Reuse of drainage water:-

Not long back drainage waters were treated as wastewaters. Analysis of water samples from surface drains showed that water in these drains during monsoon season is of good quality and it can be used in agriculture without affecting the land resource or the crop yields. Fortunately for the nation, farmers are quite conscious of this fact and this source is being exploited to the hilt. It is very encouraging scene to see the farmers pumping water from the drains, borrow pits and depressions to irrigate their fields.

Multiple use of water:-

We have discussed the issue where water released from one sector after first use would be used in agriculture. However, multiple use of water within agriculture sector should also be implemented to enhance water productivity. For this purpose non-consumptive and consumption activities needs to be identified.

Separation of grey/black waters:-

Grey water is the water On-Farm Land and Water Management released from washbasins, kitchens and bathrooms etc. This water is relatively of good quality and could be used to irrigate lawns/kitchen gardens. On the other hand sewage water is black water. The day is not far off when we would need to separate grey and black waters to reutilize grey waters to minimize the disposal related problems.

Technology up gradation in agriculture:-

Researches in water management have shown many areas, where water could be saved without detrimental effect to crops. It could be achieved through deficit irrigation as well as by crop diversification. Switchover from high water requiring crops to low water requiring crops could save a major fraction of water in agriculture. Application of resource conservation technologies such as land leveling, zero tillage, bed and furrow planting of wheat, dry or semi-dry seeding of rice could save water. Improved irrigation techniques such as drip and sprinkler can save water as well as result in higher productivity.

ALTERNATIVES

❖ Inter-Basin River Linkage

❖ Pre-Treatment Program

Publicly owned treatment works collect wastewater from domestic, commercial and industrial facilities and transport it to treatment plants before it is discharged.

❖ Subsidized Micro-Irrigation

❖ Mandatory Rainwater Harvesting

❖ Community-Based Watershed Management

Local communities are implementing several techniques of watershed development, to increase water levels and enhance productivity of crops.

❖ Recycling

❖ Conservation

Micro irrigation - Drip and Sprinkler

CHALLENGES

❖ Water Scarcity

- Agriculture is the largest user of freshwater.
- Now, at the end of 20th century, an estimated 26 countries with a population of more than 300 million people suffer from water scarcity. Projections for the year 2050 show that 66 countries with about two thirds of the world population will face moderate to severe water scarcity.
- The finite supply of water can be augmented by reducing consumption, and recycling and reusing waste water.

❖ Lack of accessibility

❖ **Water Quality Deterioration**

- Industrialization and urbanization have produced large volumes of effluent waste water, discharged in many cases into water ways which carry fresh water supplies into communities.
- The projected mega –cities and rapid industrialization world- wide have only accelerated problems such as inadequate waste treatment.

❖ **World Peace and Security**

- All this directly effects the economic and social development of a society, undermines political stability, and threatens global security.

❖ **Awareness by Decision Makers and the Public**

- Water availability is taken for granted by the public
- Similarly, political leaders are largely unaware of the present dimensions of the impending water crises in many countries.
- Requires long term and lasting solutions beyond the short term mandate of political leaders and decision- makers.

❖ **Decline of Financial Resources Allocation**

- Right now, funds for operation and maintenance are in limited supply, with existing schemes in dire need of repair and replacement.

❖ **Fragmentation of Water Management**

- At national level, the water management is divided among hundreds or thousands of jurisdictions, municipalities and the private sector; or worse, left unattended.
- This institutional chaos has led to competition among users, conflicts, duplication of efforts and contradictory policies, plans and actions. Consequently, this has perpetuated wastage of resources, and usage deficiency.

The major challenges that were found in the literature and are applicable in the urban domestic sector are presented below.

Education and training:-

There is lack of education among professionals in the water sector especially in issues regarding WM. Most of the older professionals that have key places in utilities are oriented in the supply side approach. So WM is neglected not because it is not applicable but because the decision makers are not completely aware of its purpose and benefits compared to the traditional supply side approach.

There is also lack of education to the consumers about the benefits of water conservation, water efficient appliances and environmental issues. Without having knowledge in issues like that the public cannot be engaged in doing something that will require effort and financial resources as WC.

Institutions:-

In some cases the institutions that are dealing with water issues are old and are operating under yesterday's policies and philosophies. There is also the issue of multiple institutions with no collaboration and lack of communication.

Legislation:-

A government cannot rely on the utility's "good will" for the protection of the environment and the consumers. It is also important to have regulations about the responsibilities in the water sector. The government must place policies laws and regulations to ensure that the water supply sector is operating efficiently effectively and promotes the interests of the consumers. This includes the protection of the environment and ensuring the sustainable development.

Funding:-

WM is a process that needs planning and implementation. For both of these steps funds are necessary to conduct the proper research and measurements, to develop the most appropriate program, to provide incentives to the consumers and purchase of hardware that is needed for the program. Although a WM program can be financially beneficial in the long term funds are needed at the first steps to design and implement the program.

Many places the situation is different. Funding for the water sector is based mostly on subsidies resulting in low budgets and declining infrastructure. There is a belief that water is a free good and anyone should use as much as he needs with low cost. Although water is a social good the costs for the production have to be recovered.

Level of implementation:-

Although it was shown that WM has several benefits to all parts of the society it has to be decided the level of the implementation of such programs. "The challenge today is to integrate demand management into long-range water supply planning to achieve an appropriate balance between capacity expansion and demand management". The reduction in demand has limits and development of new sources is sometimes necessary.

Alternative technologies:-

There are various alternative technologies that could be part of a WM program. Examples are in-house wastewater reuse and rainwater collection. Although this kind of technologies can reduce water consumption there are limitations that prevent their application in WM programs. These limitations are mainly public acceptance and not appropriate technologic solutions developed for the local context.

There is a belief that although grey water re-use has financial benefits, it is not socially acceptable, hygienic or environmental friendly.

Few other Challenges are listed below:-

- ❖ Changes are happening ever more rapidly
- ❖ Land management is becoming much more complex
- ❖ Research is difficult at the scale of management
- ❖ Incentive system for continued monitoring

SWOT ANALYSIS

By Systematic study of “**S**trength, **W**eakness, **O**pportunities, **T**hreats (Challenges)” we can analyze the whole issue and conclude the final methodology.

CONCLUSION

If we are not properly analyzing the present scenario of water resources available and the present and future need then we cannot plan efficiently to suffice the future need. Water management is very important for the country for the such a large population with variety and diversity. For effective growth of agriculture efficient water management is absolutely necessary without affecting the surrounding environment.

Thanks