Challenging Today's Water Threats for a Tenable Tomorrow:

A Review of Policies and Programs in the Water Sector of Maharashtra

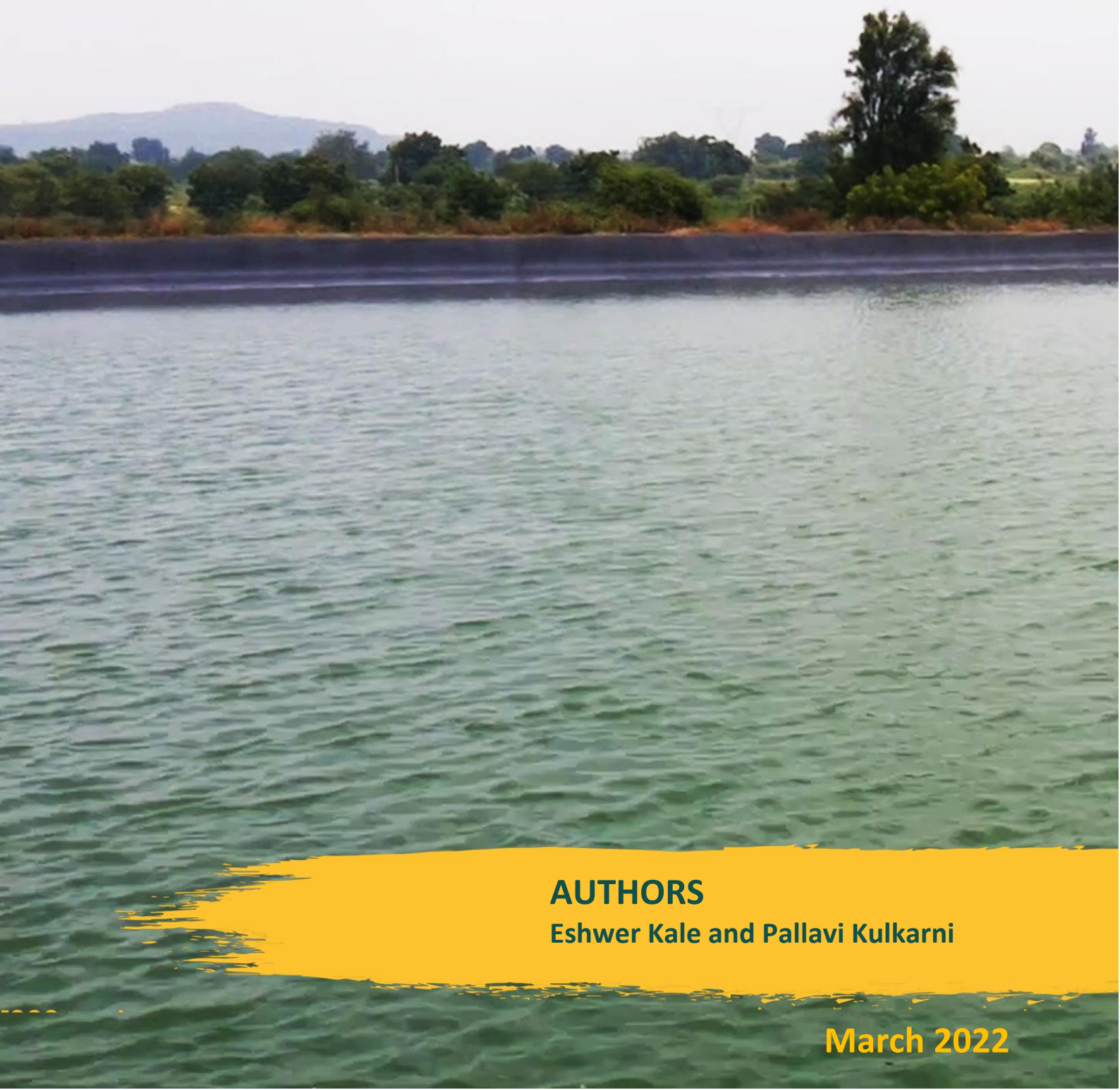

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Table of Content

Executive Summary

The Composite Water Management Index 2019 declared by NITI Aayog is alarming and compels policymakers and practitioners in Maharashtra to reflect seriously on their efforts. Maharashtra was at the fourth rank in 2015-16 when the index was first developed for all Indian states. However, it declined in 2017-18 by three positions and came to the eighth rank (NITI Aayog, 2019). The highest decline in Maharashtra's water management index in the country, after Chhattisgarh, compared to all Indian states is a terrible concern for all actors in the water sector in the state. This situation is alarming considering the highest number of dams, rich history of participatory watershed management, pioneering initiatives of community-initiated water management, numerous policies and programs in the water sector, and years of interventions by NGOs and civil societies and corporates. However, despite these interventions, water scarcity and groundwater depletion in many parts of the state continue, and the environmental and equity issues are under severe threat. Apart from these anthropogenic issues, the state has seen several years of low rainfall and drought, heavy rain and flood, and unseasonal rain, resulting in crop failures and farmers' distress in the last two decades. In this context, mainly based on secondary literature and a few expert interviews, this report analyzes key policies and programs in the water sector of Maharashtra. We have developed a 'Policy Sensitivity Index' to rank the policies and programs based on their potential and strengths in meeting the normative concerns. The selected key policies and programs in the water sector are rated accordingly.

The report highlights the urgent need for making the policy and program environment more nature-friendly (so that it doesn't damage the environment), making it more equity sensitive (so that resource-poor also get equal opportunities in participation and benefits), and incentive oriented (to enable stakeholders to take proactive steps for water management). The law-making process needs to be more transparent, accountable, and participatory, with clear operational rules for laws that have passed. Before making the key provisions of policies and laws mandatory, they need to be thoroughly piloted at a small scale to assess their practicality.

1. Key Burning Issues in the Water Sector and Need for the Policy Review

For Maharashtra, The Composite Water Management Index 2019 declared by NITI Aayog is alarming and compels policy makers and practitioners in Maharashtra to reflect on their efforts seriously. This index assesses key indicators based on the states' supply and demand-side management of water and governance efforts. According to the report, Maharashtra's present water management index for 2017-18 has declined by three compared to 2016-17. Maharashtra, which was at the fourth rank in 2015-16 when the index was first developed for all Indian states, declined by one position and came at fifth rank in 2016-17 and further declined in 2017-18 by three positions and declared at the eighth rank (NITI Aayog, 2019). The highest decline in Maharashtra's water management index in the country, after Chhattisgarh, compared to all Indian states is a severe and terrible concern for concerned actors in the water sector in the state. This situation is more alarming considering the highest number of dams, rich history of participatory watershed management, and pioneering initiatives of community-initiated water management, coupled with numerous laws and policies in the water sector, and continuous interventions for many years by NGOs, civil societies, corporates, as well as internationally acknowledged leadership in the water sector in the state. Irrespective of these, water scarcity and groundwater depletion in many regions continue. The last two decades have also seen several continuous years of acute water scarcity, heavy rains, floods, crop failures, and farmers' distress. In this context, this report presents the analysis of existing key policies and programs in the water sector of Maharashtra. It brings forward clear recommendations to improve the effectiveness of these policies and programs to achieve their targets at the ground level.

1.1 Key burning issues in the water sector of Maharashtra

Maharashtra occupies India's western and central parts and has a long coastline of about 720 km along the Arabian Sea. With a population of 112.4 million, as per the population Census 2011 and a geographical area of 0.308 million sq. km, Maharashtra is ranked 2nd by population and 3rd in terms of geographical area (GoM, 2022). Maharashtra is highly urbanized, with 45.2 % population residing in the urban area (ibid). The State enjoys a tropical monsoon climate and is semi-arid (ibid). There exists an extreme spatial and temporal variation in the rainfall pattern in the State. The average annual rainfall in the State ranges from 400 to 6000 mm. The State witnesses frequent drought conditions, whereas almost 52% area of the State is drought-prone, and about 84% of the total area under agriculture is rainfed and dependent only on the monsoon.

Half of the State's population is dependent upon agriculture for their livelihood. The area of the State is covered by five major river basins, namely Godavari, Krishna, Tapi, Narmada, and West flowing river basins. Also, a tiny area of the North-Eastern part of the State comes under the Mahanadi basin. The estimated annual availability of water resources in the State is 198 Billion cubic meters (BCM), which consists of 164 BCM of surface water and 34 BCM of groundwater, with more than 21 lakh wells in the state. As the state has the highest number of dams in the country, the storage capacity created

through State Sector water resources projects is 42.85 BCM as of June 2017 (GoI, 2020a).

This section discusses the burning issues in Maharashtra's water sector with their scope and implications on wider stakeholders, including people and ecosystems. This discussion highlights why there is an urgent need to do a detailed analysis of policies and programs, as the level of their implementation closely determines the scope and impacts of the burning issues.

1.1.1 Water insecurity for drinking and irrigation and growing groundwater depletion:

More than 50% of Maharashtra's total area (52%) is drought-prone. Most of the state has deep layers of hard basalt rock called the Deccan Trap (H. Kulkarni et al., n.d.). These conditions make this belt highly susceptible to groundwater stress. As a result, drinking water scarcity is a recurring phenomenon in many parts of the Western Maharashtra and Marathwada regions. Central Groundwater Board (CGWB), based on data from 1487 monitoring wells in the state, reported that the water levels declined in 70% of observation wells in the state in the year 2017 when compared with the decadal mean for the period 2006-2015 (Shaikh, 2017). However, all these data do not adequately reflect the precarious conditions on the ground, having large diversity at the local level in hydrogeology and an insufficient sample of wells. In the summer of 2015, for the first time in the state's history, the government was forced to run special water trains over 300 km to supply potable water to water-scarce areas of the Latur district (Kale, 2017).

Further, the Groundwater Survey and Development Agency (GSDA) reports that out of 353 talukas in Maharashtra, water levels have dropped from 1 to 3 meters in villages across 245 talukas between 2014 and 2019 (GSDA, 2019). This situation increased the drinking water dependency of the large population on the public water tankers. The data shows that from 2014 to 2019, the number of tanker-fed villages and hamlets have been drastically increased (please refer to table 1.1). As water is also required to meet the WASH (Sanitation and Health) services, in the years of the COVID-19 pandemic, in many pockets of the state, cases of the scarcity of water for frequently washing hands with soaps as well as growing stress on local water resources were reported (UNICEF, 2020).

Table 1: Increasing Tanker-dependency in Maharashtra

Week Month/Year	Villages	Hamlets	Total villages and hamlets	Govt. tankers	Private Tankers	Total Tankers
2014-May 1st week	451	986	1437	-	-	-
2015-May 1st week	1471	1777	3248	281	1533	1814
2016-May 1st week	3798	6217	10015	311	4572	4883
2017-May 1st week	1018	2768	3786	159	639	798
2018-May 1st week	937	481	1418	153	784	937
2019-May 1st week	4054	8993	13047	197	4977	5174

(Data Source: https://wsso.in/tanker.html)

Similar to drinking water challenges, the agriculture sector is facing water scarcity for irrigation due to depleting groundwater and, at the same time, increasing erraticness in the rainfall pattern and unexpected weather events. In the drought years of 2012-2013, many orchard plots (sweet lemons, orange) dried up, and farmers were forced to cut

down these plots. Even due to the late arrival of the monsoon, the long dry spells and flash floods, many farmers are losing their farm produce. Moreover, during the years of low rainfall and droughts, we have seen increased migration of rural populations to towns and cities searching for livelihoods.

1.1.2 Water guzzling crops and virtual water export:

The state's cropping pattern and water use practices are unsustainable. The single largest fact about India's water use is that 90% of it is consumed in farming, and 80% of this irrigation is for three water-guzzling crops, rice, wheat, and sugarcane (M. Shah & Vijayshankar, 2021). The area under sugarcane and cotton in Maharashtra, mainly the Marathwada region's drought-prone belts, is increasing. Maharashtra's share in total sugarcane production at the country level is 22%. This is next to Uttar Pradesh (47%), and sugarcane in Maharashtra is on 4% of cropped area but consumes 70% of irrigation water (Lee et al., 2020). However, in 2021-22 Maharashtra's share in India's sugarcane production broke all the records with an increased share of 51%, the highest sugar-producing state (Loksatta, 2022). Many authors have already indicated that the growing area under sugarcane cultivation is one of the important reasons for desertification in the Marathwada region (Banerjee, 2019). This is coupled with increasing virtual water exports in the form of water-intensive crops, fruits, and food grains. For example, producing 1 kg of sugarcane takes around 250 litres of water (and 1500 liters for refined 1kg sugar), and producing 1kg of wheat requires more than 1000 litres of water. Even though the waste of food grains, vegetables, and fruits, in harvesting, packaging, transporting, and delivery is enormous, few estimates show that one-third of produced food gets wasted in India (CSR Journal, 2018).

1.1.3 Implications of Climate Variability:

Since 2010, the state has witnessed frequent floods, droughts, hailstorms, cold and hot waves, and cyclones. Floods in Kolhapur and Sangali (in 2019), Chipalun in Konkan (2021), as well as Mumbai (in 2017, 2019, and 2021), and Pune (2019) badly disturbed human life and resulted in substantial financial losses. We have seen that during the last five years, many farmers in the state either did not timely sow or harvest due to delayed monsoon, dry spells, droughts, unseasonal rains, and floods, and cold as well as heat waves, and as a result lost their crops and produce. In 2021, heavy rain in the form of a returns monsoon made Kharif crops flooded thousands of hectares of land in many regions of Maharashtra, resulting in heavy crop loss. In the state, horticulture farmers (grapes, bananas, orange, sweet lemons and other fruit growers) have frequently lost their produce due to cyclones, heavy rain, and mainly hailstorms (in 2014, 2019, 2020, and 2021). Surprisingly, certain districts in the state are witnessing floods while others witness droughts during the same season. Many regions of the state faced a severe drought in 2008, 2012, 2013, 2016, and 2020. In the monsoon season of 2019, we have seen over 1,000 instances of heavy and extreme rain events in India; many places have had 1,000-3,000% more rain in a single day than their average (Hindustan Times, 2019). The statistics show that Maharashtra has witnessed a seven-fold increase in drought events and a six-fold rise in the frequency of flood events in the last 50 years (1970-2020), according to a recent CEEW report (Chaterjee, 2020). The state also has one of the highest numbers of districts vulnerable to extreme weather events, according to a

recent study by the Indian Council of Agricultural Research (The Hindu, 2021). The Maharashtra State Action Plan on Climate Change (SAPCC) predicts that temperature and rainfall will increase all over the state though there will be regional variations in 2050.

As discussed, the climate change phenomenon is directly related to patterns of monsoon behaviour and change in temperature, as global warming is likely to intensify, accelerate or enhance the global hydrological cycle. Therefore, in the rain-dependent drylands of India, in which much of Maharashtra falls, erratic rainfall and drought will result in a drastic fall in agricultural production and acute water scarcity for drinking and livelihood purposes. Even the changes in the proper functioning of ecosystems will increase the loss of biodiversity and damage ecosystem services; these changes are already being witnessed in many regions of the state. However, as rightly mentioned by K.J.Joy, we need to be careful while relating all changes or depletion of natural resources to climate change impacts or 'climatization of issues,' as human or anthropogenic interventions are making the situation worse (Joy & Srinivasan, 2021).

1.1.4 Water quality and pollution-sewage and industries:

The water quality in the state is affected by various pollutants. The major causes are faulty sewage and waste disposal, the release of industrial pollutants, fertilizer runoff, and coastal influxes of saltwater into aquifers as groundwater is depleted. The major concern is increasing incidences of fluoride and arsenic cases in the state. Even at the country level, about 66 million Indians are at risk due to excess fluoride and 10 million due to excess arsenic in groundwater (Khurana & Sen, 2008). The health burden due to poor water quality is enormous. Around 37.7 million Indians are affected by waterborne diseases annually, of which 1.5 million children die of diarrhoea alone. Data for three years (2009 to 2011) collected by WOTR from 6 villages in the Sangamner block show that there were 856 episodes of diarrhoea, 424 vomiting, and 47 cases of hepatitis A. All these are generally water-borne diseases. In a study conducted by WOTR in 2006 in 44 villages representing four regions of Maharashtra, 20 villages had a total hardness over 300 (mg/l); 24 had Total Dissolved Solids (TDS) over 500 mg/l; 42 villages had coliform bacteria, and 42 of 44 had E.coli present, these were above the permissible limits.

In urban areas, the water used for construction, domestic, and luxury is increasing with the improving standard of living and lifestyles. Therefore, it is observed that in Indian cities greater the water use, the more sewage and water pollution is. Besides, cities don't have the full capacity to treat wastewater and sewage water. A study by the Centre for Science and Environment (CSE) in 2012 found that Indian cities can treat an average of 30% of sewage water, whereas 20-25% of water sewage gets treated. According to a recent study by the Central Pollution Control Board (CPCB), 70% of the total municipal sewage and effluent from cities and towns are being discharged untreated into rivers, a major source of drinking water (Mallapur, 2016). According to the CPCB report in 2017, Maharashtra has the most polluted rivers in India, with 49 of the 315 river stretches running through the state. The report also points out that polluted rivers such as Mithi, Godavari, Bhima, Krishna, Tapi, Kundalika, Panchganga, Mula-Mutha, Pelhar, Penganga, and Vaitarnariver. The Ulhas river in Raigad and her tributary Waldhuni is Maharashtra's most polluted river. According to Maharashtra Pollution Control Board (MPCP), household waste in cities and towns is responsible for

95% of river pollution; the rest is industrial pollution (Dutta & Goel, 2021). As the rate of urbanization and industrial zones are speedily increasing in Maharashtra, unless the waste water is strictly regulated and treated, the situation of pollution of rivers in the state will be more difficult.

Even increased use of fertilizers and pesticides in agriculture is an important cause of water pollution in the state. In a study conducted by WOTR in village Sarole Pather in Ahmednagar district, it was noted that farmers used 625 kg of fertilizers: superphosphate, for one acre of the onion crop potash, urea, 20:20:0, 18:46:0, and 18:18:10., and 6 litres of pesticides. With the expanding area coming under agriculture and irrigation in Maharashtra, and with the spread of chemicals used in agriculture (fertilizers and pesticides), groundwater quality will worsen the already scarce freshwater sources.

1.1.5 Privatization of Water and growing Water Conflicts:

As water becomes scarce and required for development (i.e., urbanization and industry), water privatisation is considered the means to meet these ends. In the wake of the Dublin Principles (Joy et al., 2011), a raging polarized debate about water's 'social vs economic goods' character has been discussed.

In the name of PPP (Public-Private Partnership), two main types of privatisation are introduced: privatization of water sources and privatization of water delivery service systems. Both kinds of privatisation are attempted in various states of the country, coupled with a policy push towards the economical pricing of water. Many multinationals and corporate players have keenly interested in investing in water sources (rivers, streams, dams, and tanks) to make them 'private' (Gleick et al., 2002). In addition, water has been brought under the purview of global trade by including it in the General Agreement on Trade and Services (GATS) (ibid). These and many other developments within and outside the water sector indicate that the sector is being impacted significantly by the Liberalization, Privatisation, and Globalisation (LPG) regime unleashed in the country since the early 1990s.

Maharashtra Water Resources Regulatory Authority Act-2005 (MWRRA) extensively talks about the economical use of water and pricing of bulk water, where the role of the service provider is highlighted. The move towards privatization of water is seen in the construction of the Neera-Deodhar dam in Bhor taluka of Pune district to spread the canal network, which has been given to a private developer on the BOT (Build-Operate-Transfer) basis by Maharashtra Krishna Valley Development Corporation (Jamwal, 2009). Even for Aurangabad city, the water supply from the Jayakwadi dam is proposed through a private company.

As the water is being diverted, reallocated, and reprioritized in the state, ignoring the rights of people in the catchment and dependent on the catchment water, these processes result in conflicts at different levels and scales in the state. The incident in the Maval block on August 9, 2011, was notable in the state where on the Pune-Mumbai Expressway, whole villages got together and agitated against the acquisition of their land for a water pipeline to the city. As a result, three farmers lost their lives in police firing. There are many water disputes on water sharing at a regional level. The well-discussed conflicts between Marathwada and Western Maharashtra on the Jayakwadi dam water sharing and water from Ujanai dam by Baramati, Solapur and Indapur are a

few prominent. Even the effect of water privatization through farm pond construction (by pulling groundwater to store) is being felt by the farming communities as a problem. The farm pond owners are storing huge amounts of groundwater (Eshwer Kale, 2017). In short, rich and better-off people in society can purchase and access an ample amount of water, even during a scarcity period. Therefore, the privatisation of water sources has greater linkages with water availability, accessibility, and affordability. Even though there are pre-existing inequities in India's socio-economic, political, cultural, and legal structures, the ownership of land carries with it the ownership of the water above and under it. It has been said that water is attached, like a chattel, to land property (R. Iyer, 2003). Due to this rule, the landless and resource-poor are denied access to and benefits of water.

In the context of the basin, sub-basin, cluster, and watershed, the location of households determined the benefits of water availability. However, a household's location does not wholly determine water availability in a given place. The ability to pay is also a major factor. The farmers who can pay for irrigation facilities can divert water to any place in the watershed or basin area. People in the American west have an appropriate old saying, 'water usually runs downhill, but it always runs uphill to money (Rogers, 2008); this is very relevant to the current water dynamics in Maharashtra.

1.1.6 Poor or absence of Governance:

Maharashtra is seen as the pioneering state in the country in water policy reforms and law-making and has the highest number of irrigation dams in the country. Even the state has been fortunate enough to have the Groundwater Survey and Development Agency (GSDA) for decades to provide technical support for groundwater management. Apart from this, the tragedy of groundwater depletion continues. Many experts highlighted the lack of implementing capabilities/resources required for implementing laws, flaws in water policy and laws, and the absence of groundwater regulation at the local level. One can see the globally appreciated water management models of Ralegan Siddhi and Hiware Bazar and pilots by a few NGOs and civil society organisations (such as WOTR, MSSM, Samaj Parivartan Kendra, ACWADAM, BAIF, GSDA, and a few others). Still, these are a handful. In most villages, water governance is either very poor or non-existent, which has serious implications for sustainable, efficient, and judicious water use. This also pointed out that the decision-making and water resource development and management institutions are still dominated by resource-rich, with very less or no influence of marginal groups and women in participation and benefits of water, a common property.

As a composite result of these diverse issues, mainly caused by water issues linked with agriculture and livelihoods, the state has seen growing agrarian crises and growing cases of farmers' suicide in the state, mainly in Marathwada and Vidarbha regions. Moreover, during the drought years, the state has witnessed the climate-induced migration of a huge number of rural population to cities and towns in search of livelihoods as ecological refugees. The situation also made the state and administration respond quickly and in a better manner; for example, for water security for rural people, we have witnessed the drastic shift from watershed development projects to *Aplae Paani* and *Jal Swarajya*, and Jalyukt Shivar to the present well debated Marathwada Water Grid project and Jal Jeevan Mission.

2. The Need for Policy Review and Methodology

Here we discuss the policy initiative at both levels, National and Maharashtra state, in the water sector and put the rationale by presenting why the policy analysis is urgently required through this study. While analyzing the state policies, reflections on national policies are also necessary as it is expected that the state follows the national policies and makes its laws according to the national policies and model bills.

2.1 Policy Initiatives at the National level

In India, the need for reforms in groundwater governance has been felt for decades and, at the very least, since the widespread introduction of mechanized pumping devices, rapidly increasing groundwater use, and lowering water tables. This led the Government of India to acknowledge the need for a statutory framework governing groundwater (Cullet, 2012). Water and thus groundwater are under the state government's purview in India's federated system (R. Iyer, 2003). As the first formal legal step, in 1970, the Government of India put forward the 'Model Bill to Regulate and Control the Development and Management of Groundwater for adoption by the states. The 'Model Bill' has been revised several times (in 1992, 1996, 2005, and 2011) and is in revised form in 2017. At the same time (in 1972) Central Groundwater Board (CGWB), a devoted institution to managing and developing groundwater resources, was established in India. 'National Water Policy" was made in 1987, and it was revised in 2002 and 2012 and is under revision at present. However, though the policy has few proactive prescriptions, it has no statutory status and thus cannot be legally enforced. At the Centre level, the National Water Framework Law was proposed, and it was drafted in 2013 and revised in 2016. On the program level, watershed development programs are implemented at a large scale in India. All earlier different watershed programs were brought under the common guideline in 2008 known as Integrated Watershed Development Program (IWMP). This guideline has been modified very recently to make it inclusive and effective. In recent years, the government launched the National Aquifer Mapping and Management program (NAQUIM) in 2012 to map India's aquifer systems and Atal Bhujal Yojana in 2019 in 7 Indian states for groundwater recharge and management. Apart from this, to ensure drinking water availability to each household and provide safe and adequate drinking water through individual household tap connections by 2024 to all households in rural India, the Centre has come up with Jal Jeevan Mission in August 2019.

2.2 Policy Initiatives in Maharashtra

As in Maharashtra, groundwater depleting trends and their consequences on the availability of drinking water were visible from the early seventies (1970); State was compelled to initiate mechanisms to address this issue. Initially, intending to systematically and efficiently assess groundwater, the state formed Groundwater Survey and Development Agency (GSDA) in 1972. This agency primarily helps local self-government institutions (Gram Panchayats, Municipal Boards, Zila Parishads) in surveying groundwater for locating public drinking water wells and providing scientific advice on groundwater resource development. As the groundwater conditions

continued to deteriorate, the state decided to discourage the creation of new wells and bore wells (Phansalkar & Kher, 2006). It asked the GSDA to assess different parts of the state for the groundwater situations. Simultaneously, the second step of the State in discouraging groundwater exploitation was to declare that the banking sector would not lend any farm credit for sinking wells/bore wells and installation of pumps in black (over-exploited) zones. However, these moves were ineffective, making the state develop firm policy initiatives.

As the first step in this direction, the state formulated Maharashtra Groundwater (Regulation for Drinking Water Purposes) Act, 1993. The Act's main purpose was to regulate groundwater exploitation to protect public drinking water sources. The Act prohibits the sinking of a well by any person or community for any purpose without prior permission within 500 meters of a public water source. The 1993 Act was very poorly implemented and was inadequate mainly due to the absence of a participatory framework and leaving out water regulation for irrigation purposes. The state adopted its first water policy in 2003. The objective of the policy was to ensure the sustainable development, optimal use, and management of the state's water resource to provide the greatest economic and social benefits to people in a manner that maintains important ecological values. The policy was recently revised in 2019. In 2005, the policy move culminated in the State passing 'Maharashtra Water Resources Regulatory Authority Act, 2005' (MWRRA) with wider ramifications and stronger teeth for establishing an independent regulatory authority, the first of its kind in the country to regulate the water resource. In the same year, the Government also enacted an Act titled 'Maharashtra Farmers Management of Irrigation Systems Act 2005' for giving legal status to Water Users Associations (WUAs). Although the 1993 Act, State Water Policy-2003, and MWRRA 2005 were enacted, in the absence of groundwater-specific law and strict and clear regulatory measures, the concern of groundwater depletion was growing and was not adequately addressed by existing laws. With these limitations and to strike a balance between the regulatory and developmental measures, the State Government passed the Maharashtra Groundwater (Development and Management) Act in 2009, enacted in 2013.

Along with these legal interventions, many programs and schemes were designed and implemented in the state. Along with IWMP, in 2016 state came with Jalyukt Shivar Abhiyan (JYS), the flagship program aiming to bring water empowerment to 25,000 drought-affected villages in Maharashtra in the next five years. With the slogan of "Water for All", the target was set for "Drought-free Maharashtra" by 2019. The Maharashtra Government, through MGNREGA, started supporting farmers for constructing the farm ponds in 2009 and then in 2016 came up with a special program on promoting farm ponds, well known as *'magel tyala shet-tale*' in 2016 with a target of constructing 1,11,111 farm pond in the state (Magel Tyala Shetatale, 2016). In 2017, the state designed and implemented a specific program for desiltation water tanks known as *'Gaalmukt Dharan, Gaalyukt Shivar Yojana.'* This scheme has been actively implemented through the different NGOs and CSR initiatives. With the support of the World Bank, in 2018, the state started the Project on Climate Resilient Agriculture (PoCRA) to be implemented in 15 districts in Maharashtra, covering about 5,142 villages. Along with promoting climate-smart agriculture practices, the project aims to achieve supply and demand-side water management practices.

2.3 Rationale of the study-wide gap in governance objectives and their implementation

Despite numerous policy interventions in Maharashtra and at the centre level, groundwater resource is continuously depleted. This is because these policy interventions have not achieved the goal of efficient, judicious, and sustainable water resources. Thus the present condition shows that these policy instruments and agencies have not effectively addressed the critical problem of groundwater depletion. The growing depletion and scarcity of water resources show that these policy reforms and programs do not tackle the existing over-exploitation rather, they are largely grandfathering existing groundwater uses. (Cullet, 2012). As a result, groundwater resources remain either ungoverned or misgoverned (Kale, 2018); Ramaswamy Iyer (2008) rightly describes this deadlock as 'governance seems non-existent.' In this relation, the title of a comprehensive account of groundwater use in South Asia aptly refers to the current situation as 'anarchy' (T. Shah, 2010). Even in policies and programs, surface water and groundwater as well as water for drinking and irrigation, are not seen as integrated or complementary. There are separate policies, governing agencies, and programs for managing and developing these resources. Mihir Shah had rightly described this situation as 'hydro-schizophrenia' in the water sector, where the right hand of surface water doesn't know what the left hand of groundwater is doing (M. Shah & Vijayshankar, 2022).

In this context, it is essential to diagnose existing governance instruments (policies and programs) by identifying lacunas and loopholes and prescribing adequate and efficient policy measures to make them more effective and robust. The present study finds policy gaps and lacunas in these policy instruments and proposes clear recommendations to revise and make them more appropriate, effective, and implementable.

2.4. Research Approach and Methodology

This section presents the theoretical and conceptual framework followed in the study and the analytical framework applied for the analysis. Finally, the section concludes with the data sources and data collection methodology adopted for the study.

2.4.1 Theoretical and conceptual frame

In any sector, social or environmental, policy instruments (policies, laws, and programs) are created by the state and deployed by governing agencies to achieve specific governance objectives around an issue. These governance objectives differ from sector to sector and resource to resource, mainly around protecting the interests of the larger society, protecting the environment, regulating services and uses of resources, and promoting human behaviour in a 'good or expected' value-based direction (E. B. Kale, 2018). Therefore, the overall goal of the policy instrument is to protect and promote broader public interests in a particular sector or around a specific issue (ibid). Once such policy instruments are created, the responsibility to operationalize and deploy (or implement) these instruments fully or partly is given to certain governing agencies. This is how the policies and programs are being created and executed on the ground. But in real life, we often observe that these governing agencies do not meet or fail at a

different level to achieve the governing objectives or result in unintended outcomes, as the actors targeted in these policy instruments did not follow or violet the expected behaviour. The key question for the policy analyst is 'based on what type of information can better policy decisions be made?' Answering the question requires discussing the adequate and appropriate use of the currently in-use social, economic, and environmental indicators, social beliefs, and norms in use (Parto, 2005). Therefore while analyzing policy effectiveness, answers to how various stakeholders, actors, or resource users take rational (or irrational) decisions or select choices and which factors essentially decide the direction of their behaviour for taking decisions are of key importance. Most policy analysis and review frameworks answer these questions with different approaches and perspectives. In this light, the study uses the below different frameworks to see the issues in the larger picture.

Stakeholder Analysis and Political Economy Analysis are widely used frameworks for analyzing and reviewing policies and programs. The stakeholder analysis categorizes the different actors and stakeholding groups at different levels of interest and power, which influence and therefore impact particular policies. Political scientists have viewed decision-making and implementation as determined by how power is structured among different groups in the resource user communities (Brugha & Varvasovszky, 2000). Political Economy Analysis has a long tradition in social science research. There is increasing recognition across academic and aid literature that development is fundamentally a political process in key respects (Fritz et al., 2009). The political economy analysis is concerned with the interaction of political and economic processes in a society, the distribution of power and wealth between different groups and individuals, and the processes that create, sustain, and transform these relationships over time (Jamil et al., 2013). These processes are closely interrelated and part of a unified set of dynamics (Harris, 2013). Political economy analysis helps understand how incentives, institutions, and ideas shape political action and development outcomes (Duncan & Williams, 2012); this can be extremely useful when considering the feasibility of policy reform and institutional change. Institutional Analysis and Development (IAD) framework developed by Prof. Elinor Ostrom (Ostrom, 2011) is applied in a range of situations to analyze the structure of situations individuals face systematically. IAD explains how rules, the nature of events, and the attributes of the surrounding environment and local community affect these situations over time (Smajgl et al., 2009). IAD utilizes assumptions of public choice theory but adds that rational individuals are acting and making decisions in real-world institutional settings. While this theory acknowledges that individuals may act rationally in simple situations, it posits that in complex circumstances, individuals lack complete knowledge and the ability to act in an entirely economically rational manner (Polski & Ostrom, 1999). The Governance Dynamics Framework (GDF) developed by Subodh Wagle (Subodh Wagle, 2011) is based on the central premise that there is a misalignment between the preparedness of the actors/stakeholders. Therefore, the goals of policy instruments and the actors are not well prepared due to inadequate awareness, vision, willingness, and abilities to take appropriate actions.

Another important perspective to understand and analyze the failure of groundwater-related policies is derived from David Mosse's work and Marxian theory. David Mosse suggests that development agencies selectively endorse particular social theories in constructing a manageable rural society in terms of present policy goals and

administrative constraints (Mosse, 1999). He further explains the contemporary policy discourse as selective representations of a rural society that this generates. The Marxian theory also supports this argument. It advocates that every type of state is a powerful institution of the ruling class, and the state is an instrument that one class uses to secure its rule and enforce its preferred production relations (and its exploitation) onto society (Althusser, 2006).

Having a detailed review of these different frameworks, we found that the framework of normative concerns is more suitable for the present study. Normative concerns lie at the heart of development analysis and policy. Public policies are normative or based on value judgment in that they are trying to clarify how policies ought to be set (Alkire & Deneulin 2009). It allows us to assess at what level the policy initiatives are aligned with the normative concerns set for the analysis. The normative concerns are value-based concerns accepted by large actors and stakeholders in the specific sector. They are drivers to design the process and reach a collectively seen vision. These normative concerns are mainly inclusiveness, equity, gender, participation, and sustainability. Although the framework of normative concerns drives the analysis for the study, all the above-discussed frameworks are applied in analysis at appropriate places to see the larger picture from different perspectives.

2.4.2 Analytical framework applied for policy review

From a large pool of existing governance instruments (policies and programs) in the water sector, the most relevant and important policies and programs are identified based on the level of their significance, geographical scale, level of influence on the water resource, and resources allocated. Although this policy review is at the level of Maharashtra state, as discussed earlier, key policies and programs at the national level have been taken for analysis as they have important influences and impacts on the development and management of state water resources and policies. The selected policies and programs for this review are listed below,

Table 2: Selected Policies and Programs

Levels	Policies	Programs
State-level	1) Maharashtra Groundwater (Development and Management) Act, 2009	1) Jalyukt Shivar Abhiyan (JSA)
	2) Maharashtra Water Resource Regulatory Act, 2005	2) Magel Tyala Shet-tale (Farm pond Scheme)
	3) Maharashtra State Water Policy, 2019	3) Integrated Watershed Development Program
	4) Maharashtra Management of Irrigation Systems by Farmers, 2005-MMISF	4) Project on Climate Resilient Agriculture (PoCRA)
		5) Marathwada Water Grid Project
		6) Gaalmukt Dharan and Gaalyukt Shivar
		7) Solar Irrigation- Mukhyamantri Saur Krushi Pump Yojana
National level	1) National Water Policy, 2012	1) National Aquifer Management Program (NAQUIM)
	2) Composite Water Management Index by NITI Aayog, 2016	2) Atal Bhujal Yojna (Atal Jal)

Each of the selected policies and programs has been analyzed in terms of the background in which it has been designed, its core provisions and strengths, and the gaps and weaknesses at a different level. Having analyzed these components, necessary recommendations are made to make it more effective and robust. The unique analytical approach this review provides is the Policy Sensitivity Index to assess the level of sensitivity or association of policies and programs to the different normative concerns. As the below figure depicts, the Policy Sensitivity Index is developed to assess six key normative concerns of selected policies and programs, 1) Environment and ecosystem sustainability they ensure, 2) by applying Participatory and inclusive governance, 3) for Vulnerability reduction to climate change, 4) and ensure Production enhancement and resilient income of local communities, 5) and their Capacity and knowledge building, 6) with fulfilling the concerns of Equity and societal co-benefits.

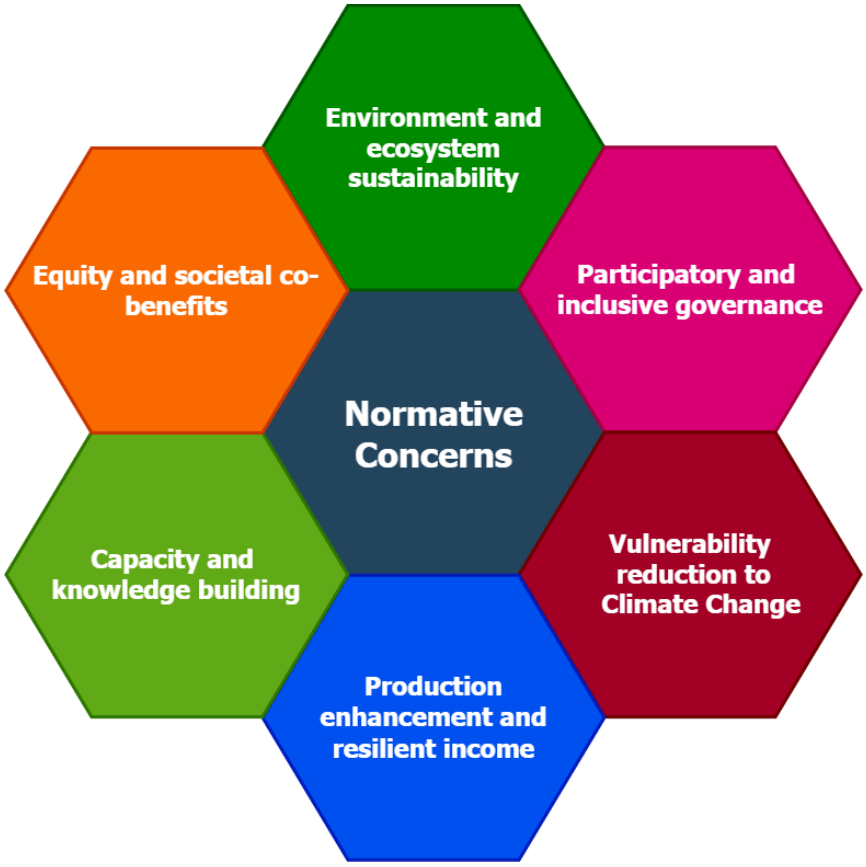

Figure 1: Normative concerns covered in the Policy Sensitivity Index

For each of these six indicators, 4 points are allotted based on the level of measure (Very high=4, High=3 Medium=2 Low=1, No=0). Thus for each selected policy and program maximum of 24 points (6 indicators X 4 points) are allotted. Depending on the level of impact and significance, a score is given to the policy and program to understand its sensitivity and relevance to the six key indicators.

2.4.3 Data sources and methods of data collection

This desk review is primarily based on the secondary literature; however, interviews of selected water experts and a few field visits have also been conducted to receive first-hand data and observations on important programs in the state.

a) Secondary sources: Existing books, reports, papers (printed as well as online), blogs, webinar recordings, videos available of water experts on social media, and content available on websites are the important secondary sources used for this review. However, this also contains the published and unpublished reports and papers developed by WOTR during the last few years related to water resources.

b) Primary data: 18 in-depth interviews of renowned water experts on the policies and programs have been conducted. The 18 experts at the state and national levels have been purposively selected, keeping in mind their rich experience in designing and executing programs or researching the selected policies or programs. At the same time, to understand the different aspects of the application and implementation of a few major government programs, a few on-ground short studies/assessments have been conducted. On-ground short studies of Jalyukt Shivar and farm ponds (under MGNREGA, *Magel Tyala Shet–tale*, and National Horticulture Mission) are made, which are crucial and largely implemented programs in Maharashtra over the last few years. A multi-disciplinary approach has studied the implementation and its consequences on different aspects. These assessments have complemented the analysis and made the study more evidence-based.

3. Analysis of selected Policies and Programs

This section is distributed in three subsections. In the first section, we present the analysis of selected policies and programs on the sensitivity index, the scoring matrix we have developed to understand the sensitivity of these policies and programs to the normative concerns. After that, each selected policy and program is analysed at the state and national levels regarding its strengths, advantages, and lacunas in its provisions or strategies and the recommendations needed for removing these gaps and making them more efficient, relevant, effective, and practical for implementation.

3.1 Sensitivity analysis of the selected policies and programs

As discussed in the methodology sections, we have developed an index of six indicators to assess the sensitivity of selected policies and programs (normative concerns). A maximum of 4 points (Very high=4, High=3 Medium=2 Low=1, No=0) is allotted to each of the six indicators based on the level of the potential, performance, and practical and feasible correlation of each policy and program with the normative concerns. Thus depending on the potential, performance, and practical and feasible correlation with normative concerns, the selected policies and programs are allotted 24 points. The final score (24 points) assigned to each policy and program is categorised as policy or program Highly sensitive (18 to 24 points), Medium sensitive (12 to 18 points), Low sensitive (6 to 12 points), and Very low sensitive (points less than 6). This analysis by applying the sensitivity index is relevant to assess and see where the important policies and programs fall or stand in achieving the current key priorities in terms of normative

concerns of 1) Environment and ecosystem sustainability, 2) Participatory and inclusive governance, 3) Vulnerability reduction to climate change, 4) Production enhancementand resilient income, 5) Capacity and knowledge building, and 6) Equity and Societal Co-benefits. The analysis of the sensitivity index is presented in table 3.

Table 3: Sensitivity index of selected Policies and Programs to Normative concerns

Proposed Policy/ program	Measures for Equity and Societal co-benefits	Relevance to indicator (out of 4 points)	Measure for Environment and ecosystem sustainability	Relevance to indicator (out of 4 points)	Measures for Production enhancement and resilient income	Relevance to indicator (out of 4 points)	Measures for Participatory and inclusive governance	Relevance to indicator (out of 4 points)	Measures for Vulnerability reduction to climate change	Relevance to indicator (out of 4 points)	Measures for Capacity Building	Relevance to indicator (out of 4 points)	Total Score (out of 24 points)
State-level Policy Maharashtra State Water Policy-2019	Highlights the aim of achieving equity, social justice, and sustainability in water resource -Water as common property and public trust	3	-Ecosystems considered in priorities of water allocation -protection of ecosystems -Adoption of ridge to valley approach -River basin and sub-basin level management. - Water resources planning, development, and management in guided by Integrated State Water Plan (ISWP)	4	-Increase productivity and efficiency of water use and make the systematic transition from the water resources development to an IWRM -Second priority to agriculture in water supply, -Promotion of micro-irrigation, etc.	2	-Emphasis on community participation in drinking water supply, ecosystem management, watershed management, etc. - Aims to apprise all the line departments, local bodies, and agencies working for the water sector, industries, and water users.	3	-Building resilience to water scarcity and drought, ensuring judicious and strategic sectoral allocation of water among different water use sectors, -Emphasis on flood and drought forecasting, -Promotion of micro-irrigation, Hydro-meteorological data collection, -Direction for water quality management	4	Provision for creation of 'Centre of Excellence for capacity building, research and policy evaluations	2	18 Medium sensitive
State-level Policy Maharashtra	-Regulations on drilling wells and limiting the	2	-Ensuring drinking water security, Negatively	2	Reducing groundwater depletion and	3	-Provision of Watershed Water resource Committee and	2	Aquifer management is a proposed strategy for dealing with	2	Regular meetings of WWRC and MWRRA have given the	2	13 Medium

Groundwater (Development and Management) Act 2009	depth of bore wells, crop planning, and safeguarding drinking water wells but with very command and punishment provisions		affecting potential water users (permission required for wells) -Present dynamics of farm ponds and Shirpur pattern not addressed		proposing appropriate crop plans		role to Grampanchat -Crop water budgeting will be discussed in Gramsabha -Highly bureaucratic and political nature of proposed institutions (WWRC)		low rainfall		function of spreading water literacy and legal awareness of the Act		sensitive
State-level Policy Maharashtra Water Resource Regulatory Act-2005 (MWRRA)	-Farmers can put forward their issues regarding water distribution - Power to take decisions on equitable water sharing on sub-basin and river-basin water allocation and transfers	2	Power to authorize the water resources project-based environmental and hydrological viability	2	No measures	0	-Provision of five special invitees in MWRRA -Process adopted of public consultations and hearing in fixing bulk water tariff -Quasi-judicial status to Authority to hear the cases and give the judgments	3	No measures	1	No measures	0	8 Very low sensitive
State-level Policy Maharashtra Management of Irrigation Systems by Farmers, Act 2005 (MMISF)	-Reservation for SC-ST community and women in the WUAs -All landowners and occupiers	1	No measures	0	Legal entitlement for assured water. Freedom of selecting	1	-Transition in central decision-making by WRD and bureaucrats towards a participatory approach by	3	-Entitlement of water -Guarantees assured supply of water -Provision of water supply	3	-Training regarding water management is to be given to both the management committee and	3	11 Low sensitive

	becomes a member of the General Body				crops		engaging farmers through water user associations (PIM) -Making Provision for a periodic meeting of the Management Committee and General Body		during deficit year		the members of the General Body -However, on the ground, the expectations are not met		
State-level Program Integrated Watershed Management Program (IWMP)	Securing livelihood activities for asset-less people is an indirect object of the policy	1	Adoption of Ridge to valley treatment helps in ecosystem restoration	1	Promotion of micro-enterprise includes livelihood activities Promotion of production Systems	4	Formation of Watershed Committee at village level Gram Panchayat, NGO can become PIA	3	Improve groundwater quantity will increase the climate resilience	1	Provision for the preparatory phase of 1 to 2 years for capacity building	4	14 Medium sensitive
State level Program Farm Ponds (*Magel Tyala Shetatale)*	-Heavy budget in subsidy form for selected beneficiaries. -Water security for horticulture farmers, cost benefits ratio mixed, groundwater mining	2	No measures	0	-Water use of stored water in the most efficient manner, protective for cash crops and vegetables for assured and more income	4	The beneficiary-centric scheme, no control of villagers/panchayat on selecting numbers and size and number of farm ponds in the village	1	-Water available when required, -Water security for irrigation, -Assured crop production, addresses rainfall variability and water scarcity	4	No measures, individual farmers are making efforts to make the most efficient use of technology and maintenance of farm ponds	1	12 Medium sensitive

State level Program Jal Yukta Shivar	No measures	0	No measures	0	Improved water supply through Nala deepening and other construction of other water harvesting structures	2	Village level Action Plan to be approved by the Gram Panchayat Desiltation measures, executed with the help of people's participation	1	-Watershed treatment, Nala deepening, tree plantation, rejuvenation of water bodies, etc. help in increasing water supply, thereby assuring the climate resilience	3	Capacity building for preparation of water budgets	2	8 Very low sensitive
State-level Program Marathwada Water Grid Project	Change in water allocations and imports from Konkan and Krishna	2	No measures	0	Provision for assured supply of water throughout the year	2	No measures	1	Provision for assured supply of water to the water-scarce region	3	No measures	0	8 Very low sensitive
State level Program Gaalmukta Dhahran Galyukta Shivar	More area under irrigation, crops, and more income	1	No measures	0	The application of silt from the dams improves the fertility of the soil, thereby improving the production	3	Provision for the formation of Village Level Monitoring Committee	1	Results in increased storage capacity of the reservoirs and also improved soil characteristics	2	No measures	0	7 Very low sensitive

State-level Program PoCRA	-Formation of Gram Krushi Sanjeevani Samitee includes 2/3 of women and SC/ST members -Priority is given to SC/ST people and women while selecting beneficiaries -Promotion of women's self-help groups and Farmer Producer Companies	3	Afforestation. Soil and water conservation. Promotion of organic farming.	3	-Encouragement to women's self-help groups and Farmer Producer Companies -Development of saline areas -Training regarding BBA plantation, -Provision for strengthening the value-chains -Provision for improving water supply by watershed treatment.	4	-Resource mapping to be done on a participatory basis, -Formation of constitutional sub-committee of Gram Panchayat, including women and SC/ST members for planning, selection of beneficiaries, etc.	2	-Farm ponds promotion in saline areas -Encouragement in micro-irrigation, -Promotion of climate-resilient seeds, crops, and supply-chain management, -Watershed development, -Water budgeting using the latest technology	4	Capacity building at three levels : 1. Institutional level, 2. Farmer level, 3. Women and youth, Training in organic farming	3	19 Highly sensitive
State-level Program Mukhyamantri Saur Krushi Pump Yojana	More subsidies to the SC-ST community	2	Promotion of clean energy	3	-Uninterrupted supply of electricity without fluctuations	2	No	0	No	0	No	0	7 Very low sensitive

National level Policy National Water Policy	Promotes the principle of social justice and equity	2	-Directions for the avoidance of evapotranspiration, aquifer mapping, -Water is recognised as sustained life and ecology, Incorporates the ecological needs of water and environmental flows	3	Improved water supply. Better agricultural practices. Inter-basin water transfer.	2	-Consideration of Public Trust Doctrine. Institutional arrangements for public participation -Stakeholder participation in land-soil-water management. Participatory aquifer mapping -Water conservation and management through public participation	3	-Emphasis on understanding the local geo-hydrological conditions -Decisions to be taken considering the impact of climate change on water resources, -Strengthening the water infrastructure, Sensitization of people about climate change and resilience	4	-Proposal for a national campaign for water literacy, -A re-training and quality improvement program for water planners, -Regular training and academic courses in water management	3	17 Medium sensitive
National level Policy Composite Water Management Index	Assurance of drinking water for the rural and urban populations	2	-Considered the change in the groundwater levels -No. of exploited watersheds and identification of recharge sites	3	Examines the variation in irrigation potential created and utilized	2	-Role of WUAs in PIM -Transfer of irrigation project to WUAs	2	-Appropriate crop plans Micro-irrigation -Separation of energy feeders -Deals with measures like groundwater recharge, watershed treatment, wastewater treatment	3	No measures	0	11 Low sensitive

National level Program Atal Bhujal Yojana	Selection of groundwater depleted 78 districts in 7 states	2	-Groundwater protection and development -Water security plans	3	No measures	0	-Strengthening of WUAs. Empowering Water and Sanitation -Committee as WUA. Involvement of Gram Panchayat	2	-Preparation of Water Security Plans at the village level, -Aquifer management, Crop diversification includes the promotion of rain-fed horticulture.	3	Provision of capacity building at a different level with an allocation of considerable funds for bringing the behavioral change	3	13 Medium sensitive
National level Program National Aquifer Management Program (NAQUIM)	Aquifer delineation useful for drinking water source strengthening	2	Protection and recharge of groundwater	1	No measures	0	- Strengthening WUAs -Formation of Groundwater Management Associations	2	Groundwater protection through recharge and aquifer management	2	-Selection of Para-Hydrogeologist (PHGs)' or 'Jal Surakshakas - Training individuals regarding groundwater management, participatory management, etc. -Stakeholder engagement	3	10 Low sensitive

3.2 Analysis of the policies and programs

In the light of the above analysis of the sensitivity index, the further qualitative analysis of selected policies and programs is made at the level of strengths they carry and gaps and lacunas in them. Then recommendations are made to remove these gaps and lacunas and make them more effective, relevant, and practical. The overall analysis of selected policies and programs is distributed in two subsections, at the state and national levels.

3.2.1 Analysis of the policies and programs at the state level

We discuss this section in two subsections, an analysis of the policies and programs at the state level.

3.2.1.1 Analysis of the state-level policies:

For the analysis, we club the policies and laws/acts in the water sector together. We understand that policy and law have fundamental differences. Policies and bills are model guidelines and principles to guide the sector, and their violation by actor/s cannot be challenged in the judiciary. In contrast, laws/acts and government resolutions (GRs) are mandatory to be executed by state governing agencies. Their violation can be challenged in the judiciary or relevant governing agencies can enforce punishment and penalties on their violations. In other words, laws, Acts and GRs are means of translating the policies into actionable form. Oxford English Dictionary defines policy as a 'course or principle adopted or proposed by an organization.' The Food and Agriculture Organization (FAO, n.d.) defines policy as 'a definite course or method of action selected (by government, institution, group or individual) from among alternatives and in the light of given conditions to guide and, usually, to determine present and future decisions.' It further notes that a policy is a set of coherent decisions with a common long-term purpose (Pandit & Biswas, 2019). Here we present the analysis of important policies and acts in the water sector of Maharashtra.

3.2.1.1.1 Maharashtra State Water Policy 2019 (MSWP-2019)

a) Background and objectives of MSWP-2019: Maharashtra formulated its first water policy in 2003, which was later revised in 2012. The government of India has also revised the national water policy made in 2003 and released the revised policy in 2012, with the intent that the states should align their respective state water policies in accordance with it. Therefore, the State of Maharashtra also revised the earlier version of 2012 and came up with the State Water Policy in 2019 to align it with national water policy, international frameworks (mainly water-related SDGs), and speedily changing water concerns and dynamics. The aim of MSWP-2019 is to inform and build cooperation in all the line departments, local bodies, and agencies working for the water sector, industries, and water users regarding their rights, roles, and responsibilities to achieve specific objectives (GoM, 2019). As mentioned in the policy, it intends to build resilience to water scarcity and drought, ensure judicious and strategic sectoral allocation of water among different water use sectors, protect

ecosystems, increase productivity and efficiency of water use, and make the systematic transition from the water resources development to an integrated water resources management.

b) **Strengths of MSWP-2019:** MSWP-19 is basically a vision document, and long-term goals are set to be achieved. It put forward an essential framework for transforming overall water governance in the state by engaging different stakeholders, strategic planning, and prioritizing investments. In the policy, groundwater is seen as a common property of society held in public trust, and protecting ecosystems is at the policy's centre. Stakeholders' involvement and engagement are considered an important strategy for building a certain degree of consensus among water users and stakeholders for achieving a long-term sustainable change. The community is expected to be effectively involved in planning and managing drinking water supply and sanitation facilities in urban and rural areas. The significant focus in the policy is also given to demand management, improving water use efficiency in all water use sectors, and achieving the objectives of equity, social justice, and sustainability. Flood management, decision support systems, and forecasting through advanced scientific tools and ridge to valley watershed development with a scientific approach are adopted as major interventions. Integrated Water Resource Management (IWRM), considering the management unit as a basin or sub-basin, is adopted as a major principle. At the institutional level, the policy also proposes creating the 'Center of Excellence' as an autonomous centre with international collaborations to promote soft skills, research water issues, and evaluate policy decisions.

c) **Gaps and deficiencies in the program and recommendations for modification:** Here, we analyze the key provisions in terms of gaps and deficiencies and provide recommendations to modify them.

Provision 1: The water will be primarily allocated for drinking water purposes (including domestic water demand), followed by agriculture and agro-based industries, industries, ecosystems, and recreational and religious purposes [8.2 (ii)].

To achieve the State's economic development, maximizing the value of water and enhancing the water use efficiency is a must; however, this should not push water for ecosystems at least priority. 'Water for ecosystems' must be the second priority, next to drinking water. Since the ecosystem is essential for providing the 'ecosystem services' for our survival, unless water for ecosystems and environmental flows is given priority, there is the danger of collapsing the overall local ecosystem and threatening the survival of the local inhabitants. This is particularly important in a climate change context and rising global temperatures, for which Maharashtra is a hotspot. Therefore, meeting water needs for ecosystems should be given second priority. This policy prescription needs to be backed by sound scientific evidence and adequate research to arrive at the water requirements of the ecosystem needs and environmental flows for landscapes and rivers. Even the priorities of sectoral water allocation should be flexible enough to decide based on water availability (annual rainfall may be a deficit, average, or surplus) because fixing it for all time will not be appropriate as it has to be decided and prioritized on the basis of changing dynamic water situation in a particular year, such as CGWB and GSDA are issuing the

notification for notified areas for groundwater regulations in deficit year. In addition to this, the rapidly changing political economy in the state, in terms of water required for the growing area under sugarcane in drought-prone areas of the state, rapid urbanisation (estimating 50% population soon in India will reside in cities and town) and growing tertiary sector (IT and service sector, education and hospital services, which provides huge employment and livelihoods, significantly contributing to GDP), needs to be kept mind while reprioritising the water priorities.

Provision 2: Water resources planning, development, and management in the State will be guided by Integrated State Water Plan (ISWP) (8.3), and the water resources of the State must be planned, developed, and managed with a river basin and/or sub-basin as the unit, adopting Integrated Water Resources Management (IWRM) approach (8.4).

IWRM is a universally adopted principle that water resource development and management needs to be promoted with the integration of soil moisture, surface water, and groundwater. However, for management purposes, the estimation of groundwater available has always remained challenging. There are different methodologies of groundwater estimations, but its precise estimation at the local or micro scale is challenging. For example, the existing Gravity Recovery and Climate Experiment (GRACE) tool developed by NASA, estimate the data at the regional level, and the scale used in the CGWB method for NAQUIM is 1:50000; (CGWB, 2012). These scales are useful for the larger scenarios but don't contribute to the program or smaller scales for actual planning and management purpose. Even the committee that formulated the Integrated State Water Plan (ISWP) has acknowledged in its report that 'despite its best efforts, we could not satisfactorily resolve issues like a revision of geographical areas of sub-basins & groundwater assessment and validation of hydrological data' (GoM, 2017). Hence, groundwater estimation methodologies must be brought to a smaller scale to make groundwater management the reality on the ground (for management at implementation) in ISWP and IWRM. There is a critique of ISWP that it is prepared after the strong push and follow-up at a legal level by civil society organisations and water experts (Deshpande, A, 2016); therefore, it has been prepared for the sake of the name, without its serious cognizance in the state water planning. However, the ISWP has to be taken seriously by the state.

Provision 3: River Basin Agencies (RBA) shall distribute the bulk water entitlements to various users within the project-wise sectoral allocation [8.2 (iv)].

Although setting the river basin management is the agenda of the state water policy since the first version of MSWP-2003, this is not yet in practice. Different existing Irrigation Development Corporations (IDCs) have been considered river basin agencies for preparing the ISWP. However, for planning and management purposes, the basins of the rivers in Maharashtra, such as the Godavari, are so big, and they flow for hundreds of kilometers throughout the state. Therefore, to make the river basin management feasible, at a primary level treating a collection of smaller catchment areas along sub-basins of rivers and also linkages with their aquifers need to be recognized, and appropriate actions need to be planned. Civil society organizations have already gained an experience and expertise in micro catchment

development, groundwater management, and governance, and hence their role should be recognized.

Provision 4: To ensure water resources don't get polluted, the polluter pays principle shall be adopted [8.5.4)].

To reduce the freshwater demand, the policy proposes that a minimum of 30 % of the recycled water be reused in the next five years, which is certainly a welcome move. However, there is enough evidence to show that the 'polluter's pay principle' is insufficient to control groundwater contamination from urban sewage and industrial effluent; instead, it allows industries to first 'pollute and pay.' (Sahu, 2020) Therefore, groundwater contamination should be treated as a punishable offense (with the provision of imprisonment), and such provisions need to be followed stringently.

The focus of the provision is on controlling contamination of water bodies and groundwater from urban sewage and industrial effluent; however, the provision needs to extend to controlling groundwater contamination by application of heavy use of chemical fertilizers in agriculture. As since years, fertilizer, mainly for cash crops, has been applied in huge quantities in the state. This practice is resulting in many places increasing the amount of nitrate in groundwater sources; therefore, this issue needs to be addressed in the provision as this will get more severe in the coming year with increasing commercialized and intensive farming.

Provision 5: The *JalYukta Shivar Abhiyan* (JSA), *Magetl Tyala Shettale* (farm ponds), and *Gal Mukta Dharan and Gal Yukta Shivar* (GDGS) schemes are to continue to increase drought resilience.

This is a problematic provision made. These schemes have received a high level of criticism from water experts and research organisations for the unscientific nature of their implementation, environmental consequences, and equity issues. Experience shows the performance of JSA was mainly confined to promoting the deepening and widening of Nalas and rivers and constructing plastic-lined farm ponds. Many studies show the negative impacts on local hydrogeology and changing overall water allocation and equity concerns (SANDRP, 2016). Most importantly, a water expert filed the PIL on the unscientific nature of JSA a few years ago. The high court accepted it by appointing the commission for its investigation. Even the present government (Thackeray government) has ordered an inquiry into the scheme's implementation and stopped it, claiming irregularities in its implementation (Hindustan Times, n.d.). Many studies show that the present nature of the farm pond scheme is problematic in light of the lack of regulation of its number in the village, size and depth, pulling groundwater to store, and rate of evaporation of stored groundwater. Thus, few resource-rich farmers privatize groundwater stored in farm ponds (Bendapudi et al., 2020; Eshwer Kale, 2017). About GDGS, few studies show that change is required in the scheme to understand the groundwater recharge potential of the tank before desiltation and ensure that poor farmers benefit from the desilted soil (Zade et al., 2020). Therefore, scientific studies are required before promoting these schemes, and clear guidelines have to be developed to avoid the ill consequences of their implementation to the environment, hydrogeology, water allocation, and equitable water distribution, considering water as a 'public trust.'

Provision 6: In watershed development, works/schemes, entitlement/right on the augmented groundwater recharge will be treated as a common right of beneficiaries in the watershed [12(vii)].

As the major expenditure on watershed interventions and projects comes from public money, the increased groundwater, as a benefit of such projects, needs to be treated as a common right. Therefore, the proposed provision is welcome and appreciable. Further, the provision mentioned that beneficiaries should provide an undertaking stating clearly that they would share the benefits obtained from the watershed development works, and such undertaking must be taken before selecting the watershed for the development. Certainly, this is a required approach, but receiving such an undertaking from the community and ensuring that villagers, mainly large irrigators, follow it is challenging, given the mindset of people treating groundwater as private property. This challenging provision has to be piloted on a small scale only after the lesson learned from this pilot should be applied at the state level. Otherwise, this may hamper and delay the state's watershed development process. Most importantly, this provision should be a part of the Integrated Watershed Development Program (IWMP) guidelines, as this is the umbrella program in watershed development in the country and, thus, in Maharashtra.

Provision 7: Flood management strategies and an emergency plan to mitigate and manage each flood-prone area will be developed (13).

The detailed provision discusses developing the decision support system (DSS) for flood forecasting in flood-prone areas and an SMS-based flood alert system. Still, flood prevention and risk-reduction measures must be taken at different levels. In the background of the recent massive and devastating floods in the Sangli and Kolhapur (in 2019 and 2021) districts of Maharashtra, the management of dams (their systematic and regular supervision and maintenance) was noted as a serious concern that needs improvement. Most importantly, a focus on treating the entire catchment area of dams is necessary. This ensures that on days of heavy rainfall, these catchments hold enough surface water and recharge the groundwater (aquifer storage) in the catchments of dams. Moreover, in the background of climate change, as changes in precipitation behaviour are projected in terms of erratic and heavy rains in a short period in a few regions, the catchment development of dams for flood control becomes more relevant.

c) Additional Provision and measures required in MSWP-2019

Provision 1: Appreciation and incentivization for villages for making good efforts to improve local water governance: In MSWP-2019, no provision has been made, or a framework adopted for intensive the village communities for making good efforts for overall water resource development and management and improve the level of water governance towards sustainable and judicious water use in their villages. Lack of appreciation and incentivization results in lower interest or no motivation for taking the initiative to villagers and their negligence towards maintaining the structures created. For a similar purpose, the central government has already come up with the Composite Water Management Index (CWMI), developed by NITI Aayog for states that assess the supply and demand side of water management and cover governance aspects resulting in an index of state-wise performance. MSWP-19 should take cognizance of this, and the CWMI, which assesses the state-level

performance, needs to be further customized and tested at the district level for greater applicability. The periodic assessment of this index at the district level will help decide the investment priorities for water resource development and management. In a similar line, at the village level system of appreciation for villages performing better in water governance has to be established. For this purpose, WOTR has developed a 'Water Governance Standard and Certification System' to incentivize villagers to adopt good behaviour and better water management practices. Based on the village performance, the certificates get issued to the villages (Yadav & Kale, 2020). Such an incentivization framework for villages to do better needs to be adopted in the MSWP-2019.

d) **Concluding comment:** Although the framework put forward in MSWP-2019 is an important vision and destination to be reached, the how-to strategies to operationalize the set objectives and time-bounded process for achieving them are not presented and discussed. Even though the violation of provisions mentioned in the policy cannot be challenged in the judiciary similar to law, and there is no obligation on the state to implement provisions of MSWP-2019, setting such policy or long-term goal is vital to lead the present course of actions of different actors. However, to reach the set goal, some guidelines on 'who' and how' (fixing or allocating clear responsibilities and functions to agencies and detailed procedures) need to be clearly specified. This is important because a look at the history of water resource development and management in the state reveals that despite having earlier versions of MSWP-2019 (such as 2003 and 2012), the result and outcomes of the policy document are not very encouraging.

3.1.2.1.2 Maharashtra Groundwater (Development and Management) Act, 2009 (MGDMA-2009)

a) **Background and objectives of MGDMA-2009**: Intending to address the gaps in earlier Maharashtra Groundwater Act-1993 (MGA-1993), in the year 2013, Maharashtra brought into force a new groundwater law, MGDMA-2009, with a broader scope, covering an entire spectrum of functions related to development and management of groundwater resource. While removing the lacunas in MGA-1993 and protecting drinking water sources on the one hand and promoting optimum utilization of groundwater for irrigation in a sustainable manner, the State Government rebuilt this Act and formulated the MGDMA-2009. The specific policy objectives mentioned in the Act are (i) ensuring a sustainable and adequate supply of groundwater for different needs, (ii) ensuring the balance between the groundwater recharge and its exploitation, (iii) making the regulatory mechanism more effective in managing groundwater in over-exploited and critical watershed areas, and (iv) provide an institutional framework to ensure community participation which was absent in MGA-1993 (GoM, 2013).

b) **Strengths of the MGDMA-2009**, several policy provisions are made into the MGDMA-2009 To achieve these objectives and align the behaviour of groundwater users. The key policy provisions proposed in the Act are (i) ban on construction of the deep well, and applying cess on groundwater withdrawal from existing deep wells, (ii) Prohibition on sinking new wells in the area of influence of public drinking

water sources, (iii) Implementation of aquifer based groundwater use plan, (iv) Registration of all owners and drilling agencies, (v) Mandatory permission for sinking a new well, and (vi) Mandatory crop planning based on sustainable groundwater use. Thus, the Act has come with very strong teeth of strict regulations where many experts realized the need for such a command and control Act to control groundwater use behaviour in the state. The important strength of the Act is seen in its participatory institutional framework, which was absent in earlier laws. To plan and enforce these provisions on the ground, the MGDMA-2009 has proposed a few new Governing Agencies (GAs) and empowered and strengthened a few existing agencies to carry out delegated responsibilities. Through this Act, for the first time in Maharashtra, a state-level groundwater authority is created, and this role is assigned to MWRRA. The provision is also made for taking additional members in MWRRA for this purpose. For the priority of regulation, the overall area is distributed in notified and non-notified areas (depending on the level of groundwater depletion). The State Groundwater Authority is responsible for implementing the Act, and the District Authority has given the overall regulatory functions. Watershed Water Resource Committee (WWRC) and Gram panchayat are proposed to prepare and implement prospective crop plans based on groundwater availability. The function of granting or refusing permission for sinking new wells in their jurisdiction is given to WWRC or Gram panchayat, the local level institutions.

c) Gaps and deficiencies in the Act and recommendations for modification

Provision 1: Construction of well below 60 meters for agriculture and industrial usage is banned in notified as well as non-notified areas [8 (1)]: The factor of high variation in elevation is important within and between villages, micro and macro watersheds, and different regions as Maharashtra have a diverse typology. Given this fact, what level (elevation) the depth of wells will be considered to measure (up to 60 meters) is not clarified in the provision because, with this provision, farmers in the upper reach would have a natural disadvantage. In contrast, farmers in the lower reach or valley portion would get more advantage to go much deeper (Kale, 2018). Even limiting the depth of the well is unfair and unjust to small and marginal farmers and potentially new groundwater users because the deep bore wells are seen as an easy, quick, and less expensive option by farmers. In contrast, the provision does the grandfathering of existing deep well owners by restricting potential new farmers. Therefore, to control groundwater extraction, we suggest limiting the area under irrigation and groundwater use by different management, and technological measures should be adopted as the key strategy. If the state finds the current provision as non-negotiable, then written permission of Gram Panchayat should be mandatory to take permission to drilling agencies for drilling bore wells in the village administrative boundary, and it should be treated as a punishable offence for drilling agencies to drill below than proposed depth in the Act, and not simply targeting farmers.

Provision 2: In non-notified areas, there is a provision for enforcing the levy of cess on groundwater withdrawal from deep wells (more than 60 meters) [8 (3)]: In the Deccan trap of Maharashtra, in many villages, there are a handful of borewells that yield water for 24 hours daily with full pressure; hence the water yield of such

borewells is very low (Kale, 2018). Therefore, it will be unfair and unfeasible to uniformly apply this rule to all bore wells that extract groundwater below 60 meters. Moreover, there is no clarity on why this provision is made applicable for only the non-notified area and not for notified areas, where it is more required. As discussed above, the issues related to the elevation of borewells are also applicable here, where borewell owners in the upper reaches get forced to extract groundwater from much deeper than borewell owners in the valley portion. The biggest challenge in applying this provision is monitoring its violation. The concerned agency/authority has to practically ensure the depth of bore wells because there is less possibility that bore well owners will share the details of the exact depth of their bore wells. Hence, the application of the provision is problematic and unfair. Therefore, this provision needs to be canceled. In case the authorities find the application of this provision non-negotiable, the low-yielding bore wells should be exempted from the levy of cess irrespective of their depth. As an alternative, the levy of cess should be based on the area under irrigation by the deep wells (and not just based on the depth of bore wells).

Provision 3: Watershed Water Resource Committee (WWRC) will be formed in notified areas, and it will comprise more than 11 villages [29 (1)]: The uniform logic behind arriving at the number of more than 11 villages as geographical jurisdiction for WWRC is not clear and justified in the Act. The Act mentions that the groundwater will be managed at the aquifer level by making groundwater-use plans, the villages that fall in the common aquifer can differ in numbers, and the number varies depending on local hydrogeology. As WWRC will be comprised mainly of bureaucrats and elected political leaders, there will be less possibility of active community participation and their role in decision-making. No active involvement of local people in WWRC will hamper the preparation and implementation of the proposed prospective crop plans and regulate the local groundwater resource. Even though there are no experiences and evidence where such a governing agency comprising multiple villages has successfully regulated even the surface water resource, managing invisible groundwater resources shared by multiple villages, will be challenging. Even the Water Users Associations (WUAs), which have been aggressively promoted since 2005 in the state through a special Act in Maharashtra to manage water for irrigation from canals by farmers, have not had very encouraging experiences, despite a few handfuls of cases. Given this reality, the proposed bureaucratization and politicization of WWRC should be avoided by limiting the number of officials and political representatives in it. Along with this, village-level members should get chances for WWRC office bearers, such as the chairperson and secretary.

Provision 4: In notified areas, prospective crop plans based on the groundwater use plan will be made by WWRC. Non-observance of these plans by farmers shall be deemed a cognizable offense. In the non-notified areas, preparation and implementation of water accounts, water budgets, and aquifer-based groundwater plans will be made by Gram panchayats [10]: There are no extensive and successful pilots of the prospective plans at the aquifer level, which is shared by multiple villages where people can visit and get motivated (E. B. Kale, 2018). There is less possibility of estimating the precise amount of groundwater availability in a shared

aquifer for planning purposes. As such plans have to come with strategies for reducing the groundwater use of large groundwater users or farmers who irrigate perineal crops, there is less possibility that such farmers will come forward and cooperate with such plans. Experiences show that even in a village, few powerful farmers do not follow crop plans made by the village and extract more groundwater, affecting the interest of farmers who sincerely follow the plans. The possible danger in proposed aquifer mapping is how communities will apply and utilize newly generated knowledge of identified aquifers and groundwater stock. This exercise may disclose the hidden sources of groundwater stocks to resource-hungry people. Village level committees cannot avoid groundwater mining and monopoly in proposed identified aquifers by resource-rich persons (Eshwer Kale, 2013). Hence, pilot-level implementation of prospective crop plans based on groundwater availability is necessary at an extensive scale to showcase its practicability on the ground. To ensure equitable share to each family in the villages/watersheds, clear criteria should be developed and specified for proposed crop plans to allow area under specific crops and irrigation, irrespective of families' land ownership. Therefore, all water use in the village-it may be surface or groundwater-should be treated as equal and should come under the purview of this provision. Practically, prospective crop plans should be made and proposed on the scale of micro-watershed (1000 to 1500 hectares), which is more feasible. In practice, aquifer mapping exercises of villages and institutional and capacity building of people for sustainable use of these aquifers must go hand in hand.

d) **Additional provisions and measures required in MGDMA-2009:** Along with the above-discussed modifications in existing provisions in the MGDMA-2009, the ground level water dynamics indicate an important need for following new additional policy provisions of the Act, which are either missed or not fully understood while framing the Act.

Provision 1: Nala and river deepening: Activities of *Shirpur* or *Khanapurkar* pattern of deepening, widening, and straightening existing streams and rivers to store and recharge more rainwater to increase groundwater availability are promoted and under promotion in many villages and streams. Even such work is being taken aggressively by the state and many NGOs, CSRs, and religious/spiritual organisations. However, many experts have raised concerns about the dangers of applying this pattern, which changes the local hydro-geology of the surrounding area and changes in water allocation in downstream villages (Joy, 2015). Hence, the activities of the *Shirpur* or *Khanapurkar* pattern in the proposed areas should be taken only after the detailed environmental (and specifically hydro-geological) assessment of interventions in the area, along with an assessment of changes in water allocation in downstream areas and the provision for the same needs to be made in MGDMA-2009.

Provision 2: Storing groundwater in farm ponds should be banned: To achieve the conjunctive use of surface and groundwater to deal with water shortage and more income, farm ponds are seen as a popular strategy by farmers (Prasad et al., 2022). The state aggressively promotes the construction farm pond strategy under the ‘Magel Tyala Shet-tale’ scheme and the employment guarantee scheme (EGS).

However, in practice, large farm ponds are being constructed rapidly everywhere, even in water-stressed areas. For storing water in them, pond users are extracting huge amounts of groundwater, resulting in almost empty aquifers and allowing pravastatin of groundwater (Eshwer Kale, 2017). Farm ponds' rapidly changing groundwater dynamics must be adequately understood as a new irrigation source. Hence, storing water in farm ponds by extracting groundwater should be prohibited in notified areas and overexploited zones, declared by GSDA, and regulated its size and numbers. In addition, as a provision in the Act is made to register all wells in the state, all farm ponds also need to be registered under the Act.

Provision 3. Need for regulating the area under sugarcane in drought-prone areas: Although sugarcane is a very water-intensive crop, the area under sugarcane cultivation is steadily increasing in even water-scarce areas, such as the Marathwada region, in the state. As a result, although more than 50% of the state is drought-prone, Maharashtra is one of the highest sugarcane-producing states. There are certain pockets in the state where sugarcane is being cultivated through groundwater, supplemented by canal irrigation. Hence, in MGDMA-2009, a provision has to be made that sugarcane cultivation should be strictly prohibited in declared over-exploited watersheds/areas and notified areas for groundwater use.

Provision 4: Incentives for groundwater saving and efficiency: The overall framework of the Act is based on the regulation of groundwater by commands, punishment, and penalties. Few groundwater-using farmers expressed their willingness to reduce their groundwater use, but they don't find any incentives for reducing their use, which discourages them. Hence, there should be some type of economic incentives/mechanisms of payments for 'ecosystem services' for less groundwater use, encouraging such users to use less groundwater. Such incentives may be from good market rates to fewer water incentives for crops, lowering seed and fertilizers costs for such crops, concession in or rationing of electricity for less groundwater using farmers (metered electricity supply for irrigation), etc.

Provision 5: The interpectoral approach needed: Managing groundwater has been seen in silos ('hydro-schizophrenia') in the MGDMA-2009, and its important link with water-food-energy-land-market-climate is not addressed. Many experts have the consensus that unless these links are appropriately addressed, the objective of sustainable groundwater use cannot be achieved. Therefore, the Act must adopt an inter-sectoral approach to reduce extraction of groundwater for irrigation which should precisely focus on a) good MSP to rainfed or non-irrigated crops, b) promotion and subsidy for increasing soil health practices, and maintaining the primary productivity of the soil, c) ensuring that promotion of energy subsidies and promotion of solar pumps does not negatively affect on the aquifers by extracting more groundwater, and d) balancing supply-side interventions, focusing mainly managed aquifer recharge (MAR), recognizing that the aquifers will be an essential buffer for communities to deal with changing monsoon pattern in the context of climate change.

e) **Concluding comment:** Overall, the MGDMA-2009 may be more robust if it regulates all water use in an integrated manner and adopts an inter-sectoral approach. Even

important provisions proposed in the Act need an extensive pilot to assure that these provisions are suitable for all agro-climatic and hydro-geological regions and will provide an opportunity for appropriate changes in them. More importantly, the Act needs to be essentially assured that it truly addresses the issues related to the normative concerns of equity and justice, gender, participation, sustainability, and ecosystem integration with the added concern of climate change. Considering the importance and urgency of implementing MGDMA-2009, there is an urgent need to approve and notify the Act's operational rules, as they have been in draft mode for more than seven years since the Act was passed in 2013. If the operative part is not in place, the Acts and Laws remain on paper; thus, as rightly mentioned by Pradeep Purandare (Purandare, 2015), incomplete legal processes make regulation impossible, finally helping free-riders.

3.2.1.1.3 The Maharashtra Water Resources Regulatory Authority Act-2005 (MWRRA-2005)

a) **Background and objectives of the Act:** The Maharashtra Water Resources Regulatory Authority is formed under the MWRRA-2005. It was the first-ever quasi-judicial Independent Regulatory Authority (IRA) in India's water sector, and many Indian states adopted this model after that. The formation of MWRRA was mainly influenced by the guidelines given by the World Bank, where the fundamental principles laid down were of collecting a water-use fee or tariff for meeting the cost of operation and maintenance of the irrigation projects. In addition, the principles promoted water as an economic good by ensuring more tradable water rights and entitlements to water users (Dandekar, 2016). As mentioned in the MWRRA-2005, the regulatory authority created under this Act is set to fulfil the objectives of (i) Regulation of Maharashtra's water resources, (ii) facilitating and ensuring the judicious, equitable, and sustainable management, allocation, and utilization of water resources, (iii) deriving the rates for water utilization for drinking, agricultural, industrial and other purposes. The 2005 Act was amended in 2016.

b) **Strengths of the Act:** During the different political regimes in the state for the last one and a half-decade, the MWRRA as an independent authority has been sustained, and functioning is a very positive sign as this was the first effort to introduce ILR in the water sector in the country. With the introduction of MWRRA for the first time in the state, wider participation and discussion were seen in public hearings and consultations on setting the bulk water tariffs where earlier such processes were taken behind closed doors. The composition of the authority is also expert-centric. It has been delegated significant powers of regulating the water sector and project approvals; this authority's important power, which makes it unique, is its quasi-judicial status. The Authority has the power to hear the different cases, appeals, and petitions on water issues in the state, such as a regional imbalance in water allocation or water deprivation to tail-enders in the canal system, etc., and give the judgments. At the same time, the authority can decide on equitable water sharing on sub-basin and river-basin water allocation and transfers. Although water is a very sensitive and politicized resource, and there is a popular mindset against its pricing, whatever progress the MWRRA has made in developing a framework for setting water tariff and pushing it by reviewing and modifying roughly after every three

years is an appreciable task and achievement. Although authorities gave few judgments, such as mandatory drip irrigation for cash crops, which are not fully implemented, they have captured the significant attention of different actors in the water sector.

c) **Gaps and deficiencies in the Act and recommendations for modification:** Following gaps and weaknesses are necessary for improving the effectiveness of MWRRA.

Provision 1: Dependence of MWRRA on Water Resource Department (WRD) for its composition and funding: As the MWRRA is expected to be independent regularity authority and function independently, its structural and composition aspects also should be independent in true nature. More importantly, as WRD is one of the important departments and agencies in the state regarding water resources, MWRRA should have the independence to evaluate and regulate decisions taken by WRD. However, MWRRA is highly dependent on WRD for different reasons. WRD has a decisive role in the appointments of the Secretary, Members, and Chairman of MWRRA. Even after the closure of initial support by the World Bank, government funds to MWRRA are channelised through WRD. Even the amended MWRRA Act in 2016, says 'when the Authority cannot be reconstituted for whatsoever reason, the powers, functions, and duties of the Authority may be exercised, performed, and discharged by a Committee to be appointed by the Government.' This committee will consist of persons holding the post of the Additional Chief Secretary or equivalent who shall act as a Chairperson and the Secretary from Water Resources Management and Command Area Development and Water WRD. For the last few years, the chairperson position of the Authority and member for groundwater resources have been vacant, and at present out of 10 directors (at different levels), six positions are vacant. The lack of adequate members on board affects the independent and active functioning of MWRRA. Thus, the above dependence of MWRRA on WRD is a severe lacuna as it results in a paradox of who is regulating whom? Whether MWRRA regulates the WRD and state water resources or WRD regulates MWRRA by selecting members on authority and providing funding. To improve this functioning, MWRRA needs to be delinked from WRD, and should be linked with either State Water Board or State Water Council. In addition, MWRRA should receive some percentage of funds directly from the annual state budget to ensure that it functions independently.

Provision 2: Apart from the chairperson and four members, there will be five special invitees, each one from 5 river basins [4.1 (D)]: According to this provision, in authority, in addition to four members, five invitees from different river basins (with a woman member) will be appointed. However, even after one and half decades, no such invitees are selected as part of the authority. Hence, there is a significant need to improve and address the delays in selecting members of the authority and invitee members to make the authority fully functional.

Provision 3: To review and clear water resources projects proposed at the sub-basin and river basin level, the Authority has to ensure that a proposal conforms with Integrated State Water Plan (ISWP) [11 (F)]: The provision in the Act is made that within one year of the formation of Authority, ISWP will be made, and the state

water board and the state water council will initiate this process of preparing ISWP. This plan was very important because the provision made is that MWRRA will clear the irrigation projects at basin and sub-basin levels with the conformity of the ISWP. Practically, it took almost 14 years to prepare and finalize the ISWP as it was completed and formally released in 2019. Even there was a strong push by the judiciary to complete the ISWP in response to public interest litigation (PIL) filed by Prof Pradeep Purandare in the Aurangabad bench of the Bombay high court in October 2014. In response to the PIL, the high court declared 191 projects illegal, which MWRRA cleared in the absence of ISWP (Purohit, 2016; Deshpande, 2016). The court has also ordered that no administrative approval should be given to new projects till the preparation of ISWP. This move expedited the preparation of the ISWP process. To avoid such a problematic situation and not get it repeated, the authority has to function transparently and professionally to deliver the time-bounded outcomes.

Provision 4: Water charges shall be based on the full recovery of the cost of the irrigation management, administration, operation, and maintenance of the water resources project [11 (D)], and quotas of water determined to entitlement by authority may be transferred, bartered, bought or sold on the annual or seasonal, basis within a market system [11 (i)]: The concept of water entitlement applied in the Act is market-driven, rather than considering it as a human right and fundamental right orientated. Water is seen as a fundamental right by the Indian constitution under the right to life under article 21 (Narain, 2009; S Wagle et al., 2009). Once this precious and life-giving resource gets treated as an economic and tradeable community, certainly the resource-poor and those whose purchasing capacity is low get disadvantaged in access to adequate water. Even as canal water access is linked to operational ownership land, the tribal cultivating lands for years but not with land titles get disadvantaged in access to water. The biggest victims of promoting the water market are the ecosystems, flora, and fauna; these are silent actors, and water for their sustenance is perceived as uneconomic. Therefore while fixing tariffs, a certain quota of water for all should be allowed for free, ensuring water for basic livelihoods and ecosystem needs. After that, it should be charged on a pro-rata basis, similar to electricity charges (minimal charges for certain units and then increased charge per unit).

Provision 5: Authority and Dispute Resolution Officer have the "powers as are vested in a civil court, under the Code of Civil Procedure, 1908 (13), and it has been categorically mentioned that "No Court shall take cognizance of an offense punishable under this Act except upon a complaint, in writing made by the Authority or by any other officer duly authorized by the Authority for this purpose" (29): With this provision, MWRRA, as an authority, has given independent power to give judgments and orders to regulate the overall water resource in the state. Using this provision, the data on the MWRRA website shows that the authority has passed a few orders and notifications on complaints raised before it. However, the data shows that the nature of judgments and orders is mostly confined to the issues related to managing irrigation projects and transferring the water from one project to another. The observations show that MWRRA has not exercised this important power as a quasi-judicial authority to transform the water sector in the state. It was

evident that cropping patterns in groundwater stress regions (such as sugarcane in Marathwada) is one of the reasons for water scarcity and desertification. There are numerous suggestions to bring all sugarcane cultivation under drips. Still, MWRRA has not taken any radical measures on this. Even in water scarcity and drought years, transferring water from one basin to another and one project to another becomes crucial for drinking and livelihood purposes. If these decisions are not taken smoothly, it creates conflict in different regions, but Authority has not actively taken the initiative to address the equity issues (Purandare, 2013). With Maharashtra Groundwater (Development and Management) Act-2009, MWRRA has been given the additional responsibility of 'State Groundwater Authority'; however, except few notifications, no serious efforts have been seen from MWRRA to operationalize and implement the Act. Even the operational rules of the 2009 Act are not yet finalized, and they are still in draft mode. No doubt, MWRRA has numerous challenges to execute its power of quasi-judicial authority, such as the less political will of state leadership to transform the water sector or take favorable decisions or not to take decisions as well as interdepartmental dynamics, but the authority has to find ways and means to improve its performance and put the right path for other states, as this was the first initiative in the country to set independent regularity authority (IRA) in the water sector.

c) **Concluding statement:** Being a first-ever quasi-judicial IRA in India's water sector, MWRRA has certainly made remarkable progress. The feedback mechanism available through public hearings and its quasi-judicial status make MWRRA a unique policy intervention. However, to make it more independent in its functioning, it has to delink from WRD, with the provision of the fund in the annual state budget. Even the political will to strengthen the authority is crucial as its members and chairperson posts have been vacant for many years. If the MWRRA receives independence in its functioning, it certainly has the huge potential to transform the state water sector, but the situation indicates that it has to go a long way to achieve this.

3.2.1.1.4 Maharashtra Management of Irrigation Systems by Farmers Act-2005 (MMISF-2005)

a) **Background and objectives of Act:** The practice of participatory irrigation management (PIM) is not new to Maharashtra. It can be traced back to the 16th century, when the *Phad* system was prevalent in North-Western Maharashtra (Singh et al., 2018). Later, several cooperatives emerged to manage irrigation water with the Maharashtra Cooperative Societies Act 1960 and Maharashtra Irrigation Act, 1976. However, the concept of 'Water Users Associations (WUA)' reflecting the participatory irrigation management (PIM) did not penetrate at a large scale. Hence the demand for a new Act promoting the PIM was slowly growing. Besides, around 2005, the Maharashtra State got a loan from the World Bank for Maharashtra Water Sector Improvement Project (World Bank, n.d.). However, the key condition for this loan was the introduction of reforms in the irrigation sector of Maharashtra. In this background, the Government of Maharashtra enacted the MMISF-2005 to provide a legal framework for the existing and forthcoming WUAs. The MMISF-2005 was modified in May 2013. The broad objectives set for the act, as mentioned in MMISF-2005, are (i) to increase the actual utilization of irrigation water; (ii) better utilization

of surface and groundwater by effectively managing the distribution, deliver application, and drainage irrigation systems; and (iii) increase the farmers' participation by giving them the statutory recognition and thereby improving the agricultural productivity.

b) **Strengths of MMISF Act:** MMISF Act provides a legal framework and statutory status to the WUAs; thus, the Act has made a valuable provision for farmers' participation in PIM. The PIM framework promoted by the Act has been an important transition in central decision-making by WRD and full power to bureaucrats, mainly irrigation engineers, towards a participatory approach by engaging farmer communities in managing irrigation projects and water service delivery. Although there are many difficulties, few successful WUAs have shown that the Act supports systematically making irrigation available to farmers and overall transfer or handing over of irrigation projects to WUAs for operation & maintenance, and management. The positive open space in the Act of establishing widespread operational ownership by farming communities over local water reservoirs is one of the biggest strengths of the framework provided by this Act, along with space for farmers and WRD officials to work together and build trust among each other. The Act has also resulted in better recovery of water use charges by farmers in command areas through WUAs.

c) **Gaps and deficiencies in the Act and modifications recommendations:** According to a recent study by TISS, until 2021, Maharashtra has 2880 WUAs, covering around 23% developed command area (Tiwale, Kale & Bhasme, 2021). This indicates there is still a long way to go to bring the remaining 87% of the command area in the state under participatory irrigation management (PIM) through the governance and regulation of WUAs.

Provision 1: All the landowners and occupiers become a member once the WUA command area of the WUA is notified [Section 8 (1)].

The basic difference between the Cooperative Society's Act 1960 and MMISF Act-2005 is that in the 1960 Act, the membership of the WUA was voluntary, whereas, in the MMISF-2005, it has become compulsory. This mandatory membership and thus formed General Body lacks the motivation for participation. Members generally hesitate to take up the responsibility as they don't have empathy towards the association. Therefore, the WUAs failed to emerge as an organisation representing all farmers. In the case of the Cooperative Act-1960, as the membership was voluntary, the process of formation of WUA generally involved the coming together of like-minded people who used to motivate others, and thus there was a sense of belongingness leading to the active participation of people. Even after one and a half decades of enacting the MMISF Act-2005, as per the data of the Directorate of Irrigation Research and Development (DIRD), around 25% WUAs registered under the Cooperative Societies Act-1960 are not yet registered under MMISF Act-2005 (Tiwale S et al., 2021). The same study also shows that most farmers involved were not made aware of the concept of PIM and the role, authorities, and responsibilities of WUAs and their member farmers.

Provision 2: Appropriate representation should be given to the women members of the Managing Committee [Section 9 (3)]: The Act clearly mentions the representation of women in the Managing Committee of WUAs. However, in reality,

the ownership or the occupancy of the land in Maharashtra is in the name of the male member of the family. As a result, though actively involved in agriculture, the women cannot become part of the WUA (S. Kulkarni, 2011). A recent study by the Tata Institute of Social Sciences reveals that, in 7% of cases, the managing committee did not have any women representation, and around 60% of the handed-over WUAs did not have any women chairperson, despite the MMISF Act reserves a two-year term for women chairperson in the six-year tenure of the managing committee (Tiwale S et al., 2021). To improve the women's participation, it is recommended that anyone from the family of the landowner or occupier can become a member of the WUA, or the automatic membership to one of the women of the family should be given if the family has land ownership. Even wider observations show that only appointing women to the managing committee of WUA was not enough; the capacities of women farmers need to be built (S. Kulkarni, 2011). Additionally, the WUA and the relevant WRD staff need to be sensitized about the role of women farmers in this process, ensuring adequate gender balance while appointing staff for executing PIM in WRD.

Provision 3: The WUA should be provided with a functional measuring device, and the water should be provided to the WUA based on a volumetric basis [23 (1) and 26 (1)]: The WUAs are expected to take full charge of irrigation service delivery, including distributing water, collecting water tariffs, and maintaining canal infrastructure. The study made by TISS indicates that 35% of handed-over WUAs were not performing their given task of irrigation management. The act clearly mentions that every WUA should be provided with functional measuring devices to ensure the volumetric water supply. However, the quality of water measuring devices was observed very poor (Tiwale S et al., 2021). Few water experts rightly shared that the state has a very poor canal network and capable devices in the command area (PTI, 2019). As a result, the proposed volumetric water supply to many of the WUAs remains on paper. Therefore, as WUAs depend heavily on the WRD for these functions, and WRD controls sources, canal water flow, and a large part of the infrastructure, WRD has to invest resources to repair and improve canal instruments and infrastructure for better canal water management.

Provision 4: The Lift Irrigation WUA shall not lift water directly from the main canal, and it shall be made available by flow under gravity through an arrangement in the intake well built by the Lift Irrigation WUA at their own cost [Section 46]: For farmers residing at higher elevations where gravity flow from the canal is not possible, the provision of forming lift irrigation WUA is provided in the Act. However, such lift irrigation WUAs are expected to invest on a very higher side. It is expected that the provision of intake well should be made by lift irrigation WUA at their own cost; besides, WUAs are expected to provide, install, maintain and calibrate water meters for flow measurement at their own cost. Even all expenditure for installation, organisation, and maintenance of the overall lift irrigation scheme (including heavy electricity bills) is expected to be borne by these WUAs. These conditions discourage such WUAs and therefore require huge support from WRD for taking loans from the private sector for installing such lift irrigation schemes and encouraging subsidy mechanisms in loans.

d) Additional Provisions and Measures required in MMISF Act-2005

Following two sets of additional policies, measures are recommended in the Act.

Provision 1: Approach and mechanism of integrated water management: As per the MMISF Act- 2005, the WRD is supposed to provide irrigation service following the principle of volumetric measurement to improve water use efficiency. However, the ground situation is that a significant number of farmers in the command use percolated canal water, i, e, groundwater, and these farmers and the corresponding irrigated area remain unaccounted for. Experiences show that more than two-thirds of farmers are accessing groundwater recharged through canals and minors. Although the Act says the WUA has the right to levy the charges on the use of groundwater, no specifications and further detailing regarding this is mentioned in Act, the same is in the case of large size farm ponds where its owners are lifting water from canal water to store it in ponds. Hence, there is a specific need for guidelines for deciding the groundwater charges and conjunctively managing canal water and groundwater.

At the institutional level, the 'water and sanitation committee' roles at the village level and the WUA function separately. In many villages, even there are 'Village Watershed Management Committee' formed under the IWMP and other watershed programs; therefore, there is the possibility of multiple organisations working in the same village to solve the common problem of water resource management. Hence, there is a need for integration of all these committees and organizations and make a single integrated committee to look after the drinking and irrigation water; surface and groundwater; as well as aquifer recharge and watershed treatment, because these issues can't be seen and addressed in silos and the WUA could very well fit in this role. Incidentally, in Atal Bhujal Yojana, the WUA as an institution is promoted by strengthening existing water supply and sanitation committees in villages. The overall concept of WUA in the Act as well the practice is made centric on water access for irrigation and water use efficiency, but as a water resource is one of the vital connectors of ecosystem health, the WUA members should be trained and empowered to manage and adapt the practices suitable for their local environment, promoting the healthy local ecosystems.

Provision 2: More emphasis is needed on capacity building: More emphasis should be given to capacity building at different levels. The training should start right from the notification of the WUA's in the command area so that the people will be well informed about the detailed process of WUA formation & functioning and also they will be technically sound to measure their water supply on a volumetric basis right on the day of handover of irrigation project to the WUA. Thus, the WUAs need to be empowered such that it becomes the sole organisation that manages the canal water, groundwater, and other water resources (ponds and streams) within the command area. Equitable access to farmers of canal water is not well addressed. The Act just mentions it as a function of WUA to ensure equitable water distribution to farmers, but no further checks and details have been made in the Act. To ensure institutional sustainability, the WUA needs to move beyond irrigation service delivery and engage in activities providing additional agricultural-related services. These activities need to include agro-advisories, access to credit, inputs, advanced technology, processing of farm produce, and market linkage.

For meaningful participation of the WUA, office bearers and the member farmers in the PIM process, significant efforts are required towards their capacity building. The WRD needs to empanel professional organisations, including NGOs, to support WUAs for the initial phase. For efficient implementation of PIM, WRD needs to change its staffing policy. WRD requires professionals trained in the interdisciplinary disciplines belonging to the domain of agriculture, geohydrology, agricultural engineering, social sciences, data management, GIS, and instrumentation to manage irrigation systems and successful implementation of PIM efficiently.

e) **Concluding comments:** The MMISF Act-2005 is important in promoting PIM and farmers' involvement, and the few successful cases have shown its limited success. However, significant modifications are required in the Act to increase the knowledge and capacity of farmers as well as WRD officials on the ground at different levels, address the village water issue in an integrated manner, and create a more inclusive composition of WUAs with improving canal infrastructure before handing over irrigation project to the WUAs. At the same time, delays or non-execution of agreements with WUAs by project authorities needs to be well addressed. As rightly agreed in Maharashtra State Water Policy 2019, the process of delineation and handing over command areas to WUAs is very slow due to a lack of funds for carrying out restoration & rehabilitation of the distribution system, canals and minors (GoM, 2019), which need to be improved on a priority basis. Given these facts, there is also a growing concern in water experts and activists that WRD is purposefully putting a poor focus on the capacity building and strengthening of WUAs because by showcasing the existing model of WUAs is least viable or weak, WRD intends to push the contractors (private service providers) in supplying canal water to farmers.

3.2.1.1 Analysis of the state-level programs

Government programs provide an important medium for the state to translate policies and priorities into actions. Therefore, the objective diagnosis of different government programs in the state's water sector is crucial to review. The analysis provides shades of their benefits, strengths, unintended consequences, gaps, and recommendations to make them more appropriate.

3.2.1.1.1 Integrated Watershed Management Program (IWMP)

a) **Background and Objectives:** Integrated and participatory watershed development and management emerged as the cornerstone of rural development in India's dry and semi-arid regions. These programs initially focused on arresting soil erosion in catchments of large and medium reservoirs but gradually grew in scope. As a result, watershed development became one of the largest interventions in the country in terms of scale, resource allocation, and agencies (Eshwer Kale, 2020). To remove the gaps in earlier Programs, such as Drought Prone Area Program (DPAP) and Desert Development Program (DDP), Hanumantha Rao Committee guidelines came in 1994, and in 2001 and 2003, the Ministry of Rural Development revised these guidelines under the nomenclature 'Hariyali Guidelines.' After that, the Integrated Watershed Management Program (IWMP) was launched in 2009-10, which incorporated the

DPAP, DPP, and Integrated Watershed Development Program (IWDP). Later three programs of the Ministry of Agriculture, 1) National Watershed Development Project for Rainfed Areas (NWDPRA), 2) River Valley Project & Flood Prone River Project (RVP&FPR), and 3) Watershed Development Project in Shifting Cultivation Areas (WDPSCA), were terminated, and IWMP remained a single national program for the development of watershed development. In 2008, the 'Common Guidelines for Watershed Development Projects' were developed and revised in 2011. Currently (2021), these guidelines are under further revision by the National Rainfed Area Authority (NRAA).

In 2015, with the sanctioning of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), the IWMP was merged into it, and from then, it has been treated as the Watershed Development Component of PMKSY (WDC-PMKSY). The main objectives of IWMP are to restore the ecological balance by harnessing, developing, and conserving depleting natural resources such as soil, vegetative cover, and water. Vasundhara Watershed Development Agency is the State Level Nodal Agency in Maharashtra responsible for the overall watershed work in the state.

b) **Strengths of IWMP:** The main strength of IWMP is its umbrella nature, where the different isolated watershed programs are merged and brought under a single guideline. Furthermore, IWMP emphasizes the convergence of various schemes for fundraising for watershed development. On one side, it uses advanced technology for planning and implementation; on the other, it seeks people's participation in the entire appraisal of the watershed initiative.

The common guideline 2011 for watershed development projects is based on the principles of 1) equity and gender sensitivity, ensuring inclusiveness at all levels, 2) decentralization to improve delegation and professionalism, 3) social mobilization, community organization, building capacities of communities, 4) centrality of community participation, 5) a participatory, outcome and impact-oriented and user-focused monitoring, evaluation, and learning system, 6) and organizational restructuring by establishing appropriate technical and professional support structures. A few important strengths of the IWMP are provisions of additional financial assistance for strengthening institutions, the enhanced duration of projects-ranging 4 years to 7 years, the adoption of a cluster approach with a broader vision of geo-hydrological units (average size of 1,000 to 5,000 hectares), and a multitier ridge to valley sequenced approach. Along with the soil, water, and land conservation, as this mainly benefits landowners, the IWMP specifically priorities livelihood promotion. Along with the soil and land development, the new approach systematically integrates livestock and fisheries management as a central intervention and encourages the dairying and marketing of dairy products. The provision of a watershed development fund (WDF) for post-project repair and maintenance and a revolving fund for women SHGs are positive sides of the guideline. These 'watersheds plus' provisions are more relevant as only landed families benefited from the huge public investment in watershed development.

c) **Gaps, Lacunas, and Deficiencies in the existing Key provisions and recommendations**

Point 1: Less focus on groundwater and aquifers in watershed planning: The policy aptly incorporates the ridge to valley development of watershed management and talks about the assessment of periodic changes in geo-hydrological potential, soil and crop cover, runoff and selecting the structure at appropriate locations by applying latest remote sensing techniques. This needs to be supported by detailed hydro-geological mapping of the watershed to know the potential groundwater zones (recharge and discharge zones). As artificial groundwater recharge and increased groundwater storage in aquifers are seen as an important strategies for building the resilience of communities to the increasing droughts and low rainfall, more concentrated efforts in the scientific delineation of aquifers and recharge measures need to be incorporated. While doing this, the water quality at the surface and groundwater should also be checked before the actual construction of water harvesting structures. In this regard, IWMP projects can benefit more from the aquifer maps generated through the NAQUIM project and village-wise Groundwater recharge and discharge maps developed by GSDA in Maharashtra. These maps will be very useful for selecting the locations for rights structures. Therefore, rather than simply focusing on the hydrologic unit for sections (of around 1000 to 5000-hectare areas), the criteria of geological or aquifer delineation also should be incorporated into the guideline.

Point 2: Lack of provision for demand-side management and appropriate governance: The overall component of demand-side management and water governance is not well addressed in the guideline, which is equally important. The tragedy of successful watershed projects in history taught us that the watershed benefits did not result in sustainability due to the lack of the above efforts. Hence, to avoid such tragedy, the approach, and strategies of demand-side measures and governance of water, addressing farmers' behaviour of water-use and crop practices, is essential to be incorporated into the guideline. This objective can be achieved by adopting the water stewardship approach and practices developed and tested by WOTR in more than 200 villages in different states in India. WOTR has documented this initiative's key learnings and processes in the book 'A Step Towards Quenching Rural India's Thirst Experiences and Learnings from the Water Stewardship Initiative in Maharashtra' published by WOTR (D'Souza et al., 2019).
Preparation and adoption of a water stewardship plan is the key strategy in the water stewardship initiative. The plan consists mainly of the water budgeting plan and its follow-up sub-plans to meet the deficiency in the water budget. These follow-up plans consist of 1) the supply-side plan- maintenance and repair of existing structures, 2) the water-saving plan- adopting efficient water use practices, and 3) making village-level rules on water use and crop selections. IEC tool, such as the Village Water Health Chart, plays a trigger to motivate villagers to follow these practices. Water budgeting requires building a cadre of water stewards to follow water saving and conservation practices, with an approach of water as a public trust. Such a comprehensive demand-side management approach must be incorporated into the guidelines to make the impacts of watershed interventions sustainable.

Point 3: Ignorance of ecosystem management: The overall ecosystem perspective is lacking in the present guidelines. The watershed does not only represent the land, water, and people, but it also incorporates the ecosystem sustaining it. Hence, while

considering watershed development, due attention should be given to managing ecosystems sustainably. Efforts should also be made to maintain agroecology, which could be achieved by promoting crop diversity. These efforts will help better manage the ecology and improve food and nutrient security. In addition to agricultural areas, the existing forest areas and newly afforested areas should also be focused on ecosystem management. Therefore, there is an urgent need to transform the program in line with ecosystem-based mitigation and adaptation. This will help design the development, mitigation, and adaptation components in a continuum.

Point 4: Need to reconsider social fencing in the watershed: The issues of social fencing (community control and rule-making for sustainable and equitable use of natural resources) should be applied strategically and effectively, and the concept needs to be widened. At present, rule-making in popular watershed programs is only confined to the ban on open grazing and tree-felling and a limitation on water-intensive crops. However, no convincing mechanisms or rules exist to prevent powerful individuals from drilling deep wells when the water table has risen, and the project has ended. Social and public control is required to avoid such exploitive behaviour by well-to-do farmers. The PIA has to play a significant role in achieving this by convincing the watershed community.

Point 5: Land capability classification, soil analysis, agro-biodiversity (LDN Targets): Before implementing the project, during the preparatory phase, the land capability classification of the watershed should be done. This classification will ensure the land's capacity for various uses and even derive its suitability for multiple crops and afforestation areas. Analysis of soil's physical and chemical qualities should be an integral part of this assessment. Besides, the characteristics of agro-biodiversity can also be included in such an examination of the land. Such keen observation and land evaluation will help achieve the Land Neutrality Targets (LND Targets).

Point 6: Climate change adaptation, resilience building, and climate-proofing of watersheds: Keeping in mind the increasing climate variations (such as excess rainfall in short), watershed structures may need redesigning to accommodate these changes. There is also a need to include biodiversity conservation in watershed development, particularly climate change adaptation. Essential components of watershed development where biodiversity concerns can easily and immediately be integrated are afforestation, drainage line and area treatments.

More productive and more resilient agriculture requires a major shift in how land, water, soil nutrients and genetic resources are managed to ensure these resources are used more efficiently (Thrupp, 2000). There is also a need for innovations in developing crops tolerant of multiple climatic stresses which can withstand drought and flood/water logging in the same season as we have been witnessing in several parts of the country. Finally, there is a need to promote innovative low-cost products for agricultural inputs that are more effective with favourable environmental impacts to ensure higher returns to the farmers. In this regard, more focus should be given to long-term reliable weather forecasts down to the micro-level (village/mandal) and effective dissemination of location-specific farm advisories for the benefit of the farming community. With the advancement of mobile technology and the availability of Android mobiles, most farmers are well equipped to receive

crop-weather advisories using mobile applications such as FarmPrecise (developed by WOTR) (WOTR, 2020). Realizing climate change is inevitable, it is necessary to mitigate the risks, reduce losses, and enhance agricultural communities' resilience and adaptive capacities. Promoting eco-friendly climate-resilient agricultural practices which increase the yield sustainably, conserve natural resources, and improve the overall agricultural productivity is the need of time. Studies showed that climate-resilient agriculture (CRA) practices, such as soil test-based integrated nutrient management (INM) and integrated pest-disease management (IPM) techniques to manage crop infestations, could help farmers reduce input costs and increase the crop yield (Gholkar et al., 2022).

To achieve these objectives, the devoted institutional arrangement needs to be factored into the program to incorporate the climate change adaptation, mitigation, and resilience-building angles in watershed development. Along with the proposed watershed committee or sub-committee of the watershed committee, such a devoted committee on climate adaptation should be capable of assessing different climatic vulnerabilities in the watershed, coupled with the follow-up of climate adaptation and resilience plan in the main watershed development plan or DPR.

Point 7: Per Hecate Unit cost: The provision of unit cost for watershed development in the guideline is Rs.12,000/ha in plains and Rs.15,000/ ha in difficult/hilly areas in 2011. Now more than ten years have passed, and the rising cost of labour and material has increased by about 3 to 4 times since then. Due to climatic trends, these norms are much below the minimum investment requirement with the increased work intensity. Therefore, we recommend the per hectare cost norm of Rs.25,000 for plain areas, and for hilly areas requiring springshed management, it should be Rs. 35,000. The state should be flexible in deciding costs based on local conditions, not exceeding the upper limits.

Point 8: Significant institutional restructuring required: In the guideline for the IWMP, different institutional arrangements are made at differing levels. For example, at the Ministry level, a Steering Committee is formed, chaired by the Department of Land Resources secretary, to sanction the projects proposed by the states. At the state level, a State Level Nodal Agency (SLNA) facilitates the projects' implementation in Maharashtra's Vasundhara Watershed Development Agency' which plays the role of SLNA. The Watershed Cell-cum-Data Centre (WCDC) is created at the district level for supervising and coordinating the projects. The Project Implementation Agency (PIA) provision is made for selecting the panchayats, government, and non-governmental agencies. At the village level, a Watershed Committee (WC) of 10 members is proposed to be formed to implement the project at the field level, with the provision of half of its members of representatives of SHGs and User Groups, SC/ST community, women and landless persons in the village. One member of the Watershed Development Team (WDT) is also given representation in the WC.

Watersheds are inhabited by different categories of people in terms of land ownership, caste and class affiliation, occupation, financial status, and gender. In rainfed areas, small and marginal farmers are a significant segment of the farming community. Besides, many inhabitants are either landless or dependent on small enterprises/occupations. People residing along the forest fringe (mainly scheduled

tribes), mostly in the watershed's upper reach, depend on primary forest produce and small ruminants. Rich farmers with larger landholdings in the lower watershed normally access a larger share of the developed natural resources. These complex situations demand inclusive benefits of watershed development in economic gain and participation. Although guidelines talk about good representation for different groups, selecting these members is vital for ensuring appropriate, active, and capable members in WC. Studies found that the provision of plain representation for women and resource-poor groups in the WC does not rectify the prevailing gender bias or socio-economic and political relations (Eshwer Kale, 2020). Other innovative and courageous participatory mechanisms need to be experimented with for this purpose. The selection of members by applying the wealth ranking method, based on villagers' set parameters, was very useful by WOTR while forming WC. The wealth ranking method ensures differentiated contributions and opportunities for equity in watershed processes (more on wealth ranking at https://bit.ly/2s24GO2). Even various sub-committees of the WC could be formed for women, landless people, and SC/ST/OBCs, with predefined equal powers in WC decision-making for these subcommittees. Such an approach may strengthen the bargaining position of resource-poor groups within the village much better than the nominal participation in the current VWC.

In IWMP projects, it has been seen that the village Sarpanch is the president of the WC and his or her follower or close person at the secretariat post, which is a salaried position in the project. This institutional structure is more favourable for project management and easy follow-up for PIA (taluka level agriculture office). There is enough evidence in this background that substantiates that the development projects have been highly successful if one or more knowledgeable and self-motivated leaders have taken the lead role in the development. These are committed to the cause and are independent of political or social gains. Therefore, the watershed development process needs to identify a few youths (men and women) from the villages that are inclined to devote their time and energy to the village. There should be, if possible, separate persons taking care of different thematic like Jal Sevaks, Krushi Sevaks, Pashu Sevaks, etc. The SLNA should develop specialized training modules for the development of this cadre. The state-level training agency should conduct training programs for this cadre to maintain the program objectives' spirit, message, and motivation.

Point 9: Project period and post-project sustainability: In the IWMP guideline, the major activities of the watershed development projects are sequenced into (I) Preparatory, (ii) Works, and (iii) Consolidation and withdrawal Phase. Given the expanded scope and expectations under the watershed development program, the project duration is four to seven years, depending upon the activities and Ministries/Departments.

As the project period of up to 7 years is too long, and it became challenging to keep villagers focused on intervention, we propose restructuring the project phases and making the project period shorter (for a period of 4 years to 5 years). However, an additional 2-3 years period may be provided as a 'Sustainability Phase' wherein government agencies and village institutions track the sustainability of interventions, including crop plants based on water budgeting, agriculture's resilience, and people

to climate variations. Furthermore, in the sustainability phase, WC needs to be more empowered to use the Watershed Development Fund (WDF) appropriately and effectively; this is more relevant in the background that this fund is found in many watershed villages unutilized or disputes in WC on its utilization. Furthermore, the creation and strengthening of the Farmer Producers Organisation (FPO) for small and marginal farmers and establishing their market linkages should be prioritized to stabilize farmers' income. These measures will certainly help to make watershed impacts more sustainable.

d) **Conclusion:** On a technical level, the IWMP approach needs a significant shift to modify its measures in line with a changing climate and the need to address the overall ecosystem approach. It also requires a paradigm shift in making the approach pro-people, especially for marginalized and excluded groups. However, incorporating strategies on groundwater-focused interventions, climate-resilient agriculture, demand-side water management, and provision of the sustainability phase in the project period can undoubtedly increase the success opportunities of watershed impacts and their sustainability of IWMP guidelines.

3.2.1.1.2 Magel Tyala Shet-tale- Promotion of farm pond scheme

a) **Background of the scheme:** In the last few decades, many parts of Maharashtra started facing recurrent droughts, erratic rainfall, and groundwater depletion. Therefore, agriculture and crop were more valuable due to the lack of water for crops at the right time. To deal with this precarious condition, the government of Maharashtra 2016-17 formally launched the farm pond scheme known as *'Magel Tyala Shet-tale'* by providing subsidies to farmers for constructing farm ponds. The main objective of promoting the farm pond strategy was to support farmers in providing protective irrigation to crops in drought-prone regions by harvesting the rainwater and allowing water to recharge. Soon, constructing farm ponds to arrest or store water and irrigating cash crops (mainly horticulture and vegetables) was seen as a miracle strategy for irrigating farmers and the state. The state took more interest in promoting farm ponds as it found it complementary to increasing farmers' income through the reliable water supply. Farm ponds have been promoted on a large scale by the State government of Maharashtra, even since 2010 (GR under various schemes, namely Jalyukt Shivar, and then came '*Magel Tyala shet-tale*' and now (Magel Tyala Shetatale, 2016), it is also getting promoted through PoCRA project. Construction of farm ponds is also promoted through Central government programs like National Horticulture Mission (NHM 2014), Pradhan Mantri Krishi Sinchai Yojana (PMKSY), and Rashtriya Krishi Vikas Yojana (RKVY). There was a subsidy or financial support of Rs. 50,000 for farmers for constructing the farm ponds, and a few schemes (NHM) also supported plastic linings for these ponds. Each year state government is putting an ambitious target of constructing ponds. For example, for 2016-17 state's target of farm ponds was 1,11,111 lakh ponds (Magel Tyala Shetatale, 2016) and received around 3.5 lakh applications, and the target set for 2020-21 is constructing 51369 farm ponds. Even recently, in the state budget speech (2022), the state's finance minister announced an increase in the subsidy amount to Rs.75000 in Maharashtra.

b) **Strengths of Scheme:** Studies find that the farm ponds benefit farmers from drought effects and increase farm productivity (Prasad et al., 2022). The benefits of farm ponds are seen as extremely useful by increasing farm income by ensuring water supply for cash crops and vegetables. Hence, farmers have increasing demand and attraction for constructing farm ponds. As the farm pond strategy is found very useful for 'doubling or tripling the farm income as it fulfils the farmers' aspirations and addresses groundwater vulnerability (Prasad et al., 2022), the state has come with generous financial assistance to farmers and budget allocation for the scheme. The main advantage of the farm pond is the reliable water source for farmers in drought-prone regions (mainly Marathwada and part of western Maharashtra) to grow or irrigate cash crops and protect horticulture. This is much necessary in the context of uncertain and erratic rainfall and groundwater vulnerability. Moreover, as in the summer season, wells and borewells either get dried or yield less water. Farm ponds help farmers irrigate horticulture crops and vegetables, which get very good market rates in summer. Thus there are several success stories of individual farmers and villages, for example, Ajnale village in Sangola taluka of Solapur district (https://www.youtube.com/watch?v=3woBF9pZbPA) and Kadvanchi Village in Jalna district (https://www.youtube.com/watch?v=RchKnSq8EMg) have transformed their agriculture economy and income of farmers highly increased with reliable water supply from farm ponds.

c) **Gaps, lacunas, and problems in the existing provisions of the program and recommendations**

Point 1: Clear deviation from the objective: Wide observations of farm pond construction practices and water use show the clear contradiction between the main objectives set behind the scheme and the actual practices of farm pond owning farmers. Although rainwater harvesting is one of the main objectives behind the farm pond strategy, we can hardly find functioning farm ponds where rainwater gets collected and stored. In contrast, almost farm pond owners extract groundwater from dug wells and bore wells to store it in farm ponds. Thus, farm ponds have become the new way of groundwater extraction and competition. As a result, such extraction is causing further depletion in groundwater levels in these regions. On another front, a farm pond is an important strategy for groundwater recharge through percolation. However, in practice, in almost functional farm ponds, high-micron plastic paper is being applied to stop the seepage of stored water from it; even the state is promoting the use of plastic lining by providing subsidies. Hence, there is almost no possibility of adding anything to groundwater through the percolation of water from the ponds. Moreover, in no functional farm ponds, in-late and outlet are mandatory by design to receive the rainwater and discharge the additional water. This illustrates that although the term 'farm pond' is widely used at the policy level, farm ponds result in big storage tanks of extracted groundwater.

Point 2: Absence of regulation on number and dimension of farm ponds: Although the GR (dated 22 February 2016) on fam ponds allow a maximum dimension of 30 X 30 X 3 meter, literally, there is an absence of regulation on whether sanctioned dimension get followed during its actual construction. Even the GR is vague, allowing farmers to invest an extra amount from their pockets and increase the

dimensions of farm pond at any level, and there is no control over this. The same is true with the number of farm ponds constructed in a watershed or a village. While sanctioning farm ponds in a village or watershed, integrated and sustainable planning of overall water resources, the carrying capacity of that area to supply the amount of water for different uses and structures need to be seriously considered. Ideally, depending on the area's carrying capacity, the number of farm ponds should be planned to construct in the specific village or watershed area. But, there is a lack of clarity on this at the policy level and functionaries involved in different farm pond schemes. There are many villages in the state where farm ponds are enormous in number. For example, in Kadvanachi village in Jalna, having a micro-watershed of 1810 hectares, there are 650 large-sized farm ponds (Nitnaware H, 2021), and Ajnale village in Solapur has more than 500 farm ponds. Therefore, the size and number of farm ponds need to be regulated. Fortunately, with the lessons learned on violation of farm pond size and numbers, the state's agriculture department has had discussions and initiated the process to set a methodology and guideline to decide the number of farm ponds for given geography (village or watershed). This process should soon reach a logical conclusion before it gets too late.

Point 3: High level of evaporation of precious groundwater resource: Groundwater is a precious resource and safe underground to fulfil human needs. As most plastic-lined big-sized farm ponds are getting stored by extracting groundwater, this precious resource is exposed to evaporation. Moreover, in many pockets of arid and semi-arid Maharashtra, the maximum temperature in summer reaches up to 40 to 45 degrees Celsius; in such weather conditions, the evaporation rate increases. In the background of the drastically increasing number of farm ponds, a huge amount of groundwater extraction to store water in the farm ponds, and changing climate, the evaporation of water from farm ponds becomes a more severe and alarming concern.

Point 4: Privatisation of a shared or common resource: The right to water has been protected as a fundamental human right by the Indian Supreme Court as part of the Right to Life guaranteed under Article 21 of the Indian constitution (Narain, 2009). Even Maharashtra Groundwater Act-2009 and central policies treat groundwater as a public trust. However, the farm pond strategy mainly resulted in resource-rich farmers privatising the groundwater, who can invest in extracting groundwater and storing it in the farm ponds. This problem has become severe as there is no control over the size and depth of farm ponds, and rich farmers have built the farm ponds Olympic-sized swimming pools. This has severe equity consequences, as these farm pond owners are not only extracting groundwater below their land but from the surrounding area where there is a number of well owners; thus, WOTR's recent study finds surrounding farmers get negatively affected as they come into the zone of influence of groundwater (as they share the same aquifer) where the farm pond owner extract to store. This also has severe consequences on water sharing in downstream villages. Even studies also show that in drought years, the carrying capacity of water resources falls significantly, so even a low level of extraction may result in a tragedy of the commons (Prasad et al., 2022). As the number of farm ponds is mushrooming in the villages beyond the carrying capacity of the village catchment, downstream villages are getting deprived of water availability. Therefore

we propose to speed up the methodology and guidelines by the state government to decide the number of farm ponds allowed in the village/watershed-based on carrying capacity and following the water-sharing principle. At least in already waters stressed regions, specifically declared semi-critical, critical and over-exploited watersheds/ zones (declared by GSDA and CGWB), groundwater extraction to store it in farm ponds should be strictly prohibited. In such regions, it should be mandatory to farm pond owners to store the rainwater or runoff in the farm ponds.

Point 5: Water stored in farm ponds is a free gift: MWRRA has the mandate and is responsible for fixing the bulk water tariff for different uses in the state. The authority revises the water tariffs every three years for drinking, irrigation, and industrial use. The past experiences show that the Authority has focused mainly on irrigation projects and canal irrigation by water user associations. However, the changing dynamics of farm ponds have not been considered by Authority. Farm pond owners in the command area are filling the huge farm ponds by pumping water from canals and minors, and at the same time at other places pulling a huge amount of groundwater resource (which is a shared resource). Till now, there is no provision or thought by MWRRA to pricing the water in farm ponds, and we propose unless the stored water in farm ponds is not priced, there will be no change in the existing practices by farmers to extract a huge amount of water in farm ponds and making it private.

Point 6: Dealing with contractor lobby: As mentioned in the GR on farm ponds, payment of subsidy for construction cannot be made in advance or before the completion of construction work. This provision allows contractors/JCB and machinery owners to take the lead and wasted interest in constructing farm ponds on farmers' land. Most of the small and marginal farmers (for whom this scheme is made) find it difficult to invest money to construct farm ponds, so the contractors are interested in getting the work done. In many cases, they pay the even farmers' contribution for subsidy on the condition that farmers will pay the amount of subsidy once it gets transferred to the farmer's account. Although this sounds good, many farm ponds can be seen either incomplete or plastic unlined in practice. One can see many incomplete, unlined and non-functional farm ponds without use in many villages, as the contractor and farmer intend to benefit from the scheme's government subsidy. Such practices are a challenge for the government official to avoid in such cases; for this, more accountability has to be brought by farmers by clearly assessing the farmer's and farm's feasibility while sanctioning the farm pond.

Point 7: Addressing the drinking water issue through common farm pond: Looking at its utility to secure water in scarce periods, the farm pond strategy has proved very useful for protective irrigation. This strategy can also be used to secure the domestic and drinking water needs of all villagers and animals throughout the year. The basic consideration behind this is that if an individual farmer can secure water for his irrigation needs throughout the year by using farm ponds, then it is also possible and feasible to secure the villagers' domestic and drinking water needs by using the same strategy. Keeping this in mind, WOTR has experimented with one of the villages in the Marathwada region. In the village, a common farm pond is constructed to provide water for at least three months of scarcity (Eshwer Kale,

2017). This experiment has come up with many possibilities and learning where there is enough potential to replicate it in small, scarce villages to secure drinking water needs. However, this idea needs to be further researched and tested on a large scale.

d) **Concluding Remark:** The farm pond strategy and the scheme have huge potential and resulted in a key strategy in addressing the drought and increasing farm income for farmers. The state's efforts and intention to promote it are also applicable. However, with the lessons learned and different studies found, there is an urgent need to make corrections to the schemes. The scheme activities must be truly regulated, ensuring that farmers follow the specified standards and dimensions. The methodology for deciding the number of farm ponds in a village/watershed gets prepared and followed. More importantly, there is a need for a strict monitoring system to control the practice of groundwater extraction to fill the farm ponds by not allowing groundwater extraction in overexploited zones. These changes in the scheme will ascertain that farm ponds are used as well-adapted drought mitigation measures.

3.2.1.1.3 Jalyukt Shivar Abhiyan (JSA)

a) **Background of JSA:** With the slogan of 'Water For All and drought-free Maharashtra 2019', Jalyukt Shivar Abhiyan (JSA) was launched in Maharashtra in 2014 by the Fadanvis Government of Shiv Sena and BJP alliance. According to GR on JSA (dated 5 December 2014), the Abhiyan (campaign) was launched in the background of severe droughts in the state (during 2012-13 and 2015-16) and depleting groundwater resources. Same time the Shirpur pattern was gaining momentum in the state. As nearly 82% of the state falls in the rainfed sector and 52% area is drought-prone, the objective set for JSA was to make 5,000 villages free of water scarcity every year and bring water empowerment to 25,000 drought-hit villages. From 2015 until 2019, the campaign spent INR 96.3 billion on 630,000 completed water conservation interventions in 22,586 villages (CAG, 2020).

Under the JSA, although 14 soil and water conservation activities work, reviewing irrigation projects, and groundwater augmentation were proposed, more focus was seen on constructing a chain of cement Nala bandhs, deepening and widening Nalas, and desiltation of water bodies. The state government claimed that during the campaign till 2019, a total of 24 TCM of water storage was created with an irrigation potential of 3.4 million hectares. The state's Soil and Water Conservation Department was designated as the nodal department to implement this project. The government schemes (IWMP, MGNREGA, NHM, VIIDP, Adarsh Gaon Yojana, Koradvahu Sheti Abhiyan, ZP cess fund, MP/MLA fund, and NGO /CSR fund) were converged to achieve the objective set for Abhiyan.

b) **The strengths of JSA**: The set of JSA activities was proposed with a good combination of increasing surface water potential, allowing groundwater recharge, strengthening drinking water sources and capacity building of water user associations, and implementing of groundwater act. For implementing the JSA, a well-coordinated network of government officials was set at state, district, and taluka levels, and funds from various schemes launched by the center and state governments were

pulled together for drought management with mobilising support from different CSRs and NGOs. Another strength of the JSA was the adoption of a water budgeting tool at the village level, and it was made mandatory to get village action plans approved by Gram Sabha. In the guideline, the provisions are made for third-party evaluation of the work, uploading the digital GIS-friendly photos before, during, and after the project completion, and clearance of bills of work only after the Gram Sabha has approved them. Thus provisions were made to ensure accountability and transparency in the JSA work. The state government claims that water storage of 24,000 million cubic feet was created in the JSA implementation in the state.

c) **The progress and present status of the JSA:** JSA has been criticized for its inceptions by water experts and scientists on different grounds. Prof. Pradeep Purandare argued that even the inception of the JSA was in the background of a highly discussed 'irrigation scam' in the state and a strong push for the Shirpur pattern (Purandare, 2021). In 2011, the Government of Maharashtra appointed an expert committee to look into the Shirpur pattern, headed by the late Dr. Mukund Ghare. The Committee found that many interventions were scientifically, technically wrong, and highly expensive (Joy, 2015). However, the government rejected this report, commissioning another study by its own officials. The second report was more favourable to the Shirpur pattern. In 2017, Dr. H.M. Desarda, a well-known economist and former state planning commission member, filed a PIL in Bombay High court on the unscientific and non-environment friendly nature of JSA, resulting in affecting the overall ecosystem. After hearing the petition by Dr. Desarda, High Court gave the order for the enquiry of the JSA through an independent committee, and thus Johny Josef committee was formed. The Josef Committee gave the assignment for studying the selected JSA villages to CTARA at IIT Bombay, and this committee came up with a few minor corrections to the JSA. Still, many experts found that the committee has not studied the larger ill effects of JSA on the environment. Many water experts, civil society groups, and research organisations continued raising concerns about JSA interventions' unscientific nature. In 2019, there was a shift in state government, and the Thackeray government (Alliance of Shiv Sena, Congress, and Nationalist Congress Party) took charge of the earlier Fadanvis Government. In the first year of government, the Thakeray government ordered a probe of JSA on financial irregularities and appointed an SIT for the probe (Hindustan Times, n.d.). Soon, in 2020, the CAG randomly selected 120 villages from 6 districts (two talukas from each selected district) having the highest expenditure) for the audit. The report found that in 83 out of 120 selected villages, the storage created was insufficient to meet the water requirement indicated in the village plan for drinking and cultivation. The report also found that, in 17 out of these 83 villages, water tankers were deployed to meet the water requirements of villages. The report concluded that Jalyukt Shivar "had little impact in achieving water neutrality and increasing groundwater level" (CAG, 2020). On this ground, Thakeray Government gave the STOP on the ambitious but highly debated JSA in February 2020 (Deshpande, 2020). In February 2021, Thakeray Government announced a three-year program with a provision of Rs. 1,340 crores, with the title ‘Chief Minister Water Conservation Programme (CMWCP)’ (Hindustan Times, n.d.). However, nothing progressed on it due to a shortage of funds and COVID-19 constraints. The

recent shift (July 2022) in state government (formation of Shinde government with BJP-Sena alliance) may again boost or revive JSA, a pet scheme of the earlier Fadanvis government.

d) Gaps, lacunas, and problems in the JSA and recommendations

Point 1: Lack of ridge to valley approach and delay in modification in priority work: The JSA program considered the village the primary implementation unit. As a result, it more or less lacked the ridge-to-valley approach of watershed management, with the balance of soil and water conservation measures. The overall JSA interventions dominated the construction of surface waterbodies (blue water) (Shah, Harris, Johnson, Mark & Wittman, 2021). It is observed that the desilted tanks and Nalas, whose depth had been increased later in a few years, got silted as soil conservation measures were not taken at the appropriate time. In 2017, the government decided that micro-watersheds should be a unit of implementation for water conservation and a group of micro-watersheds for river rejuvenation rather than a village. It also increased weightage for soil conservation. However, it was a late beginning. Later in 2018, just a year before the program's due date, the government accepted the methodology of water budgeting developed by CTARA, IIT Bombay.

Point 2: Targeted work versus lack of community participation: The program targeted making 5000 villages drought-free every year. Although the state government claimed that 24,000 million cubic feet of water storage were created, water exerts raised questions about these figures. No detailed statistics were made available for this irrigation potential. In addition, there is no clarity on whether the additional increased irrigated area is in command of the existing irrigation project (Purandare, 2021)) or whether this is additional irrigation potential created.

This was an ambitious target considering the time required for capacity building, awareness spreading, and actively involving people (E. Kale et al., 2019). As a result, the lack of participation of farmers and involvement of Gram Sabhas in the works of JSA is observed (Bhadbhade et al., 2019). To improve the people's participation, the program should have continued at least for two years in a single village (E. Kale et al., 2019).

While implementing works under the JSA, preparation of a detailed project report (DPR) for the village, including a water budget and treatment maps, was mandatory. The DPR was made compulsory to be approved by Gram Sabha. However, the findings of the study made by Bhadbhade and the team show that DPRs were neither available at the Gram Panchayat office nor the government offices in their study villages (Bhadbhade et al., 2019). The study also found that most of the villagers were unaware of the scheme and the implementation process, and their participation was poor, where most of the farmers opted for sugar cane.

In the above background, the Gram Sabha members should be trained to assess the quality of the structures being created and their impact on overall water availability. Also, they should be intensely trained regarding the ideal nature of the action plan so that they can evaluate the same before sanctioning any such plan. Besides, efforts should be made to improve people's participation in soil and water conservation activities. For this, social mobilization is needed, which requires more time. Hence,

rather than deciding the target period, such programs should also be checked on people's degrees and nature of involvement.

Point 3: Quality of work and Repair and maintenance: Studies found very poor quality of JSA interventions (Bhadbhade et al., 2019; CAG, 2020). Even after the construction, no attention was paid to these works' repair and maintenance (R & M). The Gram Sabha was expected to raise the fund to repair and maintain the water harvesting structures through cess, and the state government was to put an equivalent share for R & M as generated by the Gram Sabha. However, none of the Gram Sabhas visited by CAG had raised any funds for R & M, and as a result, no financial support was provided by the state government for this purpose (CAG, 2020). Due to this, the report found many of the structures were filled with earthen material. At the same time, farmers also had not hesitated to reclaim their land earlier given for water conservation work. Due to all these reasons, the expected water storage capacity of the village was not achieved or was reduced over a period which became the hurdle in making the village drought-free.

Point 4: Lack of demand-side management: Apart from the above issues of supply-side management, concerns were stated in the demand-side management component of JSA. One of the major concerns was that it was expected that the Gram Panchayat would restrict the digging of wells for drinking water only and also decide the cropping pattern in consultation with Agriculture Department / Agriculture University based on water availability. However, none of this happened. As the rules of the Maharashtra Groundwater (Development and Management) Act, 2009 were not published, the restriction on the digging of the well was not put. Besides, in the investigation region of the CAG in 65 out of 120 villages, the area under the cash crop was found increased (CAG, 2020). The number of water tankers raised from 3,368 in 2017 to 67,948 in 2019. Both these findings indicate that though the program was very well written on paper, its implementation had many flaws that restricted this program's success.
The water budgeting tool (developed by the Indian Institute of Technology Bombay) is adopted in the JSA; however, government officials use it to quantify the additional water harvested without spreading water literacy to the village. In addition, political interference in selecting villages for the JSA and issues regarding e-tendering for machine contractors are major areas of concern. Sugar cane, a water-guzzling crop, has mushroomed even in the drought-prone regions of Maharashtra (Marathwada). Although the Government of Maharashtra has mandated drip irrigation for sugar cane cultivation, this strategy has not resulted useful as water saved through drip irrigation is getting used by farmers to expand the area under irrigation and not water saving in absolute term.

Point 5: No clarity over decentralized storage: One of the primary aims of the JYS is to create decentralized storage in rain-fed areas. However, considering the water balance of the area, the added decentralized storage only redistributes the water in the watershed and does not provide an increased water supply (Bhadbhade et al., 2019). This means that if the water were not stored in the sub-surface, it would have joined the stream or a small dam downstream that could have been used for various purposes. In addition, there is no doubt that the sub-surface storages prevent evaporative losses. Still, the increased area under agriculture and groundwater extraction for the same does lead to more evaporation and transpiration. Thus the premise that the decentralized storages make more water available is not true, as it only reallocates water. Unfortunately, it seems in JSA interventions, this approach is not fully considered.

Point 6: Lack of scientific approach in Nala deepening: The width of the Nala should not be increased more than its base width to maintain the hydraulic geometry of the Nala. Besides, the Nala should not be straightened for the same purpose. Also, the deepening should not be done in rocky areas or in wetlands. The Nala with the sand should also not be considered for deepening. However, these basic scientific principles were not followed while implementing the Nala deepening component of the JSA. Also, the deepening of the Nala should be done to increase the groundwater recharge and not increase the surface storage. However, in reality, vice-a-versa had happened. Besides this, it has been observed that after the deepening of the Nala, the debris of the excavation is piled up on the bank of the Nala, resulting in an increasing the height of the Nala to the surrounding region. Because of this, the overland flow generated from the surrounding region cannot reach the Nala, and waterlogging occurs alongside the Nala. As a result, the crops are lost, and the land is lost to a certain extent.

Point 7: Equity issue: As less focus of the Abhiyan was on soil moisture conservation, it did not benefit rainfed farmers substantially. The activities done under Abhiyan are mainly the construction of cement Nala bandh, chain cement concrete Nala bandh, earthen dam, recharge shaft, repair of percolation tank, storage tank, Kolhapur type weir, are made to add water in surface structure and sub-surface, benefiting to farmers who have irrigation infrastructure. Even the activities of individual benefits (for example, construction of farm ponds) were promoted. The observations show that the farm ponds are resulted in the privatization of groundwater in Maharashtra, as in most cases, the groundwater is being stored in them, lifting through dug wells and bore wells (Kale, 2017). The CAG report also mentions the increase in the number of dugwell (by 10%) and borewells (by 9%) in the investigated 120 villages (CAG, 2020). A recent study made by researchers at The University of British Columbia also points out that 'the JYS excluded residents, including members of historically disadvantaged groups, who did not possess the key endowments and entitlements needed to acquire the benefits associated with drought-relief initiative' (Shah, Harris, Johnson, Mark & Wittman, 2021, p, 586).

e) **Conclusion:** Since its inception, the JSA has been criticized by different water experts on different grounds, including the unscientific nature of treatments and their impacts on the environment. As a huge administrative structure backed the JSA to implement and enough budget allocated, it could be more fruitful if the accountability, transparency, and social audit are made more meaningful, balancing soil and water conservation implementation on the ground. However, the reports and observations show the continuation of water tankers, a decrease in groundwater levels, and an increase in cash crops in a few JSA villages (CAG, 2020). There is enough ground to show that there was a political impulsion to announce the JSA villages as drought-free ((Shah, Harris, Johnson, Mark & Wittman, 2021) to justify how the Abhiyan was successful in achieving its objective. However, later the strong push for the Marathwada Water Grid project to meet the drinking water needs of villages in the Marathwada region by the same government that launched and backed JSA substantiated the limited success of JSA in making the village drought-free.

3.2.1.1.4 Marathwada Water Grid Project (MWGP)

a) **Background and Objectives of MWGP:** MWGP can be seen as the smaller version of the Inter-linking of Rivers (ILR) project. MGWP proposes that 11 dams in the Marathwada region be connected through the piped network to ensure the water supply for drinking, irrigation, and industrial utilization throughout the year. The main idea behind this project is that transfer the water from the dams having water to the dams running out of it using the loop technology. The seeds of this project were planted during the drought of 2016 when the water had to be supplied by the railway wagons to the town of Latur. Besides, in the same year, more than 4000 tankers were deployed to quench the region's thrust (Parth, 2020). To avoid such a situation in the future, the Marathwada Water Grid Project was announced by the Fadanvis government (earlier BJP-Sena government). As a part of this project, the Jayakwadi, Ujani, Yeldari, Siddhedhwar, Majalgaon, Manhajra, Lower Terana, Lower Manad, Isapur, and Sina Kolegaon, and Painganga dams are to be connected along with the other three dams. The project is divided into 10 phases. The first 8 phases are related to connecting the 11 dams of Marathwada, while the rest two deal with bringing the water from the Konkan region and the Krishna River Basin. It is expected that around 76 towns of 79 talukas and more than 12000 Marathwada region's villages will benefit from this project (K. Iyer, 2019). This project will be implemented by the Mekorot Development and Enterprise (MDE), a national water company of Israel, based on the Hybrid Annuity Model (HAM). As a part of this model, the MDE will invest 60% of the project's cost, while the remaining 40% will be invested by the state government (ibid). The project's total cost includes the main (1330 km) and subsidiary pipeline network (3220 km), and the water purification systems are expected to be Rs. 25000 crores. During 2018-19, the Fadnavis government sanctioned Rs. 4293 crores for the first phase for Aurangabad and Jalna districts and Rs.4802 crores for Beed district (The Economic Times, 2019). Thackeray government (Mahavikas Allies) initially showed few reservations about the scheme and decided to review it; however, it recently approved Rs.285 crore for the Jaikwadi dam in Aurangabad's Paithan taluka sub-scheme under MWGP (The Indian Express, 2021). The scheme was initially built to supply drinking water to villages, later adding the water supply component for irrigation.

b) **Strength of the policy:** The history of the last two decades shows that less rainfall and droughts in many parts of Marathwada are recurrent phenomena. With climate change projections, it is predicted that the frequency of such events will increase. Even the projections are that gap in two drought years will increase in Maharashtra's regions. Therefore, the tanker dependency in this region steadily increases to meet drinking water during summer. During the summer of 2016, 4883 tankers supplied drinking water to more than 10 thousand villages and hamlets, and in 2019 total of 5174 tankers were deployed to serve the drinking water to more than 13 thousand villages (GoM, 2020). According to one of the estimates, a 2,000-litre private water tanker costs five hundred rupees during peak summer. Major cities, towns, and periphery of the region like Aurangabad mainly depend on tankers. According to Sanjeev Unhale, a senior journalist and activist based in Aurangabad, the daily trade of water tankers in Aurangabad during April, May, and June varies between Rs. 30-35 lakh (Parth, 2020). Thus, in a scarcity period, water is mainly accessible in adequate quantity to those who can pay or purchase it. Others have to struggle for a minimum

amount of potable water. Therefore, although challenging, the MWGP is the hope for the people of Marathwada to address the water scarcity they have been facing for decades. Although there are few valid critics of the MWGP, the water grid projects in two Indian states, Telangana and Gujrat, and Srilanka and Israel have shown their applicability and usefulness. Few experts believe that a water diversion strategy to the water hit Marathwada region can be an excellent strategy to address regional imbalance and inequity in water allocation by diverting water from the Konkan and Krishna rivers. Marathwada has been a disadvantage, and we have seen growing conflicts between western Maharashtra, mainly Ahmednagar and Jaikwadi dam in Marathwada, on water allocation.

c) Gaps, Lacunas, and Deficiencies in the MWGP and recommendations

Point 1: Dams do not always reach their maximum storage capacity: The entire Marathwada region falls under drought-prone areas and the low rainfall region. As a result, many dams in the region do not get filled to their total capacity, even during the monsoon season. For example, the long-term data of the Jaikwadi dam (1975 to 2017) shows that around 56 % of the time, the Jaikwadi dam does not adequately fill the water demand during the Rabi season (Parth, 2020). Therefore, besides being located in the same climatic region, all the dams will face a water shortage during the same year. Hence, connecting the dams will not solve the issue of water scarcity in the Marathwada region unless the strengthening of local water resources and decentralized manner with the adoption of the scientific ridge to valley watershed approach.

Point 2: Potential disputes and conflicts on water sharing at the basin or project level: The reservoirs of the dams and the command areas are designed based on the capacity of the dam's catchment to collect the rainfall. There is no clear answer to how this balance will be maintained once the dams are connected or whether the dams can fulfil the demands of the allotted command area of the dams. That can create another type of conflict and disputes among different water users. If the scheme has to be implemented, the existing irrigation department has undoubtedly to go through a drastic transformation; whether the irrigation department is positive for this scheme is unclear. Therefore, rather than solving the issue of water scarcity, this system of connected dams might aggravate the inter-basin water conflict. For example, in 2015, the water conflict arose between the Nashik, Ahmednagar, and Aurangabad districts over the issue of water sharing of the Jaikwadi dam. The possibility of such situations within the Marathwada region or even the sectoral conflicts (e.g., agricultural and industrial sectors) over sharing of reservoir water cannot be ignored. In addition, this can also trigger political rivalry within different districts of Marathwada. In such a situation, the minimum water flow of the river, i.e., the environmental flow, will hardly be considered by any region or sector. Therefore, many experts and even government officials agree that the primary cause of frequent droughts in the Marathwada region is the lack of rainfall and the environmentally unsustainable cropping pattern. The region only receives around 700 mm of average annual rainfall, yet water-intensive crops like sugarcane are abundant here (Purandare, 2013). Unless this practice changes, there will not be a

balance between the demand and supply of water, no matter how much additional water is supplied or imported.

Point 3: Ignorance of easy local solutions: The proposal of creating a water grid has come before the entire assessment of the existing local alternatives to manage water supply. Before investing in such a vast project, it is essential to check cost-effective local substitutes like watershed treatment, farm ponds, etc. This will save money and help save the local ecosystems and environmental flows. Besides, this entire exercise is inclined towards water supply management. The groundwater and aquifer recharge has received the least priority in the state, which has a huge potential to hold the water in good rainfall years and compensate during the low rainfall years. Therefore, along with the ridge to valley approach of watershed development, a system of Managed Aquifer Recharge (MAR), the worldwide accepted approach for aquifer recharge, and even the *Shirpur pattern* (by following the scientific approach) is more viable local solutions. In several villages, these experiments show that villages gained drinking water security throughout the years by following these measures.
In addition to this, as pointed out by Prof. Pradeep Purandare, we also need to be cautious about the huge burden of increased water tariffs or charges this scheme may force to pay to different users. As the MWGP is based on the Hybrid Annuity Model (HAM), the private company will invest 60% of the project's cost. This indirectly means that the cost of the water will be higher for the end-users as the company will try to generate revenue to cover the cost and earn the benefits. Thus the water supply from the grid will be more expensive than the locally saved and judicially used water.

Point 4: Side-lining the agenda of demand-side water management: Drinking water scarcity and increasing irrigation efficiency is an essential motives for bringing the demand side measure (water-saving by micro-irrigation, better soil health practices, and selection of appropriate crops) by village communities and authorities. Thus, reducing groundwater extraction and agricultural water application is at the center of demand-side measures. The main motive for the community to take these measures is to protect the drinking water sources of villages. However, once the drinking water is secured, the groundwater in this region will get further exploited for irrigation. In this situation, no idea how and at what level implementation of present related laws and policies, for example, Maharashtra Groundwater (Development and Management) Act- 2009, will be affected or will be worked out because regulating groundwater extraction is the prime policy objective of these laws for ensuring drinking water. Moreover, the proposed implementation of MWGP by the prime focus on importing water (water supply) will surely hamper the region's local water demand-side water management efforts.

Point 5: Rights and responsibilities of Gram Panchayats may get affected: For decades, for drinking water supply, participation, involvement, and coordination of three tire systems (Zilha Parishad, Panchayat Samiti, and Gram Panchyat) in drinking water supply and management have been the important mechanism. Suppose the MWGP significantly contributes to village drinking water for villages. In that case, the existing system of Panchayati raj will be highly affected. The fund received for Gram

Panchayat for drinking water supply and maintenance may be transferred to the contractors/regulators of MWGP. The regulators will determine even water charges. Therefore, how will existing drinking water infrastructure at the village level will be merged into the MWGP is unclear.

Point 6: No mention of responsible authority and end-user unit: The MWGP is a huge project at the level of scale and cost, and hence it will require a responsible authority to make the key decisions on water access, re-allocation, re-prioritization, and water to be realized and diverted. These are socially and politically sensitive decisions requiring a transparent and independent administratively capable agency or authority. Unfortunately, there is no clarity on MWGP on who (whether Water Resource Department, Drinking Water supply Department, or MWRRA). Without a clear administrative framework, the entire system will turn into chaos and become a central point of conflict.
Similar to the administration gap, the end-user unit in MWGP is also not clear. Whether the water will be provided to the WUA and Gram Panchayat for agricultural and drinking water management or any other stakeholder/agency will be further introduced in water distribution is not mentioned and is clear in the existing framework.

Point 7: Possible losses in piped water network: As a part of this project, the main pipeline of 1300 km and a subsidy pipeline network of 3220 km are proposed in the Marathwada region. This massive pipeline network will require regular maintenance to avoid the loss of water, which will add to the project's cost. Besides, the network needs to be continuously monitored to check for the theft of water. Installing meters at the household or community level is also necessary to ensure an adequate and equitable water supply. These measures are also capital intensive and difficult to implement in the current state governance situation. The existing pipeline project for water supply in the Marathwada region is not very encouraging. The existing 40-kilometer pipeline- from Jaikwadi to Aurangabad - operates only at 50% capacity, triggering criminal wastage, leakages, and illegal water connections (TOI, 2020). Even though the piped water supply from Jaikwadi to Jalna city is not very different, looking at these conditions to reduce the water losses and theft will be a real challenge to reduce water losses and theft.

Point 8: Challenges in transplanting the Israel model to Indian conditions: The concept of a water grid is based on Israel's model. However, there is a need to understand the primary difference between the Indian (mainly in Marathwada) and Israel's conditions. First of all, Israel does not face the issues of power supply and capital investment. But in the case of India, specifically in Marathwada, the electricity supply is still a significant issue leaving apart the monitory issues. The high voltage electricity supply for lifting the water from the dam is required to implement the project, though the gravity flow model can be applied in a few cases (Parth, 2020). It is unclear whether the non-conventional energy resources will generate so much power and, if not, the alternative mechanism considered in the shadow of climate change. Another issue is the size of the project. In Israel, the sizes of the water grid are smaller in expansion. However, the grid is to be created connecting eight districts of the Marathwada region that is later to be connected to the Krishna

Basin and the Konkan region. The economic viability of such a huge project is still unsure.

Point 9: No public and expert consultation in design: The most prominent criticism of the MWGP is that no open public, civil society experts and consultations were arranged or invited while designing the MWGP. Many Civil Society organisations (CSOs), NGOs, and experts are working on the issue of drinking water security and addressing water supply, demand, and water quality issues with improving the level of water governance. Therefore, the state went on with this proposal without consulting these diverse and experienced actors, which could give a more economically viable, practical, and local solution to secure drinking water or could give the useful suggestion to modify the existing scheme while translating the Israel model into Marathwada region. Unfortunately, all the rich experiences and views of civil societies, NGOs, and experts were bypassed in the MWGP.

d) **Conclusion:** Although the MGWP has raised many hopes in the people of the Marathwada region, there is a long way to get this entire scheme a reality. Many experts even question its practical, economical, and technical viability. The scheme's important critique is ignorance of the alternative solutions of strengthening and taking local level measures and side-lining the demand-side measures. Even if the scheme gets implemented, it has many implications for changing overall water allocation in the dams' different basins and command areas. Also, the objective and implementation of relevant laws, such as the groundwater Act of 2009, to regulate groundwater and secure drinking water will not be very relevant.
The scheme's success depends mainly on the last two phases of importing the water from the Konkan region and the Krishna River Basin to the Marathwada region, which is a mammoth task and involves many technical and environmental challenges. This has been seen as a challenging task. Even Pandurang Todakar, an irrigation engineer, proposed a technical plan long ago to divert water from Konkan to Godavari, Bhima and Krishna rivers covering all of Maharashtra (https://www.youtube.com/watch?v=--XxIpUoNXE), but this was questioned on different ground. Also, there is enough ground to say that MGWP has a hidden intention to secure the water requirements of increasing water needs of growing industrial zones (Delhi Mumbai Industrial Corridor and other industries-DMIC). In short, the design of the overall MGWP shows that "small is not beautiful" (local solutions). Moreover, we have seen the high-level politicization of important schemes in the water sector during the last few years. It is important to note here that this huge scheme can be unimplemented or uncompleted, as new governments are putting many schemes of earlier governments on halt or giving STOP.

3.2.1.1.5 Gaalmukt Dharan, Gaalyukt Shivar Yojana (GDGS)

a) **Background and objectives:** In India, tank development and management have a long tradition. Intending to revitalise the tank system, the state governments took many steps from time to time. In Maharashtra, through the Employment Guarantee Scheme (which was later converted into Mahatma Gandhi National Rural Employment Guarantee Act and taken at the national level), work on tank construction and silt removal during drought years and repair and maintenance was

taken on a large scale. Even under Jalyukt Shivar Abhiyan (JSA), desilting and rejuvenating different water bodies have been taken on a large scale. At the culmination of these programs, the state launched a specific scheme for desilting water bodies known as 'Gaalmukt Dharan, Gaalyukt Shivar Yojana' (literally, silt-free water-reservoirs and silt-rich fields) in 2017. It has set up a 'Desilting Policy Committee, which recommended that 31,459 small dams and water tanks be desilted in the state (Zade et al., 2020). The government of Maharashtra issued two GRs in 2017 to promote the scheme. The key objective of this scheme is, based on age, quality, and irrigation capacity of water bodies, excavation of silt from water bodies, to make more water holding capacity of the water body and apply this fertile soil in farms for increasing the farm productivity. The cost of excavation of the silt is borne by the government (through government and CSR support), while transfer and levelling of the silt in the farm are to be incurred by the beneficiary farmer. Since the last few years, many CSRs, NGOs, and private donors have aggressively initiated desiltation activities in the state, mostly in the Marathwada region, where drought is a common phenomenon. According to Kushire (Kushire, 2019), 100.63 lakh cubic meter of silt was removed from approximately 2535 water bodies and used by farmers on their farms under this campaign. Later in 2019, the program is also recommended in the revised State Water Policy-2019 as a strategy for drought mitigation.

b) **Strengths:** The key strength of this scheme is that it helps combat the drought situation, first by increasing the tank's storage capacity and second by making farm soil fertile with the application of excavated silt which can support more crops. Besides, silt application also results in less chemical fertiliser requirement, leading to better economic benefits. Evidence shows that many silt-free structures revived their storage potential, and nutrient-rich silt improved soil fertility, resulting in higher agricultural production and reducing the cost of input like chemical fertilizers, thereby increasing the net income of farmers (Zade et al., 2020). A study made by WOTR of 3 desilted percolation tanks in Marathwada shows that the area under intercropping and perennial irrigation is increased by 300% and 112%, respectively. Rainfed areas and wastelands are reduced by 7% and 11%, respectively. The cotton, soybean, and wheat yield increased by 63%, 56, and 40%, respectively. The gross annual income for farmers cultivating on silt-applied land increased from INR 37,489 to INR 92,855. Farmlands with added silt have a higher water holding capacity and improved organic carbon in the soil as compared to control farmlands without the added silt. Thus the average benefit-cost ratio (of three tanks) is 1.31, indicating that desiltation tanks are an economically viable strategy, with a win-win situation for both a village by increasing water availability and for farmers with improved soil (ibid).

c) **Lacunas and gaps and recommendations to improve**

Point 1: Selection criteria of the tank for desiltation: GR 1 mentions the tank's selection criteria, which cover the age of the tank and its command area. In addition to this, the groundwater recharge potential of the water holding area should also be considered before its desiltation. If it is not considered, the excess water stored after desiltation works will be exposed to evaporation leading to water losses. There are

certain situations where the GR prohibits undertaking or selecting the tanks for desiltation work, such as tanks with irrigation potential of 0 to 100 hectares, tank areas under private ownership of a farmer, or when there is no clarity about land ownership. Here, we propose that along with the irrigation potential of the tank, the amount of silt deposited should also be considered an important criterion for selecting the tank. If tanks are silted to around 75% of their total water storage capacity, the government should consider desiltation. Tanks under private or encroached land should also be considered for desiltation, resulting in groundwater percolation benefits and silt availability. For approval purposes, the Gram Panchayat may take written permission from the land owners before submitting the proposal to the Tahsildar. The GR made a positive provision that tanks with more quantity of sand will not be considered for desiltation.
Further, a list of tanks constructed by the Revenue Department should be prepared where there is a presence of sand in the structures. It should be made available in the public domain to be accessible to all stakeholders and ensure that the provision is provided and not violated. In addition to these criteria, we propose that the quality of silt in the tank should be tested by a responsible NGO/Agency in case it is planned to be applied on farmlands. This is to ensure that it does not negatively affect the existing quality of soil and crop production.

Point 2: Modifications required on the institutional front: The GR-2 has suggested the formation of a Village-level Monitoring Committee (VMC) and has mentioned the proposed structure of the committee and its responsibilities. The composition of the committee proposed as i) Village Sarpanch-as President, ii) Gram Panchayat member (One)- as Member, iii) Farmers Representative- as Member, iv) NGO representative- as Member, v) Talathi/Gramsevak- as Member, vi) related Section Engineer- as Member and Secretary. Besides these, we recommend that the VMC may also have representation of women SHG, women farmers, landless households, and minority communities (SC/ST/OBCs). All village-level members of VMC should be selected through Gram Sabha. Along with forming VMC, there should be explicit provisions about conducting periodic meetings and documenting the procedure of meetings during the project. As suggested by the WOTR study, in addition to the existing responsibilities mentioned in the GR, the VMC should have assigned the additional tasks of undertaking awareness activities in the village regarding the desiltation plan, displaying and updating information about the plan and execution of the desilting activity daily at public places during the work in progress, so that people are well informed, and finding ways and means for compensating the farmers getting affected by temporary roads/approach road, as it affects the farmland of farmers (Zade et al., 2020).

Point 3: Planning, approval, execution, and monitoring for implementation of the activities: The GR-1 states that the Sub-Divisional Officer (SDO-Prant) from the Revenue Department will be the implementing officer of this scheme. In cases where the farmers or NGOs submit a proposal for transporting silt, the Tahsildar, after technical scrutiny, must send the proposal for administrative sanction to the SDO. In cases where the farmer/NGO spends its funds to excavate and transport silt, prior notice related to tank desiltation activity should be given to Tahsildar/ Talathi/Deputy Engineer (Dams) along with the schedule of work by farmers or NGO.

We strongly recommend that the concerned Gram Panchayat be the central decision-making body in project implementation along with the VMC. The SDO should be the project sanctioning authority, and Gram Panchayat should work closely with him for project implementation. WOTR study proposes that initially interested farmers or NGOs should approach the respective Gram Panchayat, expressing their interest in tank desiltation, and then NGOs prepare a detailed proposal of the desiltation work and present it to Gram Sabha for approval. For preparing the proposal, they need to take the support of engineers to estimate the tank's suitability for desiltation and the quantity of silt available. After that, the VMC gets formed in Gram Sabha, and it coordinates the overall activities of desiltation by ensuring the benefits of desiltation are inclusive.

Point 4: Inclusive Benefits As a precondition of participation: The GR-1 specifies that the farmers will bear the expenses required for transportation of silt from the percolation tank to their farm. Studies show that the most silt benefits are taken by large farmers as they imported and applied large amounts of silt compared to medium and smallholding farmers (Zade et al., 2020). Therefore, it is suggested that partial grant/support or interest-free loans be provided to small and marginal farmers to ensure the equitable benefits of public money on tank desiltation to all community sections. The temporary approach road made from the tank to the existing public road, which passes through the private land of many farmers, must be demarcated by the VMC with the help of the Talathi, and if required, the Tahsildar as it is one of the issues of dispute among farmers. Also, there should be a financial provision in the project that once the tanks' desiltation is completed, the temporary approach road made in the farmers' fields should be cleared as it affects agricultural farms severely.

Point 5: Ensuring the Ecosystem Health: The GR-1 specifies precautions to be taken while work is in progress, such as a ban on the excavation of murum and sand and not restricting desiltation to a certain distance from the walls depending on the tank size. To make this provision stronger and ensure its effective implementation, we propose that there should be a provision for canceling the license or imposing a penalty on machine operators, implementing NGOs, and the Engineers responsible for monitoring. Furthermore, only that quantity of silt should be excavated, which would help restore the tank's original water storage capacity. Along with this, while deciding the depth for desiltation, the hydro-geology in terms of groundwater recharge capacity of the submerged area needs to be factored in. These precautions are essential because changes in the topography and hydrology of the area around the tank due to its desiltation may impact the sustainability of downstream flows affecting the biodiversity and ecosystem; hence care must be taken that downstream flows don't get affected negatively.

d) **Conclusion:** Given the huge potential of the GDGS in increasing resilience to drought in the semi-arid regions, we propose a significant restructuring to address and enhance the important concerns of community participation, equitable benefits, accountability, and transparency as environmental sustainability. Expecting that GDGS, a stand-alone program, will deliver or be sustainable in the long run does not seem feasible. There are already enough observations that programs such as Jalyukt Shivar Abhiyan (JSA), whose focus is on specific activities of desilting and deepening

streams and rivers, have not resulted in a sustainable and judicious outcome. Therefore, since there is no provision for treatments of the catchments in GDGS, as in the case of a comprehensive watershed development and management program, the tanks would get filled up with silt in no time. So, we propose the need to make GDGS a part of an Integrated Watershed Management Programme (IWMP) at the national level. As in the last few years, desiltation of tanks and lakes, as well as rivers and streams, under GDGS and Jalyukt Shivar Abhiyan have become the central issue of concern; there is a need for a special comprehensive law devoted to the desiltation matters (rather than issuing periodic GRs). Such law is essential to regulate the overall desiltation planning and execution activities, which on the one hand, will be beneficial to the diverse set of stakeholders engaged in these activities and will ensure that desilting activities don't affect the ecosystem services and integrity in the long run at the other.

3.2.1.1.6 Project on Climate Resilient Agriculture (PoCRA)

a) **Background and Objectives:** The PoCRA was initiated by the Government of Maharashtra in partnership with the World Bank in May 2018. The project is also known as the 'Nanaji Deshmukh Krushi Sanjeevani Prakalp.' As the many states started facing climate challenges and increasing weather events affecting agriculture and crops, at the national level, National Innovations in Climate Resilient Agriculture (NICRA) project was designed and at a state level in Maharashtra to contribute to increasing climate resilience in the agriculture sector PoCRA was initiated in selected districts of Maharashtra. As mentioned in the project documents, the project's objective is to enhance the adaptive capacity of smallholder farmers, develop the absorptive capacity of stakeholders in the selected value chains, and enhance the transformative capacity of institutions and stakeholders (GoM, 2021). The project has four main components, namely, a) promoting climate-resilient agriculture systems, b) post-harvest management and value chain promotion, c) institutional development, knowledge, and policies for climate-resilient agriculture, and d) project management. The project's total cost is INR 4,000 crores, out of which the share of the Government of Maharashtra is INR 1,200 Crore (30%), and that of the World Bank is INR 2,800 crore (70 %). As a part of this project total of 5142 villages were selected, which belonged to the 15 districts in Marathwada (Aurangabad, Nanded, Latur, Parbhani, Jalna, Beed, Hingoli, Osmanabad districts), Vidarbha (Akola, Amravati, Buldana, Yavatmal, Washim, Wardha district) and Jalgaon district of Nashik Division (GoM, 2021). Although the PoCRA has more components of agriculture, we have purposefully selected it for this review as it has many components of water supply and demand management, and agriculture is not seen in silos but is more connected to the water resources.

b) **Strengths:** The village selection process for the project is well defined based on the scientific approach. The villages are selected by applying the climate sensitivity index by giving respective weightage to a) climate exposure, b) climate sensitivity, and c) adaptive capacity (25%, 40%, and 35%, respectively). The activities for climate-resilient agriculture were then implemented at these cluster levels rather than at the single village level. The best part of the project is that it not only focuses on promoting the climate-resilient agricultural practices but post-harvest marketing and

value chain as well as institutional building by the formation of 'Village Climate Resilient Agriculture Management Committee' (VCRMC) in each village and network of farmer producers companies (FPCs) for this purpose. Thus this provides a comprehensive framework of climate resilience and income security for farmers, mainly small and marginal farmers. The positive and innovative strategies adopted in the project are Krushi Tais (Female Mobilizers) designated to reach out to especially female farmers, farmer field schools, promotion of carbon sequestration through horticulture, integrated farming system, soil health practices, water supply measures (farm ponds and dug wells), and demand-side measures (micro-irrigation and water budge tinging practices). At the front of post-harvest management is the value chain promotion, promotion of FPCs, improving the Seed Supply Chain's performance by creating a supply chain of seeds with climate resilience features, and providing agreement services to farmers. Institutional and knowledge development by training and capacity building of VCRMC members through training, workshops, and exposure visits has given considerable focus to the project. Even the IEC material prepared for awareness and promoting climate-resilient crop and agriculture practices is in easy language but powerful. The program's unique features are the adoption and use of different technological tools developed and applied for beneficiary selection, mobile-based applications and portals, GIS and Remote Sensing technology, water budgeting, training management app, etc., for quick and transparent planning and its execution. Thus at the package level, the project has an extensive set of interventions with adequate financial allocation for making the agriculture climate resilient.

c) Lacunas and gaps and recommendations

Point 1: Need for a broader systematic vision to address climate change: Central focus of the PoCRA is on making agriculture climate-resilient. Therefore, interventions are mainly designed around crop and soil health practices and ensuring assured income for farmers. However, there is a larger agreement among scientists and experts that the climate change challenge cannot be addressed in isolation and need a holistic and integrated approach of all three continuums, climate change adaption, mitigation, and resilience building. Focusing on these three pillars, actions are needed on different fronts, such as agriculture and water management, reviving the local ecosystem and ecosystem services, biodiversity, powerful policy regulations, and restructuring the overall marketing system and political economy around agriculture. Therefore, without such a comprehensive framework, the output of making agriculture climate resilient will not sustain the long term. For example, suppose we don't address the mushrooming of sugarcane areas in the water-scarce Marathwada region by strict regulations and marketing intensive to other crops. In that case, we cannot expect a change in the cropping pattern. The crop insurance system is a great support mechanism for farmers to deal with increasing crop losses and failure incidences due to sudden weather changes and climate variations. However, there is no mention of this useful climate resilient strategy for farmers in the PoCRA. Even the way water infrastructure development (Farm ponds, river/Nala deepening) is being promoted through PoCRA, and non-PoCRA projects and other sources has many implications for overall water resource management, considering sustainability and equity. For building climate resilience, the community as a whole

should be at the center rather than individuals. Therefore, strategies should be more community-focused and less for induvial benefits. This integrated and holistic approach to addressing climate change is missing in PoCRA, a precondition for resilience building that needs to be adopted in the project.

Point 2: Lack of system of local-level weather monitoring and its application: Although the prime objective of the project is to make the agriculture climate-resilient, this cannot be achieved until the local level weather data is monitored and used for the planning process. As we can see in these days of climate change, the weather conditions, such as rainfall, vary from village to village or even within the village. Therefore, the application of weather data collected at the block or district level is not very relevant for local planning. In PoCRA, the district-wise weekly weather forecast is made available on the project website and to farmers. This system needs significant transformation to make the system more precise, relevant, and useful for farmers. Crop/weather advisories to farmers need to be based on local weather conditions and specific to their crops. Therefore, a network of weather stations has to be significantly increased in the project with the effective data monitoring and advisory generation process. In this regard, the FarmPrecise tool developed and the system put on the ground by WOTR, in collaboration with IMD (ref), can provide a useful opportunity to project to collaborate or build upon. Even the watershed or village level rainfall data is the prerequisite for making the crop water budget more precise and relevant to the village because the application of block-level or district-level data for the village water budget results in a much-distorted scenario. Therefore, if the agriculture and water management in the project village have to make climate-resilient truly, the project needs a significant transformation in its approach and practices on weather monitoring system and its application.

Point 3: More focus on individual benefits rather than community-building: An appropriate governance mechanism is essential to ensure the project impacts are sustainable and judicious. Although the project has the provision of a three-tier structure, representing the district, sub-division, and a 'Village Climate Resilient Agriculture Management Committee' (VCRAMC) at village levels, the project adopts the beneficiary approach. There are fewer or no incentives for the community (for example, the larger water bodies, addressing drinking water issues, weather stations, groundwater recharge measures, maintenance funds, etc.). In contrast, the nature of benefits is very individual-centric (dug wells, farm ponds, micro-irrigation, diesel engines, electric pumps, etc.). The good part is the formation and promotion of farmer producer companies (FPCs), which is a group activity, and more farmers can benefit from it. Unless the community-centric approach is adopted, the demand side water management, mainly water budgeting, changes in crop pattern, and security of drinking water for the village, which is essential for resilience building, can be achieved fully. Therefore, the project needs to change its focus from individual beneficiary centric to the community. As a result, they take more interest in the project and sustain the benefits.

Point 4: Equity issues and judicious benefits to vulnerable groups: The mentioned in the project documents, the aim is to enhance climate resilience and profitability of

700,000 small (1-2 ha) and 10,00,000 marginal (less than 1ha) farmers across 15 districts in the State. However, we could not find the land ownership segregated beneficiary data in the public domain to verify how small and marginal farmers benefited from the project. Moreover, although the agriculture in selected districts is predominately rainfed, most of the interventions in the project package are irrigation centric, with little focus on rainfed area development and building their resilience. Similarly, the landless population and landless agriculture labourers are also the most vulnerable sections of the community, with no focus on improvements in their livelihood and resilience building. Therefore, the project needs to ensure that the interests of rainfed farmers and landless populations also get addressed. Small and marginal farmers are supported more by taking project benefits, increasing the subsidy amount, or providing soft loans to enable them to pay their contribution to availing the benefits.

Point 5: Issues regarding sustainable use of water resources: To enhance sustainable water use, in-situ and off-situ water conservation is promoted, including constructing new water harvesting structures (dug wells and farm ponds, well recharge) and rejuvenating the existing structure, promoting micro and protective irrigation. Also, support is being provided for diesel and electrical pumps and pipes for irrigation purposes. As there are growing concerns about the increasing number of farm ponds and their ill effects on groundwater depletion, groundwater sharing (as it allows privatizing the groundwater), and increased evaporation of stored groundwater, the provision of farm pond construction needs to be very carefully promoted. PoCRA documents talk about the guiding principle for allowing the number of farm ponds, for example, the criteria of net-withdrawal capacity in the cluster, calculated by GSDA; however, in practice, at what level this is followed is not clear as largely there is no control and regulations and monitoring system in the State on several farm ponds in village, their size, and depth (ref). Given these facts, it must be noted here that the villages selected under the PoCRA project are vulnerable to climate change. In such a situation, additional infrastructure promotion like pumps, pipes, wells, and farm ponds that encourage more water extraction might lead to a further decrease in groundwater levels rather than improving climate resilience. Crosschecking whether these interventions align with the goal and objective of existing key laws and policies (for example, Maharashtra groundwater Act-2009) on water management is also necessary. This current approach to infrastructure support has to be revisited in the project.

Point 6: Crop water budget- good on paper but very less on the ground: In the PoCRA, the water budget framework is developed by implementing partners (IIT Bombay and GSDA), and based on it, the Water Budgeting app has been developed. The documents also mention that village-wise water budget charts are prepared and displayed at the village level to create awareness about water balance. However, unless village committees understand and get familiar with the water budgeting process, they don't get attached to the process, and there is a rare possibility of getting it adopted by villagers. Water budgeting apps are useful to facilitate the process. Still, there is no alternative to the manual calculation villagers do; thus, ownership of the water budgeting process and outcome is created. The biggest challenge in PoCRA in acceptance and adopting a crop water budget is the

beneficiary approach adopted in the project without putting the community at the centre. For this purpose, we suggest adopting the water stewardship approach promoted by WOTR, where villagers are as seen the custodian of water resources with the approach of water as a public resource, and a cadre of water stewards promoted in villages take the overall responsibility of preparation of water budget and its serious follow-up (D'Souza et al., 2019).

Point 7: Overburdening and workload of the officers: The present status of the position and human personnel shows a shortage of staff at higher levels like Project Management Units (PMU), District, and sub-division levels. At the PMU level, only 65% of staff is available, while at the district and sub-division level, 86% of staff is available (GoM, 2021). This is also substantiated by a key informant at the top level, as according to him, the hierarchy of agricultural officers was reduced for the speedy implementation of the scheme. However, this resulted in overburdening of Agricultural assistants. Besides, many posts of the supporting officers to SDO are vacant. As a single officer has to look after multiple projects and work on a targeted basis, it is challenging to devote complete attention to PoCRA. To address the issue of the high workload of project staff, we suggest limiting the area of Agricultural Assistants based on criteria like population and accessibility of the villages. Also, suppose the project aims to make water budgeting a reality in project villages. In that case, experts in mobilizing the communities in water budgeting have to be appointed, or the skills of existing staff have to be developed.

d) **Conclusion:** The PoCRA is innovative in many terms, with an approach of building climate-resilient agriculture and water infrastructure development, and thus raising farmers' income, mainly small and marginal farmers. However, the project can be modified and made more relevant in several ways. For example, the weather data network can be made dense for appropriate plans and water budgeting. At the same time, the beneficiary approach adopted needs to modify to make this initiative community-centric for better sustainability of the impacts.

3.2.1.1.7 Mukhyamantri Saur Krushi Pump Yojana, 2019 (MSKPY-2019)

a) **Background of MSKPY-2019:** Interpreting the nexus of water-food-energy is essential because, in silos, we cannot analyze these issues as they have casual relationships. In recent decades, groundwater extraction has been supported by access to highly subsidized (almost free) and unmetered power supply for irrigation purposes. There are around 25 lakh wells in Maharashtra, with most electric-powered pumps. Thus, the state pays a heavy subsidy to power companies per year, mainly to Maharashtra State Electricity Distribution Company Limited (MSEDCL). On electricity subsidy for irrigation, there is no accurate data available. However, it is estimated at the national level around Rs. 50,000 crores per annum (Bhushan et al., 2019). To avoid this increasing burden of subsidies, Central and state governments in India have been aggressively promoting solar-powered pumps. In this effort, in February 2019, the Centre government launched the Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahaabhiyan (KUSUM) scheme that provides a grid-based and off-grid solar pumps to farmers. For this, the target was set to bring one-third to one-fourth of all irrigation pumps in the country to be converted into solar-powered

pumps in about three years (GoI, 2022). In this effort, in Maharashtra, the 'Mukhtamantri Saur Krushi Pump Yojana' (MSKPY) was launched in 2019. As a part of the scheme, 100,000 solar pumps were planned to be distributed and installed in three phases, with solar pumps of 3 HP, 5 HP, and 7.5 HP. This goal was set to be achieved by 2021. These pumps are being deployed as off-grid agricultural pumps. For any power of the solar pump, the state government provides a 90% subsidy to the general category farmer and a 95% subsidy to SC/ST farmers (MahaVitaran, 2019).

b) **Key provisions and strategies of the MSKPY-2019:** The Steering Committee (Sukanu Committee) has been formed to monitor and implement the scheme. The Chief Secretary (Energy Department) is the chairperson of this committee, and the managing director of the Mahavitaran Company limited is the member secretary. The farmers must have an assured water source to benefit from a solar pump set. Farmers who have farmland of 5 acres are eligible for the 3 HP pump, while those with more than 5 acres of land can apply for a 5 HP or 7.5 HP pump. However, if the area comes under the over-exploited, exploited, or partially exploited watershed category of GSDA, then the solar pumps of 7.5 HP are not allowed. The depth of the water source is also considered while checking the eligibility. While selecting the beneficiaries, farmers receiving power supply from any other scheme are not eligible for having a 3 and 5 HP solar pump. Farmers who had paid for the new electricity connection but have not yet received the connection are also eligible. The solar pumps will be sanctioned in only 'safe watersheds', i.e., where the groundwater extraction is less than 60% in the case of solar pumps of 7.5HP. Most importantly, solar pumps will not be granted for wells of farmers where water is being extracted below 60 meters. The subsidy amount for farmers to take the solar pumps through the scheme is huge, 90% for farmers from the general category and 95% for farmers from the SC/ST category.

c) **Strength MSKPY-2019:** This primary strength of the scheme is that it assures the uninterrupted daytime power supply for irrigation at a convenient time for farmers. The major strength of promoting solar-powered pumps is reducing the huge cross-subsidy burden, i.e., the implication of additional charges on commercial and industrial electricity consumers to compensate for the subsidies given to the agricultural sector. Even though solar is green and clean (renewable) energy, it reduces the use of diesel pumps and coal-generated electricity, and thus pollution. Besides, the selection criteria of beneficiaries by excluding the groundwater exploited, overexploited, and semi-exploited watersheds make the scheme more environment friendly and socially concerned by allowing more subsidies and priority to remote and tribal areas besides more subsidies to the SC-ST population. Even the provision made in the scheme for not granting the solar pump to farmers who extract water below 60 meters is in line with the Maharashtra Groundwater (Development and Management) Act, 2009.

d) **Gaps, Lacunas, and Deficiencies in the existing provisions and recommendations**

Point 1: Beneficiary selection criteria: Medium-sized and large farmers are more advantageous for buying solar pumps. Farmers have to pay only 10% of the cost of

purchasing solar pumps as there is a 90% government subsidy on purchasing solar pump units. However, studies find that large farmers are primary beneficiaries of solar pump schemes implemented by various states due to the inability of poor farmers to pay even 10% of the cost (Bhushan et al., 2019). No further clarity was provided on the scheme's benefits to tribal communities. The legal landholding is the main criterion for scheme benefits. The triable population is the most vulnerable, and mostly the electricity has not reached in those areas. The challenge they have is the very small land holding, and many do not have the legal documents (cultivating land as patta). Although the intent of not allowing benefits to farmers extracting water below 60 meters is appreciable for a 7.5 HP pump, the uniform application of this provision across different geologies and land typology is not very appropriate. The provision made under 'Maharashtra Groundwater (Development and Management) Act, 2009' of limiting the depth of the well below 60 meters is challenged on different ground, mainly the huge diversity in terms of slopes, biophysical conditions, and geology and aquifer systems in different regions, farmers in upper reaches and high elevation certainly get disadvantaged and farmers in downstream with the added advantage of water availability at very early depth. Therefore, excluding the overexploited and semi-exploited watershed is a wiser criterion than 60 meters of depth for solar pump benefits.

Point 2: High possibility of excess groundwater withdrawal: The scheme is being implemented to provide uninterrupted daytime power to the farmers, which is actually a good intention. However, the continuous power supply might change the cropping pattern and, thus, more water extraction. In areas with shallow aquifers and a low recharge rate, this might lead to overexploitation of groundwater. It has already been established that 'free/subsidized electricity often leads to over-exploitation of water' (Bhushan et al., 2019). Therefore, the scheme needs careful attention. The large-scale distribution of solar pumps could result in excessive water withdrawal and significantly impact the already depleting water table, particularly with fast depleting aquifers in regions (Marathwada and Western Maharashtra). A handful of studies assess the impact of free/subsidized electricity on groundwater exploitation and agricultural production. As mentioned by Badiani and Jessoe, a 10% decrease in the average electricity subsidy leads to a 6.7 % decrease in groundwater extraction (Badiani & Jessoe, 2013). Even under this scheme, the distributed solar pumps are not connected to the grid; as a result, the farmers will not get the monetary benefits from the excess power generated. This might encourage farmers to extract more water in a rush to use the excess power generated.
Therefore, the current provision for not granting 7.5 HP in exploited, semi-exploited, overexploited villages should be applied to all areas. Also, micro-irrigation should be made mandatory for solar pump beneficiaries, or the scheme should be linked with a subsidy scheme for availing micro-irrigation.

Point 3: Less possibility of saving the capital through solar pump subsidy: Another lacuna of this model is that the state is counting on the money saved from giving subsidized electricity. However, the priority areas for distribution of the solar pumps are those where the electricity supply is not yet provided. The scheme's document clearly mentions that for 3 and 5 HP pumps, only those farmers can apply who have not yet connected to Mahavitaran feeders or those who have applied for electricity

supply for pumps but have not yet connected. In such a situation, the state will not save the subsidy in the real term (Bhushan et al., 2019). Also, as the pumps are off-grid pumps, neither farmer nor state can earn extra money by selling the electricity or reducing the cost of network generation for the distribution of electricity.
Another issue with the off-grid pumps is that the lifecycle cost of these pumps is higher than other models of solar pumps, i.e., on-greed pumps or solar feeders (ibid). In 2017, the Maharashtra government did a solar feeder scheme pilot project in two villages, namely Ralegan Siddhi and Kolambi, in Ahmednagar and Yawatmal districts. This was done under the scheme 'Mukhyamantri Saur Krishi Vahini Yojana,' i.e., 'Chief Minister Solar Agriculture feeder scheme' (ET, 2018). Later in 2018, this scheme was launched across the state. This scheme is still in continuation. As stated earlier, as the off-grid solar pumps are less beneficial than the feeder model, more efforts should be put into implementing the 'Mukhyamantri Saur Krishi Vahini Yojana' wherever possible.

Point 4: Fluctuation in power supply provided by solar panels: In the summer season, due to adequate heat from the sun, the solar panels can generate a fair amount of power for pumping; however, on cloudy days (mainly rainy and winter season), the plant may face the high fluctuation due to insufficient heat by sun. As there is no storage facility available, the issues of changes might not be fully resolved in off-grid solar pumps.

Point 5: Horse Power of the solar pump: In most cases in Maharashtra, bore wells are not yielding a high amount of water. There are very few bore wells whose water yield is compatible for 3 HP and more; in most cases, the water yield of bore wells ranges from 1 to 3 HP. Even the study done by Sawant (Sawant et al., 2018) in Buldhana and Akola region found that many of the small and marginal farmers in the region require low-power solar pumps ranging from 1 to 2 HP. This could be the situation in many parts of Maharashtra. Hence, there is a need to revise the provision of HP-wise subsidies for solar pumps according to the region or need of the farmer, benefiting more farmers with less groundwater yield and extraction.

Points 6: Maintenance issues: The scheme prioritizes the remote and tribal areas for installing solar pumps. However, it has not been mentioned how the maintenance of these solar pumps will be taken care of. Besides, the parts of the solar pumps are expensive to be replaced by the small and marginal farmers. In addition to this, local youth should be trained to solve the technical issues related to solar pumps. This will not only solve the regular maintenance issues of solar pumps but also will generate more employment.

e) Conclusion: Solar-powered pumps through the scheme certainly benefit farmers and the state by reducing the state's high subsidy amount. However, these options cannot be generalized to the entire state. They must consider local characteristics such as level of groundwater development, level of groundwater depletion and the yield of bore wells, cropping patterns, etc. Even the Jyotigram scheme in Gujrat has come with an integrated solar energy model, making available 24 hours three-phase power supply for domestic uses and 8 hours/day of full voltage power for farmers to irrigate. Such an integrated approach needs think to modify the scheme. The areas

where solar pumps are installed should be monitored and informed about their groundwater conditions. Otherwise, the safe and not-exploited watersheds might become vulnerable to water scarcity. The effectiveness of this scheme should also be checked in the face of climate change and rainfall variability, and even with more research into whether and at what level big units of solar power increase the atmospheric temperature.

3.2.2 Analysis of the policies and programs at the national level

Having analysed policies and programs at the state level, we present the national level policies and programs at the national level. The national-level policies and programs are made as guiding principles and procedures, and states are expected to take cognizance of it and modify their water governance. Therefore, we discuss this section in two subsections, an analysis of the policies and an analysis of programs at the national level.

3.2.2.1 Analysis of the policies at the national level

This section presents the analysis of key policies and frameworks in the water sector available at the national level.

3.2.2.1.1 National Water Policy, 2012 (NWP-2012)

a) **Background and objectives of NWP-2012:** India adopted the first NWP in 1987; since then, the NWP has been revised twice, in 2002 and 2012. As the water resource has been facing different challenges in many Indian states for the last few decades, NWP-2012 was formulated to propose a framework for the creation of a system of laws and institutions and a plan of action with a unified national perspective, and hence it is expected in the policy that the State Water Policies may need to be drafted/revised in accordance with this policy keeping in mind the basic concerns and principles. The overall framework of NWP-2012 adopts the principle of equity, social justice, sustainability, and good governance through transparent, informed decision-making. It also promotes water resources to be managed as a common pool community resource held, by the state, under the public trust doctrine. In November 2019, the Ministry of Jal Shakti constituted a drafting committee to revise the existing NWP-2012 under the chairmanship of Dr. Mihir Shah, a renowned water expert. As the new policy may take a year or more, we have analysed the NWP-2012 for the present review.

b) **Strengths of the NWP-2012:** The national-level framework and perspective put by NWP-2012 are comprehensive and valuable to promote principles of equity, social justice, sustainability, and climate change. NWP-2012 has proposed many useful recommendations and suggestions to build and increase the adaptive capacities of communities to climate change. Principles of water supply-side management and improving participatory governance at different levels have been adopted in the policy. To meet the increasing water demands and traditional structures of water harvestings, desalination methods and avoidance of inadvertent evapotranspiration from water bodies are proposed. In addition, a need for mapping the aquifers to

know the quantum and quality of groundwater resources is also acknowledged. For demand management, a system of evolving benchmarks for water use for different purposes, i.e., water footprints and water auditing, is indorsed. Declining groundwater levels in over-exploited areas are expected to be arrested by introducing improved water use technologies, incentivizing efficient water use, and encouraging community-based management of aquifers. At an institutional level, arrangements for promotion, regulation, and evolving mechanisms for efficient water use at the basin/sub-basin level are proposed to be established at the national level. Water pricing is promoted to ensure its efficient use and reward for conservation. An independent statutory Water Regulatory Authority is proposed to be set up by each State for equitable access to water for all and setting fair water pricing for drinking and other uses. The policy's important contribution is pushing the need for the Water National Framework Law as an umbrella law for the water sector. This framework law is expected to lead the way for essential legislation on water governance in every State and the Union and the devolution of necessary authority to the lower tiers of government to deal with the local water situation. It is assured in the policy that the framework law must need to recognize water not only as a scarce resource but also as a sustainer of life and ecology. Therefore, water, particularly groundwater, is expected to be managed as a community resource held, by the state, under the public trust doctrine to achieve food security, livelihood, and equitable and sustainable development for all. Thus, the NWP-2012 provides a comprehensive framework to guide the country's water resource development and management process.

c) Gaps and deficiencies in the policy and recommendations for modification

Provision 1: Safe Water for drinking and sanitation should be considered as pre-emptive needs, followed by high priority allocation for other basic domestic needs, achieving food security, supporting sustenance agriculture, and minimum eco-system needs [1.1 (vi)].

The NWP 2002 prioritizes water allocations for purposes of drinking, irrigation, hydropower, ecology, industries, navigation, and other uses in that order. In contrast, the NWP 2012 prioritizes water for drinking and domestic needs, irrigation, and “minimum ecological needs” as an equal and ‘high priority (National Water Policy, 2012, 2012). The NWP 2012 introduced the concept of minimum ecological needs and stipulated that these were to be given a “high priority” allocation. We propose that after water for drinking and domestic needs, ‘water for ecology and the environment must be the second most important priority. The environment and its ecology provide the essential and crucial ecosystem services- such as water, food, fuel, wood, and fiber, as well as balancing the climate - on which the survival, sustenance, and progress of the human race and civilization itself, depend. Securing these ecosystem services is of utmost importance, especially given climate change and rising global temperatures, which will adversely affect India.

Provision 2: As demand-side management, methods like aligning cropping patterns with natural resource endowments, micro-irrigation (drip, sprinkler, etc.), automated irrigation operation, evaporation-transpiration reduction, etc., should be encouraged and incentivized [6 (5)]

Wide observations show that, although water use-efficiency devices, such as micro-irrigation and automated irrigation devices, reduce crop water requirement, in real terms, farmers' overall water use doesn't get reduced as they increase the area under irrigation (Grafton et al., 2018; Perry et al., 2017). Given that around 90% of India's water is used for agriculture (Qazi, 2017), we can never hope to meet India's drinking and domestic water needs without reducing water for agriculture. Just three water-intensive crops - rice, wheat, and sugarcane - consume almost 80% of irrigation water (M. Shah et al., 2021). Along with promoting micro-irrigation, a reduction in the area under these crops and crop diversification can significantly alleviate water scarcity and make available additional water resources for other needs, especially in rainfed and drought-prone regions of the country. To reduce water-guzzling crops and increase the area under "water-lite" crops such as millets, pulses, and oilseeds, these and similar crops' minimum support prices (MSP) should be further increased. Such procured crops as millets (jowar, bajra, etc.), pulses, and locally grown crops should be introduced into the public distribution system (PDS), the Anganwadi-ICDS program, and mid-day meal schemes for school-going children while simultaneously reducing the procurement of wheat and rice. The NWP should set a clear roadmap for this.

Provision 3: To meet equity, efficiency, and economic principles, the water charges should be determined on a volumetric basis [7(2)]

The interconnectedness of surface and groundwater hydrology has to be recognized, as both are forms of the same resource. Hence, it is not logical to price only surface/ canal water while making groundwater a free gift for the few better-endowed farmers. Wider observations show that the absence of groundwater pricing causes indiscriminate extraction and depletion of groundwater resources in many regions. Therefore, a system of groundwater pricing based on the area under irrigation, similar to canal water, should be introduced. To make this legally tenable in the case of groundwater, it is necessary to revise and modify the Indian Easement Act, 1882, which confers exclusive private domain over what is essentially a common property.

Provision 4: The over-withdrawal of groundwater should be minimised by regulating the use of electricity for its extraction; for this, separate electric feeders for pumping groundwater for agricultural use should be considered [7 (6)].

This provision is mainly based on the limited success of the Jyotigram scheme in Gujarat state. Farmers in Gujarat are receiving 8 hours/day of uninterrupted, high-quality 3-phase power. The advocates of Jyotigram Yojana and separating power feeders claim that it has reduced the aggregate groundwater withdrawals without massive negative impacts on production, and it has reduced the wastage of power and groundwater and generated some incentive for efficiency in their use (Mukherji et al., 2012). However, few studies mention that this mechanism has increased groundwater extraction because the cost per unit of electricity remained unchanged or no substantial increases in tariff. The power supplied became more effective and reliable with improved quality (Chindarkar & Grafton, 2019).

On the other hand, challenges such as farmers stealing power by hooking on village feeders, which have 3- phase power all day long, and even many farmers using larger submersible motors than earlier are observed. Even there is evidence that limited hours of electricity supply for irrigation have negatively affected water-sharing

practices, and water markets negatively impacted poor farmers. Therefore, although feeder separation is a useful provision, it is certainly not adequate for reducing groundwater use. Unless the fundamental problem of cropping pattern by incentivizing appropriate crops doesn't get well addressed through the market mechanism, electricity regulations in isolation will not be sufficient to address the core issue of groundwater depletion.

Provision 5: For flood management, appropriate safety measures, including downstream flood management, for each dam should be undertaken on top priority [8(8)].

In addition to flood management measures downstream, emphasis on the treatment of the catchment areas of dams through soil and water conservation measures is necessary. This will ensure that these catchments absorb more water in days of heavy rainfall, reduce run-off velocity, recharge groundwater aquifers, and ensure warning and safe discharge of excess water in the dams. Considering the increasing events of erratic rainfall and changing overall monsoon patterns due to climate change, this needs priority attention in the NWP.

Provision 6: Water is essential for the sustenance of the ecosystem, and therefore, minimum ecological needs should be given due consideration [1.1 (v)]. Even artificial recharging projects would be allowed to ensure aquifers provide base flows to the surface system and maintain ecology.

The NWP-2012 is vocal about ensuring the water requirement for ecosystem needs and environmental flows. Even the policy talk about keeping aside the portion of the river flows to meet ecological needs ensuring that the low and high flow releases are proportional to the natural flow regime, including base flow [1.3(v)]. However, there is a dearth of evidence-based studies with respect to optimum water needs of ecological niches, ecosystems, and environmental flows for landscapes and rivers. As the agro-ecological and climatic zones and subzones differ, policy formulation needs to be backed by sound geo-ecologically representative research and scientific evidence to arrive at the optimal water requirements of these natural systems, also including under conditions of a changing climate. This is also urgently necessary as many policy documents, projects, and civil society actors are promoting tools for water auditing and water budgeting at different scales in the absence of clarity on the amount of water to be allocated to maintain local ecological functions and environmental flows. Therefore, NWP should prioritize this as an important area for in-depth study in the Indian context.

Provision 7: There is a need to evolve a National Framework Law as an umbrella statement of general principles to lead the way for essential legislation on water governance in every State of the Union (2.1)

Certainly, National Water Framework Law is essential to guide the mechanisms to address the interstate water sharing issues and provide an overall framework to guide the states. However, the critical constraint in dealing with inter-state eater conflicts on water sharing is that water is treated as a state subject; hence we propose that it should be brought under the concurrent list of subjects to deal with by the centre and states. In addition, there are different policy instruments and programs in India, either under-drafting or implementation. These are mainly the

River Basin Management Bill, the Model Bill to regulate and control the development and management of the groundwater, Jal Jeevan Mission, Atal Bhujal Yojana, NAQUIM, and state-specific programs on desiltation of reservoirs, river deepening and straightening, water harvesting, etc. The National Water Framework Law should ensure that the approach and interventions under these extant policies and programs are harmonized with and aligned to the goals and outcomes envisaged in the law to realize synergies and minimize conflicts.

d) Additional Provisions and Measures required in NWP-2012

Provision 1: Need for appreciation and incentivization at different levels to villagers for making good efforts to improve local water governance: In NWP-2012, no provision or framework has been adopted for incentivizing the village communities to make reasonable efforts for overall water resource development and management. Lack of appreciation and incentivization results in lower interest or no motivation for taking the initiative to villagers and their negligence towards maintaining the structures created. For a similar purpose, the centre has already developed the Composite Water Management Index (CWMI), developed by NITI Aayog, for states that assess the supply and demand side of water management and cover governance aspects present state-wise performance. NWP-2012 should take cognizance of this, and the CWMI, which assesses the state-level performance, needs to be further customized and tested at the district level for greater applicability. In a similar line, at the village level system of appreciation for villages performing better in water governance has to be established. For this purpose, WOTR has developed a 'Water Governance Standard and Certification System' to incentivize villagers to adopt good behaviour and better water management practices; based on the village performance, the certificates get issued to the villages (Sathe, 2018). Such an incentivization framework needs to be adopted in the MSWP-2019.

Provision 2: A special component for rainfed farming or rainfed areas should be added to the policy: The NWP-2012 mostly focuses on storing water in reservoirs and groundwater; thus, it is mostly water or irrigation centric. Even with current national-level policies and programs, the most investment made in agriculture is irrigation-centric, through subsidized electricity for groundwater use and promotion of micro-irrigation. However, the scope and contribution of rainfed agriculture in India are huge. About 197 districts spread across the country in different rainfall regions are categorized as drought-prone districts, and another 115 districts, though they have more than 40% irrigated area in each of the districts, have more than 100,000 ha of rainfed area (RRAN, 2019). Thus, these 312 districts out of 672 districts constitute important rainfed systems. Therefore, over half of the country does not figure in the NWP-2012 as the policy is very irrigation-centric. NWP-2012 needs to seriously reflect on this and incorporate strategies for a rainfed area or rainfed agriculture development.

Provision 3: S**olar energy for pumps needs to be promoted**: Solar as clean and renewable energy is being promoted at different levels, at the centre and states, and at present, there is no mention of this as an important strategy for irrigation pumps.

Therefore this should be seen as a vital strategy in NWP-2012. However, while doing so, care has to be taken so that solar pump promotion does not negatively impact the groundwater resource leading to further depletion, mainly in hard rock basalt aquifers.

e) **Concluding remark**: Although the NWP-2012 is comprehensive, it should spell out a clear roadmap with a clear responsibility and accountability structure at all levels. The policy should include a separate section on strategies for promoting rainfed area development, promoting the strategy of Water Governance Standard, and incentivizing farmers to cultivate rainfed or less water-required crops. These provisions have an immense potential to shift the "use narrative" in the water sector in India. As the National Water Framework Law, proposed in NWP-2012, is essential for India, a clear roadmap and timeline should be put to formulate and pass this important policy instrument.

3.2.2.1.2 The Composite Water Management Index (CWMI) by NITI Aayog

a) **Background and objectives of CWMI:** To encourage 'competitive and cooperative federalism' in the country's water governance and management, the National Institute for Transforming India (NITI) Aayog developed the framework of the Composite Water Management Index (CWMI). NITI Aayog came up with the first state-wide CWMI for 2015-2016 (NITI Aayog, 2018b). The primary aim of the index is to create a data-based system for improving the country's water resource management level. The other broad objectives behind applying the index system are (i) establishing the baseline for analysing the performance of a state in the water sector based on key indicators, (ii) benchmarking the performance of states, (iii) evaluating the performance of states over the period, and (iv) identification of the areas in which there is need of investment and deeper engagement by the states to improve the overall water management. In the Index. Maharashtra state was at 4th rank in 2015-16, which later slipped to 5th rank in 2016-17; in 2017-18, its position further declined to 8th. On the other hand, the state of Gujrat remained in the top position during all these three years (NITI Aayog, 2019).

The indicators for assessment in CWMI have been grouped into nine broad themes, and the scoring scheme of these themes is as below (NITI Aayog, 2019),

Table 4: Indicator themes and weights

No.	Indicator theme	Weights
1	Source augmentation and restoration of water bodies	5
2	Source augmentation (Groundwater)	15
3	Major and medium irrigation-Supply side management	15
4	Watershed development-Supply side management,	10
5	Participatory irrigation practices-Demand side management	10
6	Sustainable on-farm water use practices-Demand side management	10
7	Rural drinking water	10
8	Urban water supply and sanitation	10
9	Policy and governance	15
Total		**100**

NITI Aayog claims that the CWMI is a first-of-its-kind, comprehensive scorecard for identifying, targeting, and solving problems in the water sector across the country.

b) **Strengths of the CWMI:** The primary strength of the CWMI is that it provides space for creating a competitive environment for the states to improve water resource development and management efforts. Although governance indicators are not sufficiently comprehensive, the Index gives importance to both, water supply-side and demand-side measures and, more importantly, recognizes the need to focus on groundwater augmentation. The Index is also helpful for states to obtain an objective analysis of their performance and take necessary steps to improve their level of water management. The method and review process for preparing the Index is also made more objective as provision has been made for an Independent Validation Agency (IVA) to review, validate and approve the data of indicators and sub-indicators related to the performance of states. Fieldworks are also conducted to verify the data and understand the reporting methodology used by the states and union territories (UTs) to collect, collate, and present data against specific indicators. Thus, it seems serious efforts are being taken to make the process of preparing the CWMIs more transparent.

c) **Gaps, lacunas, and deficiencies in the CWMI and recommendations for improvement**

Point 1: The assessment is based on PIM policies formulated and not on their level of implementation: As governance indicators, the assessment of CWMI is confined mainly to only those policies regarding Participatory Irrigation Management (PIM), mainly the Water User Associations (WUAs) made for command areas of irrigation projects. There are two major lacunae in this provision. First, the assessment is confined to only the laws on paper or targets achieved in terms of the number of WUAs formed. However, many studies show that most registered WUAs are non-functional and inactive, and very few are performing well (Tiwale, Kale & Bhasme, 2021). Hence, along with just passing the law, the level of its implementation also matters a lot. At another level, in the governance aspect, groundwater governance has been completely missed in the assessment of the Index. Groundwater is the backbone of Indian agriculture and drinking water security and a vital resource in many states in the western, eastern, central, and southern parts of India. There are many policies and agencies at the central and state levels (such as GSDA in Maharashtra). Therefore, groundwater-related policies and the effectiveness of related policies and agencies must be assessed while preparing the CWMI. More importantly, the extent of their execution, adoption, and efforts made by states for their execution needs to be weighted.

Point 2: Community efforts on water management not considered: India has a rich history of community-based natural resource management (CBNRM), and numerous examples of community-led water management practices exist in different states. These ideas are echoed in experiments by social entrepreneurs like Anna Hazare and his disciple Popat Rao Pawar, Hardevsingh Jadeja in Rajkoat, Rajendra Singh of Tarun Bharat Sangh in Rajasthan, Hermann Bacher of WOTR with design and wide implementation of IGWDP in many watershed villages, and the late Vilasrao

Salunke's Gram Gaurav Pratishthan at Pune. Many spiritual organizations and civil society organisations like Swaminarayan Sampraday and Swadhyaya Pariwar in Saurashtra, Gujarat, Art of Living, Isha Foundation, Paani Foundation in Maharashtra, and many more NGOs working in different parts of India. The immense contribution of these initiatives in water resource development and management and Participatory Groundwater Management (PGWM) has not been reflected in the present assessment of the CWMI. Thus, the present set of indicators of CWMI is more technical and engineering-oriented, focused on water augmentation and supply-side management. To make the CWMI comprehensive, the key social and behavioural aspects of institutions and participation need to be incorporated into the Index.

Point 3: CWMI is more irrigation and blue water-centric: The set of indicators of CWMI is mainly irrigation-centric and deals with blue water (surface water and groundwater). However, the scope and contribution of rainfed agriculture (where green water in the form of soil moisture plays a crucial role) in India are huge. A total of 312 districts out of 672 districts in India comprise important rainfed systems (RRAN, 2019), and three fourth of the total geographical area in India is drought-prone with arid (19.6%), semi-arid (37%), and dry, sub-humid (21%) (GoI, 2009). Therefore, over half of the country does not reflect in the assessment of CWMI; there is no reference to soil health and quality practices in the CWMI. Therefore, CWMI must incorporate strategies and indicators for assessing rainfed agriculture development and green water management.

Point 3: Equity issues and judicious water management not valued in CWMI: Equitable and judicious use of water is a key concern because water is seen as a public trust, and access to this precious resource is considered a fundamental right under the right to life in India. However, CWMI does not include the approaches and practices of water sharing, violation of water rights, efforts to bring more rainfed farmers under irrigation, efficient water allocation and use, and provisioning for ecosystem needs and biodiversity. Therefore, CWMI must include the concerns of equity, water-use efficiency, and judicious use to encourage states to promote these fundamental principles and practices.

Point 4: Inadequate indicators on groundwater depletion and water quality: The change in overexploited and critical units for groundwater use, based on measurement of pre-and post-monsoon water levels, in selected observation wells by the State and CGWB (piezometers installed for the purpose), is considered as a significant indicator for assessing the CWMI. Many researchers have already found that, as the number of observation wells is very insignificant in India (less than 1% of total wells) and there is huge diversity in hydrogeology in India, the findings of groundwater depletion in a vast country like India do not reflect the true scale of groundwater depletion. Therefore these observations on groundwater depletion are more indicative rather than representative. A few researchers even argue that findings from observation wells don't match the results of the GRACE methodology of NASA and ground observations of wells (Hora et al., 2019). Therefore, more credible indicators such as the change in percentage of tanker-dependent villages in

the states and changes in the area under water-guzzling crops need to be added to the CWMI assessment.

Although NITI Aayog's CWMI report highlights that around 2 lakh people in India die each year because of the poor quality of drinking water, CWMI has not given adequate weightage to water quality. The index only assesses the percentage of reduction in rural habitations affected by water quality problems. The assessment of the index does not cover the larger water quality issues in agricultural water use, its status, and states' efforts in regulating industrial water pollution and treatment, use, and disposal of sewage from cities and towns into rivers, etc.

d) **Concluding comments:** While improving the CWMI, the government should accelerate the impact of the Index by developing a common platform that can be accessed by researchers, academicians, NGOs, entrepreneurs, opinion makers, and policy makers. This open platform will enable to incorporate the further development and innovation insights into the broader water ecosystem in the index. Furthermore, incentivization by way of additional grants or financing on preferential terms to states that achieve significant improvements in their ranks should be done to make computing the Index really competitive, change-driving, and transformational. Even at the second level, there is huge potential to bring this Index to the regional districts, sub-districts, and even the village level. WOTR has already started working in this direction and developed a robust 'Water Governance Standard and Certification System' to assess the village-level status of water governance and incentivize different actors working on water issues (Yadav & Kale, 2020). While the practice of preparing the CWMI on an annual basis was started five years back, it is now time to incorporate new elements as proposed and evaluate how successful it has been in achieving its goal of encouraging 'competitive and cooperative federalism' in Indian states and UTs.

3.2.2.2 Analysis of the programs at the national level

This section presents an analysis of two important programs at the national level, Atal Bhujal, and the National Aquifer Management Program.

3.2.2.2.1 Atal Bhujal Yojana

a) **Background and objectives of the program:** On the 95th birth anniversary of India's former prime minister, Mr. Atal Bihari Vajpayee, the Atal Bhujal Yojana, also known as Atal Jal, was launched in 2019. This central sector program is planned to be implemented in identified priority areas of 7 states: Gujrat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Uttar Pradesh. A total of 78 districts comprising 193 blocks and 8353 Gram Panchayats having water stress are identified for implementing this program. Out of 8353 Gram Panchayats, 1339 Gram Panchayats represent 35 blocks, and 13 districts belong to Maharashtra (GOI, 2020). The program's primary objective is to improve the groundwater condition through participatory groundwater management. The five-year implementation of the program started in 2020-2021 and will continue till 2024-2025. For the implementation of this program, Rs. 6000 crores has been allocated. Out of this, Rs 3000 crores will be provided by the World Bank as a loan, while the central

government will give the remaining Rs. 3000 crores to the states as a grant-in-aid (GOI, 2020).

b) **Strengths of the program**: The policy's primary strength is allocating funds based on achievements regarding Disbursement Linked Indicators (DLIs) or, in simple words, the progress achieved. This provision will ensure the states' wholehearted performance; otherwise, further funds cannot be availed. Besides, the convergence of different central schemes, such as Jal Jeevan Mission, the Swachh Bharat Mission, MGNREGS, etc., for sustainable management of the groundwater with the help of public participation is another advantage program. This approach will certainly contribute to achieving the objectives of each other; for example, increased water availability through Atal Jal will ensure the drinking water availability through Jal Jeevan Mission. The program's activity of preparing Water Security Plans and water budgets at Gram Panchyat level and implementing various interventions at the village level is also a much more necessary process in a given time of growing groundwater depletion. These plans prepared under the program will be an essential component of the Gram Panchayat Development Plans; thus, they may get serious attention. Another logical and relevant provision made in the program is the flexibility in deciding the area or scale of interventions; for matching the boundaries of program implementation with the watershed and aquifer boundaries, the 20% variation in terms of the number of Gram Panchayats is allowed in selected blocks. One of the program's important plus points is the provision for extensive training and capacity building as well as awareness activities at different levels on groundwater management issues. The focus is on increasing the skills and capacities of officials and teams engaged on one side and the overall behavioural change of communities through IEC strategies.

c) **Gaps and deficiencies in the program and recommendations for modification**

Below are gaps and deficiencies in the Atal Jal and recommendations to address them.

Point 1: The water supply and demand-side interventions will be an important strategy of the program: The program involves interventions related to both the demand side and supply-side water management. As part of the demand side management, the project promotes micro-irrigation, recycled/reused water for irrigation, crop diversification, promotion of rainfed horticulture, underground pipelines, feeder separation for irrigation power supply, and pressurized irrigation in canal command areas. The supply-side interventions include the construction of check dams, percolation ponds, contour bunds, drainage line treatment, recharge trenches or wells, sub-surface dykes, farm ponds, etc. In fact, no innovation is found in this proposed set of interventions. Through PMKSY, IWMP, and other state-level schemes (Jalyukt Shivar and PoCRA), most of these interventions are promoted at a huge level, even in groundwater-stressed regions. In demand-side management, more focus should be on addressing and promoting the suitable cropping pattern and regulating it through incentives in these regions, as water-guzzling crops, and thus export of virtual water is huge in these groundwater depleted regions and that is one of the reasons for the depletion. Even promoting subsurface dykes as an

intervention needs to be reconsidered, given that impacts of this may go against the principle of water as common property and change the overall groundwater flow regime and thus the overall water allocations in the area. A subsurface dyke is a structure built in an aquifer to obstruct the natural flow of groundwater (Sonkar, 2016), thereby raising the groundwater level and increasing the amount of water stored in the aquifer. This structure may also lead to the privatization of groundwater for a few handfuls of irrigated farmers, ignoring the value of base flows and groundwater rights of downstream people. We are already experiencing such ill effects of the widely promoted farm pond strategy, resulting in the tool for groundwater mining and privatizing this by recourse wealthy farmers. Such interventions towards privatizing the groundwater should be avoided or very carefully implemented.

Point 2: Grampanchayat level Water Security Plans (WSPs) will be prepared based on water budgets: WSPs are expected to be prepared based on water budgets at the Gram Panchyat level, and the WSPs will be made for five years. These plans will specify investments and interventions to meet the anticipated demands and will be customized to meet the specific challenges in the GP and include any water-related investments/interventions. Water budgeting has become the general practice in many government programs and civil society initiatives. This tool is more useful for awareness generation and sensitizing the people on water use; however, the tool has many challenges and does not fully fit for precisely measuring and calculating available water stock for management purposes. Therefore, aquifer-based groundwater management is seen as a more technical and scientific tool for effective groundwater management, and it has been proposed by progressive policy initiatives such as Maharashtra Groundwater (Development management) Act, 2009. However, the present National Aquifer Mapping and Management Programme (NAQUIM) will not be able to provide anything useful to the Atal Jal in terms of mapping groundwater at the Gram Panchayat scale as the scale of NAQUIM for the aquifer mapping is huge (1: 50,000). Therefore, groundwater recharge potential maps made for villages by GSDA or practically delineating aquifers at a micro-scale will be the more suitable strategy for the program. Thus, the aquifer-based groundwater management and managed aquifer recharge (MAR) approach, adopted worldwide for sustainable aquifer management, needs to be adopted in the program.

Point 3: Institutional arrangements at a different level: The program has made very useful provisions for the Water User Association (WUA), empowering the village water and sanitation committee as WUA. Adequate flexibility is provided in the formation of WUA to make it inclusive and capable. However, at higher levels, in National Inter-Departmental Steering Committee (NISC) and State Inter-Departmental Steering Committee (SISC), only government officials, mainly principal secretaries of different departments, are proposed to be members. Thus, no space for the representation of NGOs working in water management and water experts who bring valuable knowledge and experiences in this sector is made in the program, and this should be well addressed.

Point 4: Convergence of Jal Jeevan Mission, the Swachh Bharat Mission, MGNREGS, etc., are proposed at different levels in Atal Jal: The provision is made for the integration of supply and demand-side interventions as well as training, capacity building, and IEC activities of Atal Jal will be aligned with the Jal Jeevan Mission, the Swachh Bharat Mission, MGNREGA, etc., so that resources are used optimally, and there is a holistic approach to water use and management at all levels. However, this approach may dilute the core objective of groundwater management, and the emphasis of actors may be confined to popular activities of individual benefits. For example, in the convergence approach in Jalyukt Shivar Abhiyan, we have seen that the central focus was on activities of Nala and river deepening and widening and constructing farm ponds, keeping aside other relevant interventions. Therefore, while mutually benefiting the objectives of relevant schemes, in Atal Jal, care has to be taken that groundwater management's core principle and objective don't get diluted or distorted by adopting the convergence approach or adding other components.

d) Additional Provisions and Measures required in the program

Point 1: Water stewardship approach missing in the program: The approach or framework to be adopted in conceptualising any schemes and programs is very important to understand and realize how we see the different actors and stakeholders and their association with each other as well as their rights and responsibilities. The water stewardship approach, tested and proven its usefulness, is missing in the program. This approach brings diverse stakeholders together, builds their sense of stewardship of local water resources, and makes them realize their responsibility for efficiently, judiciously, and sustainably using the water resource. Here, water users are not seen as passive beneficiaries or culprits for groundwater depletion, but if their skills and capacities are developed with behavioural change, they are seen as good water managers. WOTR has done extensive work in designing and promoting this approach (D'Souza et al., 2019). At the approach level, adopting the water stewardship framework will certainly help achieve the objectives set by Atal Jal.

Point 2: Adoption of CDVI tool for aquifer literacy: For achieving behaviour change of villagers and mainly groundwater users, they must understand the shared nature of groundwater and it as a public trust. WOTR has developed and applied an innovative tool called CoDriVE – Visual Integrator (CDVI) to sensitise communities about the groundwater's common-pool nature. This science-based tool develops 3D models of the aquifer's surface (land topography) and subsurface (aquifer thickness). It has been seen that this tool is immensely useful to sensitize the village on the common –pool nature of groundwater (E. Kale et al., 2022). Such valuable and scientific tools should be included in the IEC toolkit in the Atal Jal.

Point 3: The program interventions should be made in line with existing groundwater policies: The experiences have shown that IEC and awareness generation components and adoption of water budgeting tools have certainly the limited success. The strict regulatory measures to control farmers' water use and crop practices are more important because economic interests mainly trigger them.

For this purpose and sustainable groundwater management, Maharashtra has already come up with Maharashtra Groundwater (Development and Management) Act, 2009, and at the Center level, the Model Groundwater bill. The principles of these policies are not reflected in the interventions and strategies of Atal Jal; for example, according to Maharashtra groundwater Act 2009, there is a ban on sinking well more than 60 meters deep, wherein Atal Jal, there is no reference for sinking deep wells. Therefore, the package of interventions of Atal Jal should be in line with the existing policies in the water sector.

Point 4: Measures for ensuring groundwater quality need to be focused: In Atal Jal interventions, the adequate focus is given to supply and demand-side management; however, the growing concern of groundwater quality and pollution are not adequately focused on. According to Niti Aayog, yearly, 200000 people die due to water quality problems (NITI Aayog, 2018a); given this fact, serious efforts have to be taken in Atal Jal to prevent groundwater pollution.

e) **Concluding statement:** Capacity and awareness building on water management are given adequate focus in the program; however, the common pool nature of the groundwater has to be promoted, and the program has to be made in line with existing policies and legislations. The adoption of water budgeting and water security plans must get well-regulated with incentives and strict regulations. More importantly, the water stewardship approach needs to be incorporated into the Atal Jal.

National Project on Aquifer Management (NAQUIM)

a) **Background and objectives of Act:** In 2011, the Working Group on Sustainable Ground Water Management (WGSWM), Planning Commission, presented its reports highlighting that for better management and governance of groundwater at a local level, understanding the present aquifer is essential. WGSGWM made three key recommendations in its report: better database management, alternative methodologies to be adopted for assessing the recharge estimates where existing methods fall short of matching the ground realities, and effective mapping of aquifers. Based on these recommendations, in 2012, CGWB initiated the National Project on Aquifer Management (NAQUIM) to map the aquifers and quantify available groundwater. With the initiation of NAQUIM, the CGWB is shifting towards the new water management paradigm from the old water development paradigm (CGWB, 2012). The principal objectives of NAQUIM are – i) To detect and prepare a map of an aquifer, ii) To estimate the available groundwater potential, iii) To propose an aquifer management plan based on the demand for water, nature of aquifer, and institutional arrangements. The primary outcome of this project is stakeholder engagement for the sustainable management of the aquifer. Its motto 'Know your Aquifer, Manage your aquifer' rightly reflects this expected outcome (CGWB, 2012).

b) **Strengths of NAQUIM:** The primary strength of the NAQUIM project is that the project is not limited only to the delineation of the aquifer, but it tries to achieve groundwater management by the community. For this purpose, a component of

Participatory Ground Water Management (PGWM) is also included in this program, which thieves for capacity building of farmers and groundwater users to monitor groundwater, improve water use efficiency, and plan cropping patterns for efficient use of groundwater. Besides, adopting a groundwater management approach rather than groundwater management itself is one of the program's positives. Provision of strengthening of Water User Associations (WUA) or the formation of Ground Water Management Associations (GWMA) as in charge of groundwater management also ensures the participation of local people. Such WUAs and GWMA will also be responsible for deriving the cropping pattern based on water availability. Besides, the PGWM Groups (monitoring) will also be formed. The training will be given to selected persons regarding shared groundwater management and the collection of primary hydro-climatological data. These trained persons will be called 'Para-Hydrogeologist (PHGs)' or 'Jal Surakshakas.' Such steps will help gather the local data, which could be used for effective water management and even for hydro-climatological predictions. Another peculiar aspect of this program is that along with an assessment of the quantity of groundwater, an analysis of the variation in groundwater quality is incorporated into it. The data collected and processed will be made available in the standard format suggested by the Technical Support Group (TSG). This homogeneity of data format will make interpretation easy.

c) Gaps and deficiencies in the Act and recommendations for modification

Point 1: Awareness and capacity building on groundwater resources: The main objective behind the aquifer mapping is to develop sustainable groundwater management plans for each aquifer through GWMA. Though this exercise may help know the groundwater availability in the specific aquifer for better groundwater management, we need to be very cautious about the hidden dangers in this process. The aquifer mapping is expected to develop the knowledge of the local communities about the aquifers and groundwater issues. In other words, by this exercise, communities will be literate about the source of groundwater stocks in their areas (Kale, 2013). The hidden danger in this process is how communities will apply and utilize this newly generated knowledge about the groundwater, which is a precious source now. Communities must be well aware through the behavioural change of the common property nature of groundwater to avoid the blind race of 'groundwater-mining' by resource-rich farmers.

Point 2: Remuneration or incentives 'Para-Hydrogeologist (PHGs)' or 'Jal Surakshakas': Though Para-Hydrogeologist is made, there is no mention of the provision remuneration or incentives to be given to this Para-Hydrologist. The experience shows that a lack of incentives or monitory benefits fails to keep practitioners motivated for a long time. Hence, for the successful implementation of this program, incentives are essential.

Point 3: Scale of the aquifer maps (1:50,000): The aquifer maps are to be generated at the scale of 1:50,000 (CGWB, 2012). This scale is particularly unsuitable for making a scientific and social intervention at a village level. Hence, with the advent of technology and the participation of academicians, individual researchers, and NGOs, attempts should be made to reduce the scale of the maps.

d) Additional Provisions and Measures required in NAQUIM

Point 1: Formation of Ground Water Management Associations (GWMA): Like the WUA, the members of the GWMA should belong to both the recharge and discharge regions of an aquifer. Also, similar to the provision of the Secretary of WUA, the Para-Hydrogeologist should be appointed for each GWMA. Besides, in the initial phases of the functioning of GWMA, they should be encouraged to be associated with an NGO for better technical guidance and participatory management. Also, there should be monitoring of the functioning of the GWMA, which should not only be restricted to the audit of GWMA if, like WUA, they are also empowered to collect groundwater charges. For evaluating the performance of the GWMA, like Composite Water Management Index developed by NITI Aayog for states. Various competitions can be organized to increase the competitive spirit of the GWMAs, and raise the cooperative spirit, and exposure visits can be organized to GWMAs, which are functioning successfully.

e) Concluding comment: NAQUIM is certainly a good move for identifying groundwater's dynamic nature through the delineation of aquifers. This data and knowledge can be used to manage supply and demand-side groundwater, design and implement managed aquifer recharge projects, and strengthen drinking water sources. However, this needs to be coupled with the spreading of groundwater and aquifer literacy in communities so that they apply this importation knowledge for the sustainable use of aquifers. Although at present, for the initial scale level, the scale is used very wide for delineation, it needs to be narrowed down significantly in the second round to make the rich knowledge of aquifers for local communities for actual groundwater planning.

4. Challenges Today, Threats for Tomorrow: Ways Forward

While presenting the detailed analysis of the selected policies and programs, this section points out the broader issues in terms of gaps, lacunas, and challenges in the overall water governance in Maharashtra. In the discussion, the focus has been pointed out broad challenges and gaps related to the normative concerns, and recommendations are made to address them.

4.1 Equity and co-benefits

Existing rules of access to and control over groundwater based on the common law doctrine are continued in the selected policies. This gives the landowners the right to take as much groundwater as they desire from wells dug on their land. Even the amount of water to be extracted does not legally depend on the area of land owned by the individual; any landowner can abstract any amount of water. Such a legal framework leads to indiscriminate access to groundwater and also implies that only the landowners own groundwater. Consequently, the landless, who constitute more than 30 % of the rural farm population in India, do not enjoy private ownership of groundwater or other water rights. This association between groundwater use and

land ownership is not delinked in selected policy measures and is further continued. Selected policies (mainly MGDMA-2009) largely rely on control and command mechanisms (a permit system). These reforms propose mandatory permits for sinking new wells and other groundwater uses from the State and restrictions on the depth of wells. Thus, these policies bestow the right to use groundwater on those who have already sunk a well, excluding others who have not benefited from groundwater resources. Therefore, although challenging, delinking groundwater rights from land rights is the necessary measure that puts the overall water resource in the domain of public trust in a true manner.

4.2 Participatory and inclusive governance

It is widely proposed that Hardin's 'tragedy of the common's and the 'collective-action' problems can be overcome through proper institutional and governance design. However, the capacity to overcome these problems appears limited when individuals have no expectation of mutual trust and no means of building trust. Participants lack the authority to create their self-governing institutions. Young rightly shared that there is no universally shared concept of 'community' (Young, 1986). Mostly the powerful in the community represent the community and become the channel for developmental programs. These people make every effort to strengthen or keep their group interests alive. It seems the structures of governing agencies in the selected policies and programs are also confined to such superficial understanding of the 'community.' Hence, it has less potential to achieve the policy or program goal. The representatives of resource-rich people, local political leaders, dummy members (for the namesake only), and the bureaucratisation of institutions and committees (more government officials at key positions) are key barriers to the existing and proposed institutions and committers in the selected policies and programs. This arrangement allows little space for the active participation of local people in the design and implementation of the project interventions. Hence, unless governance reforms are embedded in considerations of equity and justice, they cannot address the larger community's interest. These lacunas are clearly observed in the proposed composition of the Watershed Water Resource Committee (WWRC) under MGDMA 2009, Village-level Monitoring Committee (VMC) in the GDGS project, current membership on MWRRA, WUAs, and Village Climate Resilient Agriculture management Committee VCRMC in PoCRA. Unless we restructure the composition of these committees and lay down a more transparent process of selecting its members, the meaningful participation of local communities and their ownership of interventions (community as a whole) cannot be truly expected.

4.3 Mainstreaming gender in the water sector

On the issue of gender, provision is made for women's participation in governing institutions and committees in almost policies and programs. However, grouping women as a homogenous category for institutional participation is a fallacy that needs to be tackled. It is important to understand that women are not an abstract homogenous category and come with large differences across class, caste, and tribe in the Indian context. The gendering of identities and roles allows men to dominate decision-making processes and create social taboos and stigma barriers to women's

mobility and participation in public places. These and gender-based divisions of labour are key barriers to women's effective participation in water management. The findings of this review highlight that serious attention has to be paid while designing the policies and programs on water management. A gender-balanced team is necessary to incorporate concerns, views, and subjective perspectives of women members at different levels in the program. Hence, gender-equal outcomes will not materialise without appointing female staff and team members. In addition to involving women in sufficient numbers, fostering an environment of respecting and valuing their views and ideas with gender sensitivity is equally important. While selecting active women from the community as representatives on local water management committees, it is challenging to avoid dummy or proxy women representatives (with the power being exercised by men from their families). Due to village-level dynamics, project staff and teams face enormous difficulties and pressure. Finding and selecting active women from village self-help groups and organising special Gram Sabhas, which can select and nominate representatives of women from weaker sections, may be more useful strategies to ensure their true representation.

4.4 Capacity and knowledge building

Capacity and knowledge building is crucial at both level, members of responsible institutions and authorities, program/project personnel, and the larger community or specific target groups. The awareness, better clarity, development of skills and capacities, and appropriate and sufficient information and knowledge are essential factors for effectively performing the role and responsibilities of target groups and actors. This allows target populations to meet the expectations of policies and programs. It has been clearly seen that this area of policies and programs has received very low weightage in terms of devoted resources, and this s coupled with unclear procedures put in process. For example, we don't have an effective practice or system for promoting legal literacy at a larger level for the common audience. Hardly a few villagers and CBOs are well aware of the groundwater laws and MWRRA and GSDA and their few provisions and functions. Given this situation, how can one expect that they follow the law and do not violate it. On the other side, there is an urgent need to build the multidisciplinary skillset of functionaries in the water sector. Water management is a technical and engineering issue, but its social, economic, and governance dimensions need to be well acknowledged. We can see that largely the officials at these agencies are technically very sound. Still, behavioural change experts, economists and market experts, and agriculture scientists have a useful role in promoting better water management practices. Even though it is necessary to drop the beneficiary approach; it resulted in PoCRA, GDGS, Farm Pond schemes, and community needs to be put at the centre. Most importantly, villagers' and mainly irrigated farmers' approaches and perceptions have to be transformed by sensitizing them about the public property nature of water, the water budgeting practices, and collective actions for managing local water resources. These are process-oriented goals and require serious and continued efforts. Therefore, resource allocation (human resources) is essential. Considering this, the adoption and promotion of well-designed behavioural change communication (BCC) strategies need to be re-designed and seriously promoted,

which are the prerequisite for achieving the change in behavioural practices of water users.

4.5 Environmental and ecosystem sustainability and rapidly changing groundwater dynamics

Water access and use dynamics are changing rapidly, and many vital issues that highly affect the water resource, overall environment, and ecosystem are not addressed and considered in existing policies and programs.

4.5.1 Shift from dug wells to Farm ponds: Realizing the advantages of the farm pond strategy, the state and the central government are promoting it on a large scale through various schemes and subsidies. However, the overall ground-level picture of farm pond usage and practices is very dismal. There is a clear contradiction between the main objectives of the farm ponds mentioned in policies and how farmers are actually using these ponds. Although rainwater harvesting is one of the main objectives behind the farm pond strategy, it is almost impossible to find a functioning farm pond where rainwater is being harvested and stored. In fact, in direct contradiction to the purpose of building such ponds, most farm pond owners extract groundwater from dug wells and bore wells and then store it in the same farm ponds. Therefore, farm ponds have become the new way for groundwater extraction and increase the competition amongst farmers for further groundwater extraction, resulting in groundwater privatization by affecting nearby farmers' groundwater availability. Even at the administrative level, there is no guideline on sanctioning and constructing a number of farm ponds in the village. Even the practice of pumping large amounts of groundwater from shallow and deep aquifers may affect the water groundwater availability of neighbouring farmers and flows in streams and drains, creating another threat to the already diminishing ecosystem.

These dynamics in regard to farm pond practices are not considered and well addressed in the existing governance instruments. Farm ponds are not considered for registration, while provision is made to register all villages' water groundwater structures and sources. To effectively address the issue, specifically in semi-critical and overexploited zones, the extraction of groundwater to store it in farm ponds should be strictly prohibited. It should be mandatory for farm pond owners to store the rainwater or run-off in the farm ponds in such regions. At the same time, considering the overall sustainability of the water resource and the area's carrying capacity in any village or watershed area, the total number of farm ponds that can be constructed should be determined.

4.5.2 Dangers in Shirpur pattern not considered: Nala (stream) and river deepening, widening, and straightening - popularly known as Shirpur or Khanapurkar pattern- are rapidly implemented in many parts of Maharashtra, particularly in the Marathwada region. Considering its advantages to storing and recharging more rainwater quickly, many farmers and village leaders in almost villages are deeply interested in implementing this pattern. Simultaneously, there is a huge support and push from corporates and funding agenesis to implement this pattern, pushing many NGOs to implement these interventions. However, many experts have raised their

concerns about possible dangers in changing the overall hydro-geology of the surrounding area with these treatments. Here, the threat also affects judicious access to groundwater and ecosystems. In many study villages, these structures have made the huge canals of streams and Nalas. These interventions, which have the potential to highly affect the overall hydrogeology of the villages and watershed, are not addressed and understood in the selected policy instruments in the study. Hence, it is important that only after environmental (and specifically hydro-geological) assessment of interventions of Shirpur or Khanapurkar pattern decisions of such work should be taken in the proposed areas.

4.5.3 Basic principle of Ridge to Valley is neglected: IWMP, JSY, and GDGS are important programs of the state. However, mainly resulted in water augmentation or increased surface or 'visible water.' Although these programs have provisions for a number of soil and water harvesting structures and groundwater recharge treatments, the programs are mainly confined, benefiting the small patches of areas by ignoring the holistic watershed approach with a ridge to valley principle. This creates negative implications for the landscape; for example, as the upper catchments are not developed with adequate soil and water conservation, increasing soil erosion adds to silt deposition in downstream water bodies. And therefore, GDGS came into existence to desilt the downstream structures and applied this silt again in farmland. Therefore ridge to valley approach is a must for regenerating the watershed and sustainable and judicious use of water resources. Therefore schemes like GDGS, JYS, approach, farm ponds, Nala widening should be integrated with IWMI, with the sound package with scientific modification in them.

4.5.4 Changing economy: The rapidly changing political economy in the state is not truly addressed in existing water policies and programs. There are various burning political economy issues in the state, for example, more promotion for specific crops like sugarcane, grapes, and banana, speedily growing urbanisation, a tertiary sector highly contributing to GDP, and thus increasing water needs, flourishing water markets in terms of private tankers and packed water bottles, etc. With the growing rate of urbanisation, cities and towns will grow speedily. Considering this, cities will have to learn waste and sewage management by recycling and reusing every drop of the sewage they generate. This is very important because the polluted water of rivers adds to freshwater sources downstream and makes more freshwater unsafe.

Hence, today, the challenge is implementing watershed projects efficiently in a participatory, equitable, comprehensive, and integrated manner and achieving this by adopting a larger eco-systems approach that includes diversified livelihoods. This is necessary because human well-being today is critically dependent upon our ability to reduce the emission of greenhouse gases, build resilience, reduce risk, adapt to change, and reduce poverty. Regenerating, enhancing, conserving, and sustainably and equitably managing watersheds can significantly contribute to climate change mitigation, adaptation, and overall development goals. Putting these issues at the centre, the existing policies and programs need to be revisited to ensure that they meet the goal of sustainability and equity in the larger context of ecosystem integrity.

4.6 Crop selection and market link underestimated

Crop choices of farmers mainly get determined by the market. Market rates stimulate and, even at a certain level, pressure farmers to select high water-intensive crops with higher market value than less water-intensive crops. Different tools and strategies are proposed in existing policies and programs; for example, sustainable groundwater-use plans, water security plans, water budges, and prospective plans are supposed to motivate farmers to shift from high water-intensive crops to low water-intensive crops and achieve water-use efficiency. However, there is no provision for incentives for farmers and communities to adopt these strategies. Assurance of good market rates by state for rainfed crops and less water-intensive crops may change the farming community's overall water-use game. Still, this crop selection and the market link are not precisely reflected at the practical level in the existing water policies. Many experts have already proposed prioritising the procurement of crops that are water prudent, like millets as against rice, and introducing cereals and millets in public distribution systems and mid-day scheme for school children, and these needs to be seriously taken.

4.7 Delays in making operational rules of the Laws and Acts

Rules for the laws and acts are the prerequisite for their implementation on the ground. Therefore, only sanctioning policy instruments are not sufficient. The operative part, which includes rules, notifications, agreements, government resolutions, orders, and circulars, is equally important for the laws and policies. If an operative part is not in place, the policy instruments remain on paper. Thus, incomplete legal processes make regulation impossible which finally helps free-riders. In the absence of rules for the last 20 years and the non-issuance of basic notifications, MGDWA 1993, which is supposed to be the parent Act, has remained mostly on paper. Under Maharashtra Water Resources Regulatory Act, 2005 (MWRRA), Maharashtra established an Independent Regulatory Authority in the water sector (also State Groundwater Authority under MGDMA 2009). This is undoubtedly a pioneering effort, but the actual implementation of this Act is frustrating. MWRRA Rules were prepared seven years after its enactment, and that too only after an order by the High Court. In the case of MGDMA 2009, the rules for operation are not yet formed even after seven years of the inaction of the law, yet they are just in ‘draft’ mode. Therefore, rules for the selected policy instruments and required operational processes need to be laid down soon to make the policy instruments workable at the grass-root.

4.8 More focus is needed on demand-side measures for water management

Demand-side measures significantly reduce consumptive use of groundwater. These measures mainly cover tools of micro-irrigation and soil-health practices. Although there is a subsidy available for micro-irrigation from the state, farmers have less publicity and motivation to adopt practices that increase the soil health or the primary productivity of soil by increasing its soil content and moisture-holding capacity. The present review shows that most irrigated farmers are aware and willing to adopt micro-irrigation (drips and sprinklers). However, due to delays in receiving subsidies and the current mechanism of investing 100% amount at a time, farmers are discouraged from going for micro-irrigation. Hence, an urgent step to improving

the subsidy delivery mechanism for micro-irrigation is required; low-cost (non-ISI) drip systems must be subsidized and promoted. However, care has to be taken at the regulatory level that the application of micro-irrigation by farmers in real sense results in a 'saving' amount of water which can be further used in scarcity period or transferred to other users. The larger observations are that farmers who save water by applying micro irrigations expand their own area under irrigation to utilize the saved water. Hence, in practice, water is not saved, and only it gets used inefficiently. Therefore, all measures have to be taken to achieve 'saving water' and its efficient use. Thus, there are enough opportunities and an urgent need to make the micro-irrigation schemes effective and responsive.

4.9 Promoting conjunctive use of surface and groundwater

At the level of administrative governance, for decades, planning and management of surface water and groundwater resources have been treated separately. However, there is an inseparable link between both of them. Mihir Shah has rightly noted this situation as 'hydro-schizophrenia' in the water sector, where the right hand of surface water does not know what the left hand of groundwater is doing (M. Shah & Vijayshankar, 2022). For decades, participatory watershed development programs, particularly with a ridge-to-valley approach, have delivered increasing surface and groundwater resources, which benefited larger groups in farming communities. However, the ridge to valley principle will be bypassed in a few years, and soil and water conservation activities will be implemented in isolation. The government has come up with different major schemes and activities, such as farm ponds, Jalyukt Shivar, River and Nala deepening, and others, and separate governing agencies manage these tasks. Unfortunately, there is no integration of these interventions. All these interventions increase only visible water, i.e., surface water, and contribute less to recharging groundwater. Hence, integration and synergy at different levels are much required in surface and groundwater management, bringing governing agencies and their interventions complementary.

4.10 Need for extensive piloting of proposed strategies in laws and acts

Water-related challenges in the state provide diverse living laboratories to pilot different policy strategies and test their practical utility. Before proposing any important measures at a large scale, it must get well piloted at an adequate scale to understand its potential in practical implementation. Many strategies and provisions may be ideal but practically not implementable. Different key policy strategies proposed in selected policy instruments, such as aquifer management, groundwater-based prospective crop plans, restrictions on the depth of wells, formation of WWRC, etc., need to be extensively piloted on a large scale in a controlled manner. This will provide gain lessons about its technical feasibility and socio-institutional effectiveness. Even the complex environment and regional variation within groundwater management hinder ideal models' development. Hence pilots must get implemented in different agro-climatic settings. This piloting type is important because villagers mostly learn through 'doing by seeing.' People get motivated and convinced to adopt it only after successful models or villages. Hence, extensive piloting of lead policy remedies is a prerequisite for its effective application on a larger scale.

4.11 Need to apply a multi-sectoral approach

Because water serves different important purposes, it is essential to address linkages with other sectoral policies and programs on agricultural practices, market, energy, fertilizer industry, soil health, industrial development, water transport to cities, and technologies that have a large impact on groundwater resource use. Thus, water governance essentially goes far beyond water-resource itself. Groundwater-specific management goals must look beyond straightjacket regulatory mechanisms and develop alternative niches in livelihoods, energy use, and opportunities offered under adaptation and coping strategies that focus on events such as droughts, floods, economic drivers, and climate change. Therefore, there is a need to integrate science, technology, sociology, economics, and different sectors where there is a link to groundwater. This is necessary because, in isolation, targeting regulations on water use for agriculture will not serve the purpose of reducing groundwater extraction. Unfortunately, such an integrated multi-sectoral approach is lacking in overall water governance.

4.12 Concluding statement

Undoubtedly, the governance of water resources, mainly groundwater resources, in many aspects, is a challenging endeavor. This is primarily challenging because of its unseen or invisible nature, and as being a common pool resource, there is increasing competition to tap it. Along with its hidden nature and below-ground features, it is superimposed by a complex web of above-ground socioeconomic and governance factors that determine the dynamics of groundwater extraction. These dynamics have created anarchy in the groundwater sector; efforts are needed at different levels to avoid this. However, priority is required to make the existing policy and programs appropriate, adequate, and practically feasible, addressing the key normative concerns of equity, gender, participation, ecosystems, sustainable incomes, climate change, etc. In addition, in layman's language, water users and mainly groundwater-using farmers need to be well informed about the groundwater science, crop-water requirements, and policy issues.

More importantly, there is a need to adopt the multi-sectoral approach for governing the water resource by taking appropriate measures in each related sector linked to water. Harmony and dialogue between actors and stakeholders at different levels, from policy makers to practitioners (water users), is much required. For this purpose, water policy and governance call for a true multi-disciplinarily nature where science, technology, and sociology come together to find solutions. The policy-making process in the water sector needs me to be more participatory and accountable, not just by asking for comments to revise but by engaging stakeholders during the policy formulation phase. This set of policies must be thoroughly piloted before proposing on a large scale. Therefore, adequate space in the policy environment needs to be created to hear the policy critic, analysis, and recommendations on relevant issues. Unless today we challenge the burning issues, changing dynamics, and failure of policy and program in appropriate spaces and make conscious efforts to rectify them, we cannot see a realistic tenable tomorrow in the governance of precarious water resources in Maharashtra.

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