International Conference on Swaraj Native Models of Self Governance

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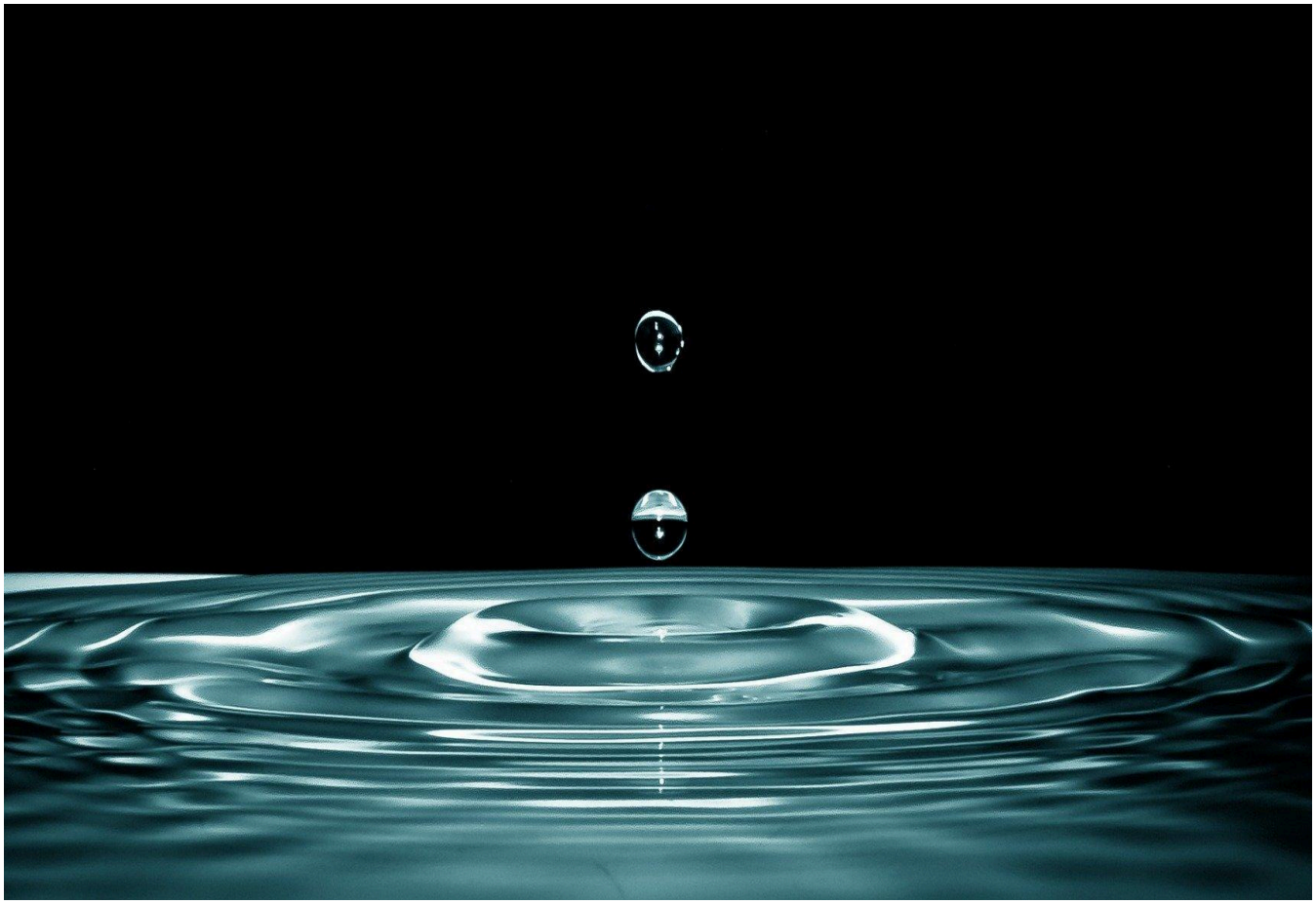
Research Paper on review of "Water Management Policy" &

"Traditional Water Management System" adopted in India



Abstract:

Panchamahabhootas which is consisting of five elements of the nature such as Air, Water, Space, Earth, and Fire, holds Water as the highest amongst them. As per ancient Indian literature comprised of Veda (s) and Upanishad (s) water has spiritual, medical, poetical, philosophical, and cosmological essence attached to it. Water being a critical natural resource if not managed well through a prudent strategy can lead to severe crisis in the future. Due to unprecedented rise in population, changing scenario in economic activities followed by climate change, available water resources facing severe pressure worldwide. Today, the changing world order forcing leaders to redraw their strategies on water management policies to safeguard the basic human rights of the citizens to avail water. India has national as well as state level water policies to cater to the future challenges owing to water management. Irrespective of the fact that India has well-intentioned water policies in place, their 100% realization is yet to be seen which is forcing both the Central as well as different State Governments to adopt new strategies in a time-bound manner to face the future challenges in water management. The present paper aims to review the water management policy adopted both at national as well as state's level and the challenges involved in implementation. This paper will also do a detailed analysis of alternative water resource management strategies like the Rainwater Harvesting System, Traditional water harvesting models.

Introduction:

India has a high dependence on "Rain Fed Rivers". Hence it is more important that we harvest what is available but going to waste. As an example my home state Odisha although blessed by 11 major rivers, still faces the problem of water scarcity after the winter months. Most of India has a very high dependence on a good monsoon for the fulfillment of its water requirement. 78% of the rainfall happens only between June and September of any year. Any variation in the rainfall causes substantial stress on the existing water resources. Owing to lack of water management, intense pumping, rainfall deficit in the last few years have fueled the groundwater depletion in most part of our country. A decline in groundwater level to the tune of 6.71% between 2009 and 2017 in my home state Odisha raises an alarming bell which was mostly contributed by overexploitation of groundwater along with frequent dry spells between these years (Government of Odisha, Department of Water Resources,2019), which even holds true for some of the states in India . National Water Policy (NWP)2012 states that "Special emphasis should be given towards mitigation at the micro-level by enhancing the capabilities of communities to adopt climate change resilient technology option" (NWP-2012, Para 4.1. Rainwater Harvesting renovation method, water allocated for irrigation purposes, storage of rainwater during monsoon, use of water for utility purposes need a thorough review and necessary implementable action . In this regard, it makes all the more important to have a better water management strategy in place to have a long sustainable model for groundwater recharging in the country.

The paper will try to find an answer to some of the main research questions on What can be the best suitable alternative water resource management strategy adopted by the Government of India to face the future challenges in the water-stressed districts of various states followed by what methods can be adopted to make decentralized institutions like Panchayats, municipalities effective partners in the management of water resources ensuring

fixed quantum of supply of water for irrigation and drinking purposes through community-based association?

The paper will also delve deep into finding answers to the below sub research questions which are critical while drawing future strategies on water management.

A) **Is there any state water policy in place to look exclusively into alternative water resource management? If so, does the policy is in line with the national water policy and able to achieve the desired objective?**

B) **What are the reasons for the low success rate of the existing policy?**

C) **Is there any success story from within India on the Rainwater Harvesting system in any Indian which can be adopted for future prospective?**

D) **What steps need to be taken to improve and sustain groundwater levels and how do we buy people's involvement for a community-based execution of the policy?**

E) **Why the findings on Rainwater Harvesting Model need to be studied very closely to adopt a future sustainable model in both urban and rural areas of the water-stressed districts of most of the states?**

F) **Are there any traditional means of water harvesting which are being employed in other regions of the country?**

G) **Are there any historical references that can be relevant in the present context on artificial groundwater recharging?**

H) **Can TERAFIL water filtration technology developed by CSIR be adopted in flood prone or mining prone areas of our country for availing pure drinking water?**

Literature Review:

The objective of the Literature review was to view the findings on alternative water resource management and its successful implementation which can be replicated or based on the

findings if a new strategy can be drawn to meet the future challenges in the water-stressed Districts of various states in India .The literature reviewed was broadly centered around the water policies of the Government of India .Rainwater Harvesting Systems (RWHS), traditional harvesting systems, critical analysis over the schemes on Rainwater Harvesting Systems floated in any state .

All the National Policies on the water since 1987 highlighted the fact that apart from making farmers aware of proper use of groundwater for irrigation followed by co-ordination with agriculture department for promoting suitable cropping pattern which would help efficient and equitable use of water, artificial recharge of groundwater including Rooftop Rainwater Harvesting can be encouraged as an alternative measure.NWP-2012 states that the future will depend on demand management of water. It highlighted the need to adopt a new strategy for direct use of rainfall, desalination & avoidance of inadvertent evapotranspiration.

Document on Jal Shakti Abhiyan which was launched in the year 2019 under the new Jal Shakti Ministry of Central government to provide potable water to each household in the country states that it will be the joint venture of state government, central government and citizen of India where state District Administration will make District Water Conservation Plan in water-stressed districts.
Findings and suggestions from primary sources taken by India Water Partnership (GWP-India) highlighted over-drawl of water by the agriculture sector due to increased cultivation of water-intensive, even water-guzzling crops which take place during periods of drought, low canal water use efficiency, almost negligible interaction of engineers with farmers, lack of coordination among different departments leading to groundwater depletion.

Studies on the 20 most popular traditional methods of water recharging systems which were implemented successfully at different states across the nation in the past found a mention on TheBetterIndia digital platform were also reviewed .

Objective:

The objective of this paper is to study the National Water Policies to understand the progress made so far about alternative water resource management strategy. The main objective of this paper is to analyze Rainwater Harvesting model and other traditional water harvesting

model which can be taken into consideration by the water-stressed districts of our country to ward off any crisis in the future. This paper will also study how the RWH model is being implemented across the globe to meet future challenges. In addition the paper is intended to see a revised water policy of the states in line with the recently launched scheme by the Government of India which is aiming to provide Public disclosure of groundwater data/information and reports, Preparation of Community-led Water Security Plans, Public financing of approved Water Security Plans through the convergence of ongoing/new schemes, Adopt practices for efficient water use thereby looking for Improvement in the rate of decline of groundwater levels (GOI- AtalBhujalYojana,2019).

Methodology:

In line with the above mentioned objective a methodology was adopted on the basis of Primary and well as Secondary research .A review on traditional systems of water harvesting was done. A study on the highly acclaimed "Catch the Rain" campaign launched by the Ministry of Jalshakti Mission was completed. The data received from the case study on quantification of recharge from the Rainwater Harvesting structures in two villages named Srirampur and Nachhipur villages located in Nayagarh district which is identified as the water-stressed district by Niti Aayog are analyzed for further studies. Findings on the rising water table depth in dug wells located within the command area during the monsoon season (Sethi R R, 2020) are also considered.

Background history upon taking research work on alternative water management policy in India :

A visit to two tribal villages named as Govasala and Bagua in the district of Jajpur,Odisha way back in 2016 led me to go for a research on water management as a subject apart from my regular work .My advance management course in Public Policy embolden my desire to go for deeper studies on the same . During my visit to above mentioned villages which was followed by an interaction with the tribal communities there ,I came across with a startling revelation on water which changes its color within 5 minute and they were drinking such water which led to malnourishment in that area posing serious health hazards. After returning from those locations, I had a detailed discussion with Dr Vikash Jena, a senior scientist working in IMMT (CSIR), Bhubaneswar on "Terafil Water Filtration Technology"based filter used in flood prone areas so that people in emergency can have pure

water .Suggested the community to use this Terafil low cost filter as an immediate measure .Below is the picture depicting the situation in those villages followed by the Terafil filter briefing by CSIR.

Pic Ref: Visit and interaction with the community in Bagua and Govasala village ,Jajpur ,Odisha

TERAFIL Water Filtration Technology

1. Application :

TERAFIL is a low cost burnt red clay porous media (disc/candle), used for filtration & treatment of turbid raw water into clean drinking water for domestic/ community applications. Suspended particles, sediment, iron & many heavy metals, micro-organism, colour & bad odour etc are separated from raw water effectively during filtration, without clogging the core of the TERAFIL. It can be fixed with any container for purification of water. Quality of product water is within BIS limits, especially for turbidity, iron & micro-organisms. Cost of purification is within Rs.2/- per ton of product water, considering total cost of plant. It operates without electricity, spent water and sludge management. Average life of TERAFIL media is five years. 1 to 50,000 lit/day capacity filter/plants is available for domestic, online & community applications.

2. Raw Materials:

Pottery clay, sand & wood saw dust for preparation of TERAFIL media (disc/candle).

3. Process Features:

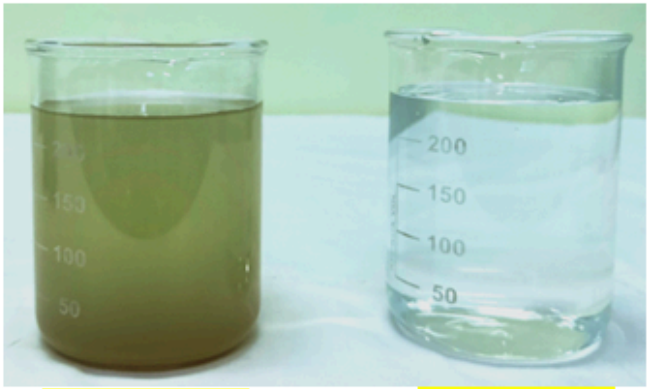
TERAFIL is prepared out of a mixture of sand, red clay & wood saw dust. Terafil media comprises of thin clay walls (clay membranes) and each clay wall separated by large size pores. The thin clay walls contain ultra-fine capillary openings (sub-micron in size) which bridge the pores. Raw water flows from one pore to anther through capillary openings during filtration in Terafil media, leaving behind sediments, suspended particles etc on top surface of Terafil. Terafil helps for effective filtration & treatment of raw water into clean drinking water. Terafil is fitted at the bottom of any container for filtration and treatment of raw water.

Terafil Water Filtration Technology

Pottery clay, sand & saw dust | Terafil Disc | Pore Size: 0.2 µm

SALIENT FEATURES

- Turbidity removal : > 99 %
- Iron removal : 90-95%
- Life cycle : > 03 Yrs
- Low cost : 03 paisa/liter
- Capacity : 50-100000LPD
- Electricity not required
- User friendly
- Green technology
- Zero water wastage



RAW WATER | FILTERED WATER

Pic Ref: IMMT (CSIR) ,Bhubaneswar Terafil Water Filter

Highlights on Past and Present Water Management Models:

(A) Historical background of Rainwater Harvesting (RWH):

Archaeological findings in many parts of the world reveal that since the prehistoric period people used to use rainwater for their domestic use and it was the main source for potable and non-potable use. During that period Rainwater Harvesting was considered to be most important for their living. In India, the collection and storage of rainwater for domestic and agricultural uses have also been very common in the past. The archaeological findings also reveal that there were specific hydraulic structures for the harvesting and storage of rainwater implemented in different villages, cities and palaces in different regions in the past which used to cater to the water need of the people. There were findings on several Greek cities where rainwater was harvested through open spaces on the roofs, yards, and other open spaces into covered cisterns for storage and future use, to meet their daily water needs. Numerous cisterns of the Classical and Hellenistic era have been found in private or public buildings all over which were usually flat, pitched or vaulted roof, always coated with impervious material, and either built at ground level or carved deep into the earth, so as the harvested water could be kept cooler and thus more palatable, with its temperature constant. Many of them were multi-sectioned for water filtration. Their dimensions depended on their private or public use and the needs that had to be covered. Research on Roman private and public buildings reveal the inclusion of cisterns, similar to those in Minoan palaces or Classical/Hellenistic constructions. They were usually located under paved courtyards, to collect rainwater and increase the water available from the city's aqueducts. Moreover, Roman rich houses and villas used to have shallow, oblong uncovered tanks, located on the ground, in the middle of the atrium, called an impluvium, in which rainwater was gathered from the ceiling, and particularly from a rectangular hole in the roof, known as a compluvium, to be available for household use or even for irrigating small gardens (Yannopoulos et al, 2019).

(B) Examples of Rainwater Harvesting Models (RWH) across the World:

Today, the development happened in computer technology, hydrological modeling, multi-criteria analysis, geographical information systems (GIS), and remote sensing has made it possible to go for new procedures to identify suitable sites for RWH. Numerous research and applications are being carried out in the following segments which go like (a) the use and management of RWH; (b) the quality of harvested rainwater; and (c) hydrological or economic data for RWH. But the degree of its implementation varies across the globe (Yannopoulos et al, 2019).

There are examples of different countries both developing and developed ones who have promoted measures to install and use RWH systems with financial incentives under a legal

framework. Like in our country India, there are some forms of RWH is mandatory for buildings and houses in various cities and states. Even some of the corporations in India made RWH structures compulsory for building plan approval. In Catalonia of Spain; in Flanders of Belgium; in new buildings of some states of the USA, in many Caribbean islands; in Germany, for newly constructed buildings in Seoul of South Korea; and in Malaysia only for large buildings like factories, schools, or bungalows, among others in some of the Australian states, such as South Australia, New South Wales, and Queensland, where regulations stipulate a new rainwater collection system or alternative water source. These days RWH is extended to the following: (a) larger systems usually used for providing water for schools, stadiums, airports, and so on; (b) collection systems for high-rise buildings in urbanized areas; and (c) land surface catchment systems and stormwater collection systems to prevent the pollution of water sources from roads, industrial sites, and agriculture in many developed and developing nation across the globe (Yannopoulos et al,2019).

RWH is mostly used to supplement conventional systems for non-drinking water purposes such as irrigation, laundry, and toilet flushing in developed countries which includes Japan, Singapore, Belgium, France, Germany, USA, Sweden, Canada, Spain, and so on. In countries like Australia, the collected water also has potable use. In developing countries like Bangladesh, Botswana, India, Kenya, Nepal, Namibia, Uganda, South Africa, and so on, RWH is mainly used to address water shortages for both potable and non-potable purposes.

There are many examples of RWH systems that are having wider acceptance across different countries in the world. One of the most successful examples can be seen in the cities of Australia where RWH is highly popular. Even in urban areas, RWH systems are being used to complement the main water system where many rural and peri-urban communities completely rely on this. It was found that around 30% of the rural population in Australia use RWH, while 7% use RWH in the capital cities followed by 13% of all Australian households use RWH as their primary source of drinking water. For this reason, the Australian state and local governments adopted a wide range of policies, including subsidies and grants, to provide the installation of rainwater tanks in houses. These incentives vary from state to state, depending on the size of the water reservoir and the purpose of using the collected water.

In South Australia, it was found almost 50% of the population live in houses equipped with a rainwater tank. In the USA, RWH is having a wider acceptance and being used considering it as a serious practice for protecting water resources.

In India, RWH was revived in the year 1960s in response to declining groundwater availability caused by the rapid expansion of irrigation pumping (Yannopoulos et al,2019).Today, many states like Gujarat, Rajasthan, Haryana, Punjab, and Maharashtra have started reviving the age-old method of RWH using new technology. Many big industries like Ambuja Cements Ltd have started promoting the use of RWH as part of their CSR initiatives. The company's technical team enabled the conservation of 60 million litres of water per annum in states like Gujarat, Rajasthan, Maharashtra, Himachal Pradesh and Madhya Pradesh. The analysis made on the above-mentioned data can also be considered while designing a successful RWH model for the state. Successful examples of traditional water harvesting models and the techniques involved there can be analyzed to find the best suitable option for the state of Odisha

(C) Examples of Traditional Methods of Water Harvesting:

Modern India can learn a lot from these traditional models on water harvesting which includes Jhalara, Talab/Bandhi, Bawari, Taanka, AharPynes, Johads, PanamKeni, Khadin, Kund, Baoli, Nadi, BhandaraPhad, Zing, Kuhls, Zabo, Bamboo Drip Irrigation, Jackwells, Ramtek Model, Pat System, Eri. (Pal,2016)

Though there are several versions of traditional water harvesting models, however, some of the models like JOHADS, PANAM KENI AND ERI etc can be taken into consideration by the water-stressed districts in our country. The details against these three above mentioned models are explained below .

JOHADS:

Picture – 1.1
Source-http://www.ecotippingpoints.org/our-stories/indepth/india-rajasthan-rainwater-harvest-restoration-groundwater-johad.htm.

Johads which are of small earthen check dams that capture and store rainwater considered to be one of the oldest systems used to conserve and recharge groundwater. Constructed in an area with naturally high elevation on three sides, a storage pit is made by excavating the area, and excavated soil is used to create a wall on the fourth side. Sometimes, several johads are interconnected through deep channels, with a single outlet opening into a river or stream nearby. This prevents structural damage to the water pits that are also called mandalas in Karnataka and pemghara in Odisha (Pal,2016).

PANAM KENI:

Picture – 1.2

Source: - The Better India,2016

Panam Keni is a special type of well used by the Kuruma tribe of Wayanad to store water. Wooden cylinders are made by soaking the stems of toddy palms in water for a long time so that the core rots away until only the hard outer layer remains. These cylinders, four feet in diameter as well as depth, are then immersed in groundwater springs located in fields and forests. This is the secret behind how these wells have abundant water even in the hottest summer months (Pal,2016).

THE ERIS TANK SYSTEM

Picture – 1.3

Source -The Better India,2016

The Eri (tank) system is one of the oldest water management systems in India used in the state of Tamil Nadu. This system is still widely used in the state, eris act as flood-control systems, prevent soil erosion and wastage of runoff during periods of heavy rainfall, and also recharge the groundwater. Eris can either be a system eri, which is fed by channels that divert river water, or a non-system eri, which is fed solely by rain. The tanks are interconnected to enable access to the farthest village and to balance the water level in case of excess supply. The eri system enables the complete use of river water for irrigation and without them, paddy cultivation would have been impossible in Tamil Nadu (Pal,2016).

These models are cost-effective and ecologically safe systems that can be considered while revisiting our water policies.

(D) Key inputs from Atal Bhujal Yojana :

Atal Bhujal Yojana is a unique, time-bound scheme aimed at sustainable groundwater management with community participation, which needs robust institutional arrangements for successful implementation. A four-tier institutional mechanism at National, State,

District and Gram Panchayat levels with necessary linkages is drawn concerning its successful

Implementation. The primary objective of this Scheme is "to improve the management of groundwater resources in the water-stressed areas of the selected States" (GOI-MOJS,2020). The said scheme is focusing on important activities at the Gram Panchayat level which will include:

(a) Ensuring community participation in planning sustainable management of groundwater,

(b) Development of GP level water budgets and

(c) Preparation of GP-level Water Security Plans (WSPs).

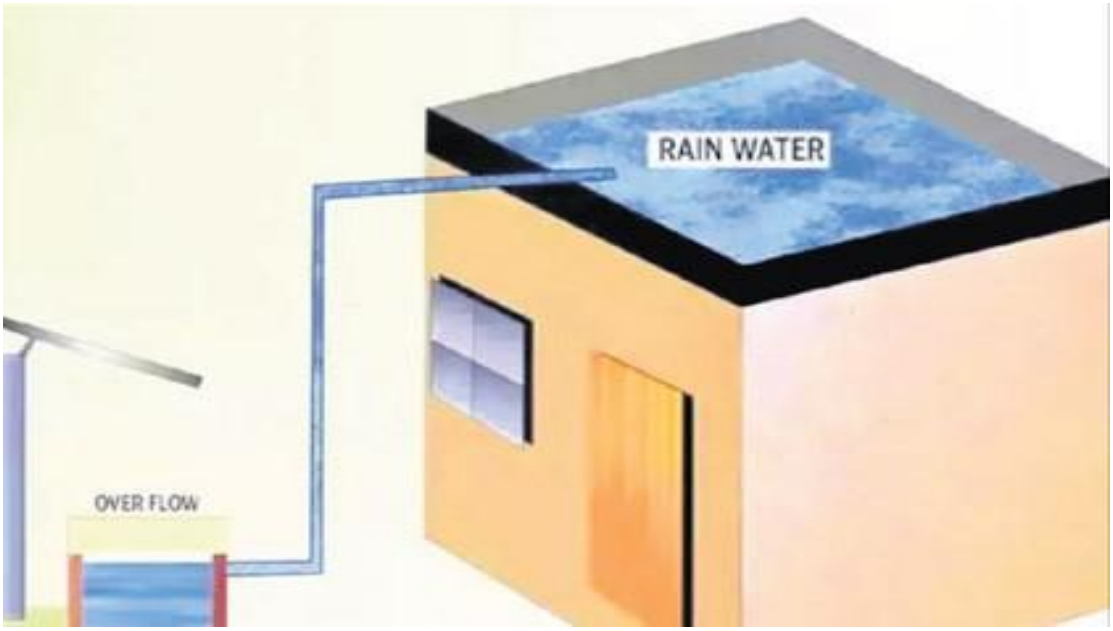
(E) Highlights of Catch the Rain Campaign of Government of India:

"Catch the Rain" campaign was launched by the National Water Mission under Ministry of Jal Shakti, Ministry of Youth Affairs and Sports and Nehru Yuva Kendra Sangathan of Government of India focusing on water conservation and rainwater harvesting. The campaign has a tag line named "Catch the rain, where it falls when it falls".

The plan of action under the "Catch the Rain" campaign includes. Setting up "Rain-Centres" (RCs) or Jal Shakti Kendras (JSK) in all the districts-Collectorates/ Municipalities/GP offices. All RCs and JSK should have a dedicated mobile phone number, trained person in RWH and act as a technical guidance centre of the district. An ambitious goal was set in the Catch the Rain campaign to have an RWH system in all buildings in a district and water flowing out of the compound should be nullified or limited to prevent urban flooding and its consequences.

The activities proposed under the Catch the Rain Campaign needs active participation at the community level such as having Roof-Top RWH system in all buildings, all compounds to have water harvesting pits, new check dams or repairing of old check dams, de-silting of tanks to increase their storage capacity, repairing of traditional stepwells and other RWH systems, usage of defunct bore-wells after making them functional. Identifying unused wells and making them usable to recharge aquifers.

Example on Critical Review of the Findings on Rainwater Harvesting Model implemented in the state of Odisha



Picture – 1.4

To address the issues about groundwater depletion due to overexploitation in the state of Odisha, the Government of Odisha in line with its water policy of 2007 tried some of the measures which need critical research on the success /failure at the implementation level. One such measure was taken in the financial year of 2014-15 where the state government acknowledged the fact that due to rapid urbanisation the scope of natural groundwater recharge gets reduced with each passing day. The Government started exploring options where it can have a strategy to conserve rainwater through Rainwater Harvesting systems. The Department of Water Resources (DoWR) of the State Government intended to adopt Rooftop Rainwater Harvesting Systems in private and Government buildings in all the ULB of the state.

The scheme on RWHS was launched on a pilot basis in the urban local areas of some of the cities including the state capital which are expected to face a shortage of drinking water in the future. The action plan was drawn to cover 550 Government and 16405 private buildings with a period of five years at an estimated cost of around 100 crores. The eligibility criteria for the private buildings were also decided based on their roof areas which were less than 200 sqm and not having more than three floors. There was also a provision for payment subsidy to owners of such private buildings up to Rs 45000 or adoption of the RWHS. The action plan was drawn to meet the objective of augmenting the groundwater recharge,

improving the water table and water quality conditions in all urban areas through mass adoption of RWHS.

In the first phase, five numbers of water-stressed towns were taken as a pilot project and then in the later stage, 6 more towns were added making it 11 numbers of water-stressed towns where the above scheme was floated. After 5 financial years when the Government tabled its report, it was found that there was a derailment in the implementation of the scheme reason why at the end of FY2018-19 226 numbers of Government buildings and 4102 numbers of private buildings could only adopt the RWHS (GoWR -Odisha, 2019). The figure was far below the target intended to be achieved. Later it was found that people's participation in the scheme was abysmally low and there was a lack of coordination among the Government officials as well as the technical experts. Also, there was a negligible monitoring system by the Government followed by a lack of awareness which led to the derailment of such scheme (Otv,2019).

There is another case study that can be studied in terms of impact analysis of the RWH system which was based on quantification of recharge from the rainwater harvesting structures in the district of Nayagarh which is one of the hard rock areas of Odisha. Nayagarh district was also marked as a water stress district by Niti Aayog. Srirampur and Nachhipur villages under Daspalla block in Nayagarh district were identified for the case analysis where the water balance approach was used to estimate all inflow to the structure as well as the outflow from the rainwater harvesting structures. In this study, monthly water level change was measured from the RWH structure and the effect of recharge /surface flow was determined. (Sethi R R et al, 2020).

Conclusion:

Its high time every state government must come out with a revised water policy in line with the National Water Mission of the Government of India which is focusing more on water conservation through alternative systems such as the RWH model, encouraging adoption of suitable irrigation pattern & having less water-intensive varieties of crops.

Lessons drawn from the failure of implementing RWH models in the urban areas of water-stressed districts can be taken into consideration and a proper model and implementable methodology can be adopted with increased participation of the public at large to meet the future challenges. It was observed that due to lack of coordination among academicians working on water management issues, policymakers of the State Government and social workers working in this field which led to lack of awareness on the salient features

and benefits of RWH models among the citizens. This paper suggests a cohesion among the Policymakers, Social workers and Academician need to be established while preparing the water management strategy on an alternative water resource. Premium institutes like IITs can be engaged to find new economically viable models on Rainwater Harvesting.

This paper suggests the RWH model adopted in Australia which is having a wider acceptance in both the rural and urban areas can be taken into consideration. A study team formed by the state can be sent there to study the successful implementation of the RWH model both in urban and rural areas. There are examples of some other countries that implemented successful RWH models out of which some of them can be studied to get a varied sense of ideas about RWH models. There are some other states in India like Maharashtra, Gujarat, Rajasthan where successful RWH models can be studied.

The study also reveals that there is a greater need to estimate District wise requirements of water followed by knowing committed and non-committed flows of rivers water need. The study also highlighted that a satisfactory mechanism for synchronization and validation of data from various sources on the status of water and the irrigated area within the state as well as data on the relevant socio-economic aspects need to be created. Besides, a multidisciplinary database with provision for data updating needs to be created. These strategical recommendations should be implemented with letter and spirit by the State Governments.

This paper suggests the state to go for a massive awareness campaign on the "Catch the Rain" campaign initiated by the Government of India across all the villages and urban areas in the state. In the village's teachers and the village, heads hold significant importance among the villagers who can be engaged in the said awareness drive. Opinion Makers of the society, Educational Institutions and Media, in particular, can be engaged in the awareness drive to enhance people's participation. Examples from the neighboring state capital which is a successful one like the "Blue Hyderabad" initiative can be studied. The damaged wells, unused ponds can be identified and repaired for water recharging in the water-stressed districts. There is a need of the eco-friendly traditional water recharging models which can be studied and implemented using modern technology while preparing the revised policy.

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