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# Measuring social and natural capital generated through Jal Shakti

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# Executive summary

With Hon'able Prime Minister Shri Narendra Modi's 'Vision for New India' acknowledging the need for sustainable use of water as one of the key dimensions, efficient management of water resources has become a top priority. The government of India, businesses and non-governmental organisations (NGOs)/non-profit organisations (NPOs) have been collaborating to develop and implement water resource rejuvenation programmes, thereby transforming the socio-economic and ecological conditions of the country. Thus, to thoroughly assess the effectiveness or overall impact of these programmes, it is crucial to account for the social and natural capital generated through them.

In this paper, Grant Thornton India LLP focuses on the frameworks for measuring these social and natural capital while also discussing the major rejuvenation initiatives and evaluation methods currently used. The paper aims to support the newly formed Ministry of Jal Shakti, businesses and NPOs determined to generate a rounded positive impact while working towards growing the water wealth across the country.

This paper also provides insights through various case studies and deliberates on quantifying the generated social and natural capital for better evaluations. Additionally, it talks about capturing the created social and natural capital using transformative technologies like artificial intelligence (AI) and Internet of Things (IoT), which are highly efficient and effective.

# Foreword from Grant Thornton

Water resource rejuvenation initiatives have created an impact even beyond the envisioned outcomes in the form of social and natural capital generated for the respective stakeholders.

As India aims to develop itself into a USD 5 trillion economy by 2024, sustainable use of resources becomes paramount. Water is one of the most crucial and stressed resources in our country, not due to its scarcity but rather its mismanagement amidst burgeoning demand. Furthermore, the fact that India is primarily an agrarian economy underscores the criticality of water resource rejuvenation.

The government of India, taking cognisance of the situation, has set up the Jal Shakti Ministry to streamline water management with a data- and impact-oriented approach. River rejuvenation (National Mission for Clean Ganga [NMCG]), irrigation management (Pradhan Mantri Krishi Sinchayee Yojana [PMKSY]) and groundwater recharge (Atal Bhujal Yojana [ABHY]) have been amongst the vital rejuvenation areas of policymaking and programme interventions by the government, corporates and NGOs. These initiatives have created an impact even beyond the envisioned outcomes in the form of social and natural capital generated for the respective stakeholders. Consequently, measuring these social and natural impacts becomes imperative to judging the overall success of these programmes in the holistic development of the critical beneficiaries, that is, the ecology and the community of the region.

In this paper, Grant Thornton in India aims to highlight the criticality of rejuvenating water resources and explore the best practices adopted around the world and how social and natural capital can be measured and thus inculcated into the initiatives itself. We intend to leverage our experience in sustainability to propose all-encompassing assessment frameworks for a more robust and comprehensive knowledge of on-the-ground impact.

**Vikesh Mehta**
**Partner**
**Grant Thornton India LLP**

# Water resources and programmes

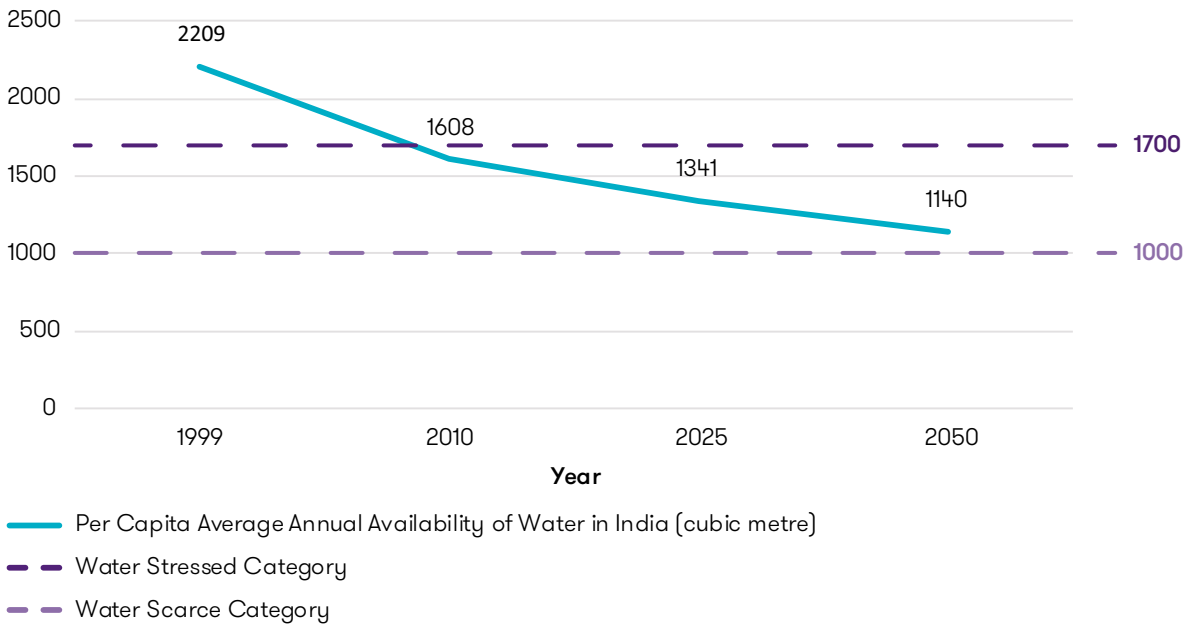
# Current status of water resources and programmes

India has 2.45% of the world's landmass supporting 16% of the world's population, whereas the freshwater resources are only 4% of that of the world.

The global per capita average annual availability of water is 5,932 cubic metre as per World Bank's 2014 statistics.

On the other hand, India, which had per capita availability of 5,177 cubic metres in 1951, slipped into the 'water stress' category in the late 2000s.

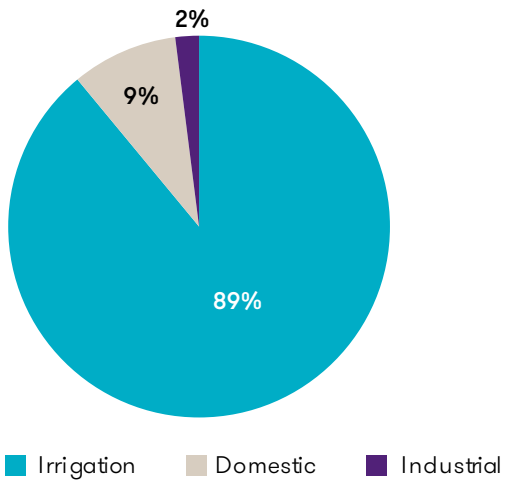
**Per capita average annual availability of water in India (cubic metre) [1]**




These statistics resemble the estimates by the Central Water Commission (CWC) as per statistics from 2000 and 2010. However, a recent report from NITI Aayog titled 'Composite Water Management Index' shows resources to be in a more critical state with a stark difference in supply-demand projections for 2030. It highlights that the overall demand is expected to exceed supply twofolds by 2030. Additionally, World Bank indicates that India's per capita water availability may shrink to half, which would push the country into a 'water-scarce' category by 2030.

1. Ministry of Water Resources, River Development and Ganga Rejuvenation, and Central Water Commission - Water-Related Statistics, 2015

**Sector-wise groundwater demand**




Source – Ministry of Water Resources, River Development and Ganga Rejuvenation

Groundwater demand for irrigation has also escalated significantly, as over 50% Indians are dependent on agriculture, with most of the water resources being utilised for irrigation. Efficient irrigation practices are significant drivers for better groundwater management and, therefore, in addition to policy changes, technological interventions to monitor and control are required.

# Impact of water scarcity

## On economy

World Bank cautioned the Indian government in 2016 saying that countries that lack a sufficient amount of water could see their GDPs decline by as much as 6% by 2050.[1]

## On agriculture

Lack of availability of water has hindered farmers from managing the cycles of their crops. Low reservoir levels are delaying planting of pulses, cotton, paddy and millets in western and central states. This has impacted the livelihood of sharecroppers and farm labourers and affected India's food security as well.

## On industrial sector

Industrial houses are stopping production in water-scarce regions as the nature of risk heightens in different socio-economic and geographical settings. Sectors like textiles, food and beverages, paper mills, cold storage, and ice production are likely to suffer more.

## On shortage of drinking water

As per a NITI Aayog's report, 40% of the population will have no access to drinking water by 2030. [1] According to UN-endorsed estimates, Bengaluru is "most likely to be the first Indian urban settlement that will run out of drinking water." [2]

1. NITI Aayog Composite Water Management Index
2. https://www.financialexpress.com/india-news/bengaluru-alert-why-indias-it-capital-may-face-cape-town-fate-leaving-millions-without-drinking-water/1065856/

# Key policies and initiatives

## 1. National Water Policy (NWP)

- The objective of the NWP is to take cognisance of the existing situation, propose a framework for creation of a system of laws and institutions, and come up with a plan of action with a unified national perspective.
- The basic principles to achieve this will include planning, development and management of water resources. These are to be governed from a common integrated perspective considering local, regional, state and national context, with an environmentally sound outlook, keeping in view the human, social and economic needs.

## 2. Namami Gange Programme

- The programme is being implemented by the NMCG and State Program Management Groups (SPMGs).
- It is about cleaning up river Ganga by focusing on 'aviraldhara' (uninterrupted flow), 'nirmaldhara' (clean flow) and ensuring ecological and geological integrity.

For this, the following steps are being undertaken:

- Ensuring ecological rejuvenation by conservation of aquatic life and biodiversity
- Promotion of tourism and shipping in a rational and sustainable manner
- Knowledge management on Ganga through Ganga Knowledge Centre

## 3. National Water Informatics Centre (NWIC)

- It is a repository of nation-wide water resources which and provides latest and reliable data (other than classified data) through web-based India Water Resources Information System (India-WRIS) on a GIS platform in the public domain.
- NWIC is a component of the National Hydrology Project (NHP) and is in consonance with the National Water Mission which aims to "conserve water, minimise wastage, and ensure more equitable distribution through integrated water resources development and management."

Sources: (http://jalshakti-dowr.gov.in/sites/default/files/NWP2012Eng6495132651_1.pdf)
(https://nmcg.nic.in/NamamiGanga.aspx)
(http://mowr.gov.in/schemes-projects-programmes/schemes/national-hydrology-project)

# 4. PMKSY (Pradhan Mantri Krishi Sichai Yojana)

The aims of the PMKSY scheme are as follows:

- Achieve convergence of investments in irrigation at the field level
- Enhance recharge of aquifers and introduce sustainable water-conservation practices
- Explore the feasibility of reusing treated municipal waste water for peri-urban agriculture
- Attract greater private investments in irrigation
- Promote extension activities related to water harvesting, water management and crop alignment for farmers and grass-root-level field functionaries
- PMKSY has been formulated keeping in mind the following ongoing schemes:
  1. Accelerated Irrigation Benefit Programme (AIBP)
  2. PMKSY Per Drop More Crop
  3. Integrated Watershed Management Programme (IWMP)
  4. Har Khet Ko Pani (HKKP) and Command Area Development (CAD)

Source - (http://jalshakti-dowr.gov.in/sites/default/files/PMKSY-Guidelines_0.pdf)

# Current monitoring and evaluation framework

The need for a monitoring system has been recognised to observe a programme's effectiveness and delivery mechanisms on both a continuous and a disaggregated basis. The main aim is to capture the progress in achieving objectives and deviations, and provide learnings and a framework for better decision making, thereby documenting the processes and results.

Keeping the above factors in mind, the government has acknowledged the need to have an external, independent agency to sanitise the system of any bias for the task.

The series of processes that are currently followed are as follows:

### Baseline study

Establish the benchmark for assessing the impact of project interventions

### Concurrent process monitoring

Collect the field data for different indicators at the project level and present the observations in the periodic process monitoring reports

### Input-output monitoring

Generate periodic input-output monitoring reports with the analysis of MIS data

### Pathway analysis

Use both process and input-output monitoring (MIS based), carry out pathway analysis, and specify and analyse the key aspects emerging over time

### Impact evaluation

Undertake an impact assessment to establish the net impact of the programme in terms of identified indicators at different time frames

### Feedback and dissemination mechanism

Regular feedback and dissemination mechanism for learning and course correction

### Documentation

Documentary evidence of programme processes through good quality photographs, videos, slide shows, brochures, case studies/success stories, thematic studies and all evaluation reports

Source: https://dolr.gov.in/sites/default/files/Model%20M%26E%20ToR%20%28ext.%20agency%20at%20SLNA%29.pdf

# Why measuring social and natural capital is important?

Water resources are linked to social and natural factors that govern us. Therefore, incorporating them into project analysis provides a much more comprehensive and broader insight into the positive impact generated.

## Social capital

### Health

The quantity and diversity of pollutants reaching freshwater systems have increased manifold, thus resulting in severe health conditions. Close to 2,00,000 people die each year because of polluted water.[1] Annually, about 37.7 million Indians are affected by waterborne diseases, 1.5 million children die of diarrhoea, and 73 million working days are lost leading to an economic burden of USD 600 million a year.[2]

### Gender

Women and girls are responsible for water collection in seven out of ten households in 45 developing countries, including India.[3] Across the world, this time accounts for a total of 200 million hours or more than 22,800 years every day.[4] One report also reveals that almost 23% of the girls in India drop out of school on reaching puberty due to a lack of water and sanitation facilities.[5]

### Livelihood and migration

The agriculture sector employs over 50% of the total workforce in India. Thus, water scarcity affects the job opportunities and subsequently leads to migration and even consequences as adverse as deaths.[6] Suicides of nearly 60,000 farmers have been linked to climate change in India.[7] Additionally, lack of water security has forced people to migrate to other areas, putting stress on those destinations.

### Education

The health of students directly affects their attendance in schools. With 31% schools lacking safe access to water and sanitation in schools, one out of four girls and one in seven boys do not complete primary school.[8] If for instance in India, water and toilets were accessible to even 1% more girls in secondary schools, the country's GDP would rise by more than USD 5 billion.[9]

### Conflict and social divide

Water scarcity leads to disagreements on the use of available water resources like ponds, lakes, reservoirs, rivers and even oceans, from a local level to national and international levels. Also, the economic and social divide has affected the weaker section's access to water. The marginalised have to pay for water, sometimes 10 to 20 times more than their wealthier neighbours. Water trading and supply by tankers have become a costly yet well-established practice in rural India.[10]

1. https://www.indiawaterportal.org/articles/when-water-kills
2. https://in.reuters.com/article/india-water-crisis/indias-worst-water-crisis-in-history-leaves-millions-thirsty-idINKBN1JV23W
3. WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation "2015 Report and MDG Assessment" Available from http://www.wssinfo.org/
4. https://www.unicef.org/media/media_92690.html
5. https://www.downtoearth.org.in/blog/health/23-girls-drop-out-of-school-on-reaching-puberty-5949
6. https://www.financialexpress.com/budget/india-economic-survey-2018-for-farmers-agriculture-gdp-msp/1034266/
7. https://www.theguardian.com/environment/2017/jul/31/suicides-of-nearly-60000-indian-farmers-linked-to-climate-change-study-claims
8. https://www.financialexpress.com/budget/india-economic-survey-2018-for-farmers-agriculture-gdp-msp/1034266/
9. https://www.theguardian.com/environment/2017/jul/31/suicides-of-nearly-60000-indian-farmers-linked-to-climate-change-study-claims
10. https://www.wsp.org/sites/wsp/files/publications/2122007110846_whopaystheprice.pdf

## Environmental capital

An increasing number of water bodies are disappearing from the urban and rural landscapes due to uncontrolled urbanisation and their misuse. This has led to a reduced forest cover, mixing of wastewater, and overuse of groundwater, which have disturbed the flora and fauna.

In addition to that, land degradation and erosion have become more prominent in water-scarce regions, and have affected the cropping pattern too.

As a result, climate change adaptation, disaster mitigation (drought/flood) and revival of traditional knowledge on ecological/environmental management are of paramount importance.

# Case studies

# 1. Addressing water salinity - Ambuja Cement Foundation (ACF)

Despite having access to reasonably extensive aquifers, the coastal regions of India face a risk of saline water intrusion, rendering their water unusable without treatment. ACF observed that salinity had seeped inland in the Gujarat coastline and the total dissolved solids (TDS) limit was found to be as high as 4000 mg/litre for certain sea coast villages. The situation worsened owing to the intensive agricultural patterns in the area and the overexploitation of groundwater. As a result, the local community in Kodinar had no potable water available, and agrarian yield was adversely hit, impacting the primary source of community livelihood.

Since this issue of coastal salinity was a natural phenomenon, traditional knowledge acquired by the community over the years was used through the following initiatives:

- **Surface water harvesting structure:** Construction of check dams, revival of traditional water bodies, farm ponds, pond deepening and interlinking canals
- **Groundwater recharge:** Construction of nala bunds, farm ponds, percolation wells, and tube well recharge
- **In situ moisture conservation:** Drainage line treatment, nala plugs, etc.
- **Creating water reservoirs from mined out pits:** These pits were a low-cost sustainable solution for storage of rainwater

## Outcome

- 16,575 wells from 151 villages benefitted
- 66 km diversion canal network for interlinking rivers and reservoirs built
- 37 MCM of water storage capacity created

## Impact

- Saved two to seven women hours that were spent on fetching water per day
- Improvement in the community's cohesion and health
- Reduced cases of water-borne diseases and kidney stones
- Reduced TDS level with a range of 500-5000 PPM
- Increased water table with a range of 2-12 metres

**Calculation of social return on investment was carried out through an independent study. The programme was reported to deliver a 13-time social return on investment.**

Source – SAMHITA (Making the case for corporate action in water)

# 2. Integrated community development through watershed management - Larsen & Toubro (L&T)

In 2015, L&T decided to strengthen livelihoods in rural communities affected by drought. It chose to focus on water-scarce areas of the Rajsmand district in Rajasthan, Ahmednagar district in Maharashtra and Coimbatore district in Tamil Nadu.

The project areas had experienced a protracted drought-like situation for three years. The surface water structures had dried up, and the groundwater table was low and dipping rapidly.

The programme designed in each area was customised to meet its needs but contained some standard best practices like constituting Village Development Committees (VDCs) for community participation and management, and sustenance of water conservation structures.

The focus was on repairing and creating watershed structures in villages (anicuts, contour trenches, bunds, etc.) with L&T's engineers overseeing the design and construction, and initiating training on farming methods.

## Outcome

- Groundwater table levels rose more than 1 metre across the project area for all project locations

## Impact

- The proportion of the population engaged in farming rose to at least 50% in three clusters
- Crop production increased for 40%-60% of the farmers
- Family incomes rose by 33% and 50% in two out of five clusters

**L&T commissioned two types of evaluations – one to measure the technical outcomes (groundwater table levels, soil moisture and crop productivity) and another to assess the socio-economic outcomes of the integrated approach (impact on the quality of life, reducing drudgery, monitoring indicators of women empowerment, etc.).**

Source – SAMHITA (Making the case for corporate action in water)

# 3. Watershed rejuvenation - Project Bhujal

The Bundelkhand region of central India is the hotspot of water scarcity. Degraded lands, poverty, along with inefficient institutional structures for health and education have worsened the situation. This led to a poor socio-economic condition of people in the whole region. The region of intervention – Parasai Sindh watershed of Jhansi district – has three villages and covers nearly 1,250 hectares of land.

Project Bhujal aimed at the successful implementation of watershed interventions in this area by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) along with the local community from 2012. Some of the significant steps undertaken were construction of six check dams and 15 farm ponds, renovation of 60 existing structures, recharging of 100 wells, along with contouring in eight locations.

## Outcome

- Storage capacity of 100 million litres of water created
- Cropping intensity increased up to 30%
- Significant increase in groundwater recorded up to two to five meters

## Impact

- 100 acres of land made cultivable
- Extra source of income of about INR 20,000 per acre for the farmers
- Employment generated from within the community
- Benchmarks for future interventions set

**A regular public interaction platform was developed in which there was equal representation of women, men and all the stakeholder groups. This allowed for discussions and suggestions, and gave a fair and transparent evaluation of the intervention.**

Source - Selected best practices in water management, August 2017 - NITI Aayog

# 4. Groundwater injection well - Bhungroo

Bhungroo is a water-management system that was aimed at injecting and storing excess rainfall water underground so that it is usable for irrigation during summers. Through this practice, artificial recharging of aquifers by adding rainwater to underground water reservoirs was carried out. The non-saline rainwater when mixed with the underground saline water brought down the salinity of the groundwater.

Farmers were trained in the installation of bhungroos. Design and estimation were done under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). Installation of one unit was done with sub-surface storage at three levels between 25 and 110 feet with a total capacity of 2 crore litres. Additionally, a piezometer was installed for water level monitoring on a daily basis.

## Outcome

- Reduced dependence on rain-fed agriculture
- Enabled farming for more than half of the year
- Groundwater became fit for agricultural use
- Enabled people to lift and use the stored water during dry spells
- A 10-day harvest supplied water for seven months

## Impact

- Underprivileged female farmers were uplifted and empowered
- Women were made chief owners and experts of the practice
- Sustainable livelihoods was provided to more than 18,000 marginal farmers
- Food security was provided for over 96,000 families supported

**Sites for intervention were identified by the Gram Panchayat through resistivity surveys by the groundwater department and geologists from DWMA (District Water Management Agency) for the purpose of setting up of bhungroos. The pilot project was carried out in Gujarat with user groups.**

Source - Selected best practices in water management, August 2017 - NITI Aayog

# 5. Groundwater management - Randullabad Village

Randullabad is a progressive village in western Maharashtra which is dependent on groundwater for fulfilling all its water requirements. Due to a gradual decrease in the groundwater level, a detailed plan of water management was formulated.

A detailed hydrogeological study was conducted by the Advanced Centre for Water Resources Development and Management (ACWADAM). A monitoring network, which included an automatic weather station, 'V-notch' for monitoring runoff and water quality, was set up in the village. The monitoring of these parameters was done for three years. Based on the data collected, aquifers were delineated, and the storage and transmission capacity of the aquifers was assessed. Locations for recharge augmentation and construction of check dams and recharge structures were also identified.

## Outcome

- Equitable, efficient and sustainable use of groundwater was started
- A complete ban on borewell drilling from the past 18 years
- Village no longer requires water tankers
- Use of sprinklers up by 60%, improving irrigation

## Impact

- Developed a water balance in two years
- No water-intensive crops like sugarcane or banana are grown
- Increase in allied activities like dairy and horticulture
- The entire horticulture is under drip irrigation
- Significant improvement in the income of farmers

**Many training and sensitisation activities were carried out for generating awareness about groundwater management and other water-related issues. The community was actively involved in the whole monitoring process.**

Source - Best Practices of Ground Water Harvesting in Different Parts of India- MoWR, RD & GR

# 6. Restoration of water table – Tarun Bharat Sangh (TBS)

In Rajasthan, most of the population lives in rural areas and is highly dependent on agriculture and livestock for their livelihood. There were 48 drought years of varied intensity in the state between 1901 and 2002. This has increased the chances of a meteorological drought happening in the state by 47%.

TBS constructed several rainwater-harvesting systems with more concentration in the districts of Alwar, Karouli and Tijara. These structures have different nomenclature, viz., Johris, Johads, Bandhs, Anicuts, etc., depending on the size, material used for the construction, location and purpose. These structures are made in the form of either ponds or bigger storages such as talabs. Infiltration of this water and seepage through subsurface flow led to the recharge of open wells and thus an improvement in the availability of water.

## Outcome

- Increase in the water table of the region
- Brought water back to 1,000 drought-hit villages
- Revived five rivers which had gone dry
- Significant rise in water in existing open wells
- Increase in the base flow in the streams of rivulets

## Impact

- Culture of growing trees revived within the community
- Increased forest cover by 33% in the regions
- Increase in the yields up to 50% with additional area brought under cultivation
- Enhanced and more intensive animal husbandry livestock patterns
- More income generated from the sale of increased produce
- Water bodies have abundant aquatic fauna
- Efforts brought back antelopes and leopards in the area

**Semi-structured interviews using a flexible interview guide were conducted with various households to assess the level of income and livelihoods improvement, taking into account the support provided by TBS. Focused group discussions were also held to monitor, evaluate, increase awareness and promote better decision making.**

Source - Flow – River Rejuvenation in India - Impact of Tarun Bharat Sangh's work

# 7. Water conservation for food security - Bhagirath Krishhak Abhiyan

Overexploitation of soil has led to a loss in productivity and production, and complete crop failure in some areas. Dewas district of Malwa plateau of Madhya Pradesh is one such region which was facing acute water scarcity problems. With the production and productivity significantly going down in the area, the district administration led by Umakant Umrao stressed harvesting rainwater as the only solution.

Farmers were persuaded to change the usage of 1/10th of their land to 1/15th for a water conservation-cum-harvesting structure which could store runoff water during the monsoons and thereby ensure the availability of required water for irrigation during the rabi season.

Decentralised rainwater harvesting structures, along with wells and borewells, were constructed on the lands of farmers to promote optimum use of available water for sustainable growth. This approach to water harvesting was called Rewa Sagar.

## Outcome

- Increase in the number of ponds to 6,000 in Dewas district alone
- Significant increase in the water level
- Agricultural intensity and productivity increased significantly
- Agriculture diversified, and farming systems improved
- Farmers have shifted to multi-cropping

## Impact

- Multiple livelihood options and increase in employment days
- Women now contribute to the family's growth
- Improvement in the enrolment ratio in schools
- Improved biodiversity with flocks of deer, blackbuck, and several species of birds, insects, reptiles and flora showing presence
- Completely mitigated drought in case of a monsoon failure
- Changed microclimate to tackle climate extremities

**The administration locally managed rainwater harvesting structures and conducted surveys to analyse the impact of the project.**

Source – Five years of UN-Water "Water for Life" Awards 2011-15

# 8. Lake Naivasha payment for ecosystem services project - Kenya

Lake Naivasha basin suffers heavy soil sedimentation within the Malewa river, which is a significant cause of massive eutrophication in the lake downstream. The situation was so grave that there were fears that if no urgent remedial action was taken, the lake ecosystem would collapse in the next 10 years.

The World Wide Fund for Nature (WWF-Kenya country office) in partnership with CARE-Kenya piloted a Payment for Ecosystem Services (PES) scheme where downstream communities which benefit from upstream conservation initiatives reward land owners settled upstream for voluntarily undertaking conservation measures that reduce silt load in rivers. This was done to ensure the availability of clean water downstream.

Conservation efforts upstream include rehabilitation and maintenance of riparian zones, establishment of grass strips and terracing along steep slopes, reduction of agro-chemical use and indigenous trees and high yielding fruit trees, and cover crops for improved farm productivity.

## Outcome

- Riverbanks are now protected
- Reduced wastage and improved productivity in the farms
- Improvement in the quality and quantity of water flowing downstream

## Impact

- New knowledge and skills from training improved farm practices
- 20%-40% increase in sales of the benefiting farmers
- Reduced time spent by women in search of fodder
- Women now invest more time on farm work, business and childcare

**The upstream land managers/owners, who are small scale farmers, are therefore the sellers of the environmental service (ES), while the downstream water users are service buyers and consist of economic entities like flower farms, tourist establishments and government-related institutions. WWF-Kenya with CARE-Kenya overlooked the dialogue and transactions between the two through farmer group discussions.**

Source – Five years of UN-Water "Water for Life" Awards 2011-15

# 9. NEWater project - Singapore

In 1965, Singapore's riverways and canals resembled open sewers. The city-state was almost entirely reliant on outside water sources. Most of the population lacked a clean water source and sanitation. The project initiated by Singapore's national water agency PUB aimed to ensure sustainable water supply to support Singapore's economic growth.

Called the 'Four Taps' programme, the initiative comprised an expansion of water catchment areas, importing water from Johor in Malaysia, the Sing Spring desalination plant and NEWater.

NEWater is a highly advanced water recycling programme which involves putting treated used water through dual-membrane (microfiltration and reverse osmosis) and ultraviolet technologies. A water-efficient building programme was also carried out that provided guidelines for construction to ensure taps and even washing machines are efficient.

## Outcome

- Replaced the use of potable water for the industry with NEWater
- NEWater now meets about 40% of Singapore's water needs
- During dry months, reservoirs are topped up with NEWater
- Limited use of land for water storage as water is recycled continuously

## Impact

- NEWater has helped Singapore achieve its water sustainability goal
- Guaranteed high quality; very reliable water supply
- Made Singapore attractive to water-intensive businesses as well
- Employment opportunities were also significantly increased

**Twice a year, NEWater undergoes rigorous audit processes by an external audit panel comprising international experts in engineering, water chemistry, toxicology and microbiology. The PUB did impact studies in the local environment.**

**Public outreach programmes on water are also conducted on different levels from pre-school to university level.**

Source – Five years of UN-Water "Water for Life" Awards 2011-15

# 10. Efficient irrigation using real-time soil monitors and an Agricultural Innovation Platform (AIP) - Southern Africa

Small-scale communal irrigation schemes in Africa have not realised returns on investment. They are often under-performing and characterised by poor market integration, low capacity to invest in crop production, low yields, difficulties paying for water, or lack of willingness to participate in system maintenance. The result is unsustainable utilisation of resources, failed infrastructure, inefficient use of water and land, and increased conflict over access to these resources.

Therefore, to bring about an overhaul, smart water management (SWM) technologies were used. This included monitoring soil moisture and nutrients and facilitating farmer learning about irrigation water management to increase yield. These technologies are sophisticated but simple to use to support a farmer-centred learning system. Additionally, agricultural innovation platforms (AIPs) were developed for bringing key stakeholders together to develop solutions to turn increased yield into increased profitability.

## Outcome

- Time saved due to reduced irrigation frequency
- Increased supply and less consumption of water
- Significant increase in crop yield

## Impact

- Improved reliability during the scarcity period
- Increased willingness to engage in collective action
- Reduction in conflicts between irrigators and households
- Increase in income of the farmers

**The AIP identified solutions to support ongoing learning, problem-solving and impact assessment. The AIP facilitation ensures that the information generated by the tools is used to develop a deeper understanding which allows farmers to make more informed decisions about water and nutrient management, and engage in farm-level experimentation.**

Source – Smart Water Management, International Water Resources Association

# 11. Real-time rainwater collection and monitoring for household stormwater management – Stormwater Smart Grid – Canada

Cities around the world are committing to sustainable stormwater management by increasing permeable surfaces through water-sensitive urban designs or investing in stormwater harvesting to collect and retain large volumes of stormwater. Property-based rain harvesting faces the same problem as land-based infiltration systems - of ensuring that there is sufficient reserve capacity to reduce stormwater overflow when the system is already storing water from a previous rain shower.

To address the issue, the RainGrid Stormwater Smartgrid in Canada was developed to apply real-time weather AI management and IoT automation to passive residential-scale stormwater cisterns. AI will determine how much water will fall from household roofs given the predicted rainfall and rooftop area, while the IoT-automated cistern captures, filters and stores it in a suitably-sized cistern.

## Outcome

- Availability of recycled water for use in the household
- Timed discharge into the sewerage system, employing electrically actuated valves controlled by IoT

## Impact

- Greater groundwater recharge
- Able to gauge consumer behaviour regarding potable water demand offset
- Able to determine potential flood and drought conditions in real time
- Data insight into community-based rainfall patterns
- Increased access to carbon-neutral water for environmental and domestic use

**Stormwater smartgrid operational data dashboard, specific to each property, visualises the AI micro-climate rainfall data. The on-board sensors calculate temperature, barometric pressure, and rooftop run-off retained in the cistern. These will help in further real-time monitoring for more efficient water resource management.**

Source – Smart Water Management, International Water Resources Association

# Future course of action

Measuring the social and natural impact of water rejuvenation programmes has been predominantly driven through extensive on-ground data collected from targeted beneficiaries using in-depth individual interviews, focused group discussions, community workshops and historical timeline analysis. These require numerous field visits and large sample size, which limit capturing the nature and distribution of the generated capital, thereby affecting the cost and time efficiency, and learnings of the programme, too. Further, these impacts do not have a market value which inhibits comparison and affects decision making. These limitations thus call for a better framework of impact assessment, better approaches to data collation, and better ideas for water resource management.

# 1. Quantifying impact for better assessments

Quantitatively evaluating an impact would lead to greater awareness, appropriate decision making and comprehensive comparative assessment over the course of the project, thus resulting in consequent modification of the programme model and strategies.

Assigning proxies to be used as metrics for impacts by consulting all major elements in the complex natural and social systems would help in incorporating externalities while reporting. This further helps to establish or discover a market price for the identified capital if not already available, and creates a more robust and strategic accounting for the generated social and natural capital. Further, this helps in envisioning long-term sustainable value creation within the project, enhanced risk management, and identification of new opportunities and more focused targets.

Below are the approaches that provide a framework for natural and social capital accounting and bring data and values together to help make informed decisions.

1.1. **Social return on investment (SROI)** is a principle-based method for measuring social value related to the resources invested. It can be used to evaluate the impact of a particular project or organisation on stakeholders and identify ways to improve performance and activities that are most effective.

1.2. **Traditional cost-benefit analysis (CBA)** can be used to calculate the relative value generated by a project where details of direct financial impacts can be estimated.

1.3. **London Benchmarking Group (LBG) model** is a standard model for measuring and benchmarking community investment that allows organisations to measure their overall contribution to the community, taking account of cash, time and in-kind donations, as well as management costs.

1.4. **Ecosystem service valuation** builds an understanding of the value of ecosystem services (ie the services provided by natural capital like climate regulation) to an organisation and its stakeholders. It can be undertaken from a shareholder or societal valuation perspective and is usually done considering both.

1.5. **The environmental profit and loss account (EP&L)** approach identifies and quantifies an organisation's environmental impacts and dependencies, and applies a monetary valuation so that they can be presented in the format of a financial profit and loss account. An EP&L can be used at an organisational level or to assess full value chain impacts and dependencies.

1.6. **Total impact measurement is an extension of the EP&L** approach that provides an assessment of how an economic value is impacted or generated for different stakeholder groups. This uses a range of methodologies to place a financial value on social, environmental and economic impacts.

1.7. **Triple bottom line (TBL)** accounting is also an extension of EP&L. It accounts for social as well as environmental and economic impacts of businesses.

1.8. **Total contribution** is an approach that assesses direct, indirect and enabled contributions across economic, environmental and social areas.

Source – Natural and social capital accounting - A4S

# 2. Using technology for better data collection

Understanding what data we have, how we collect it and how to standardise and integrate it is crucial for a comprehensive analysis of the capital generated. This is why it becomes imperative to have technology instilled into the programme structure itself.

Creating an information infrastructure involves using the latest IT tools like big data, AI, IoT, and even blockchain to capture and process a foundational set of identified indicators and standards, thus creating a synchronised all-encompassing dataset for actionable information that enables thoughtful analysis and better decision-making.

**2.1. Big data:** From satellite data (GIS, remote sensing, etc.) to data generated from mobile phones, big data is offering a game-changing opportunity to move existing water rejuvenation programmes into the smart water management ecosystem. Big data has the potential to supplement traditional sources of data and provide a broad outlook of social and natural impacts by working across programme timelines to inculcate historical information as well as real-time inputs from various sources.

**2.2. AI:** Large amounts of datasets require efficient processing and management of results. AI comes with the ability to not only carry this work tirelessly but also improve from each processed data set and adapt to externalities. Using advanced data analytics and probabilistic algorithms, AI can help with the uncertainty and variability in water management and its effect on the associated social and natural indicators by making a precise prediction for a better and more beneficiary targeted decision-making.

**2.3. IoT and drones:** Implementation of IoT with data analytics and use of sensors to intelligently monitor the usage of water resources can be a boon to the water industry, especially concerning irrigation practices. IoT can enable simplification and automation in capturing on-field hydrology data as well as data addressing indicators relating to people and ecology more efficiently through the use of smart devices. Drones have also been instrumental in improving the quality and accuracy of the inputs and increase in sample size to monitor a wide range of outcomes and impacts. Drones also provide access to areas that are often too expensive or dangerous to explore.

**2.4. Blockchain:** While addressing the looming water crises, the World Economic Forum (WEF) said, "By providing a secure, transparent and distributed ledger to record transactions between parties, blockchain-based technology could fundamentally transform the way water resources are managed".[1] Blockchain enables transparency of the collated data and can be an essential tool in keeping track of social and natural indicators, thus avoiding a lack of accountability or gaps in monitoring and reporting.

1. Source - https://www.asiablockchainreview.com/wef-blockchain-to-fundamentally-change-water-management/

# 3. Innovation for better water resource management

Addressing the need for interventions in water resources, rejuvenation programmes can also take a bottoms-up approach wherein the negative impacts of water scarcity affecting the communities and environment are dealt with through a piecemeal execution via innovative practices. These practices are tailor-made to specific issues, so the social and natural capital generated can be customised and measured more comprehensively.

**3.1. Wastewater as a resource:** The United Nations World Water Development Report 2018, 'Wastewater: The Untapped Resource', advocates wastewater to be considered as a potential resource and not a costly problem. For instance, only 8% of domestic and industrial wastewater is treated in India.
The UN development report underlines strategies to tackle wastewater by reducing, removing, reusing and recovering. Additionally, wastewater is a solution that does not rely on changing the climate.

According to the World Water Development Report 2017, more than a fifth of global phosphorus demand worldwide could be met by recycled human urine and faeces. Wastewater is a rich source of nutrients, minerals and energy, all of which can be extracted cost-effectively. Thus, wastewater acts not only as a new resource but also as a sector in itself that can create employment opportunities for communities with the help of a systemised infrastructure.

**3.2. Nature-based solutions:** Recently, the UN World Water Development Report 2018 titled 'Nature-based solutions for water' was released. These are solutions that are inspired and supported by nature and use, or mimic natural processes to address societal challenges effectively.

Nature based solutions are designed to address major societal challenges like food security, climate change, water security, human health, disaster risk, social and economic development.

**3.3. Solar desalination:** With over 70% of the global water resources being saline, economic desalination of sea water is an excellent option to meet the future shortage of sweet water for human consumption. Currently, desalination of sea water is expensive and non-popular. However, with solar power, desalination can be a viable alternative to meet the water needs in coastal areas. This off-grid technology is capable of providing sufficient clean water for family use in a compact footprint and can be scaled up to provide water for larger communities.

Sources – United Nations World Water Development Report 2018, 'Wastewater: The Untapped Resource
India Water Portal
http://news.rice.edu/2017/06/19/freshwater-from-salt-water-using-only-solar-energy-2/

# About CSRBOX

CSRBOX is India's largest Corporate Social Responsibility (CSR) analytics and partnerships platform. It lists CSR portfolio of 1000+ companies falling under the ambit of mandatory CSR and investing altogether more than INR 10,000 Cr. on CSR projects each year. The platform takes the engagement with organizations a step higher, where not-for-profits and social enterprises are provided support and outreach services to help them connect with businesses that are looking for good CSR implementation partners. The symbiotic partnerships service also focuses on facilitating business-business (B2B) collaboration for larger CSR projects that ultimately helps in reducing the duplication of efforts by various agencies. Broadly, it's a combination of online and offline support services to businesses, CSR services providers and CSR implementation partners to actualize CSR partnerships.

For more information, please visit www.csrbox.org

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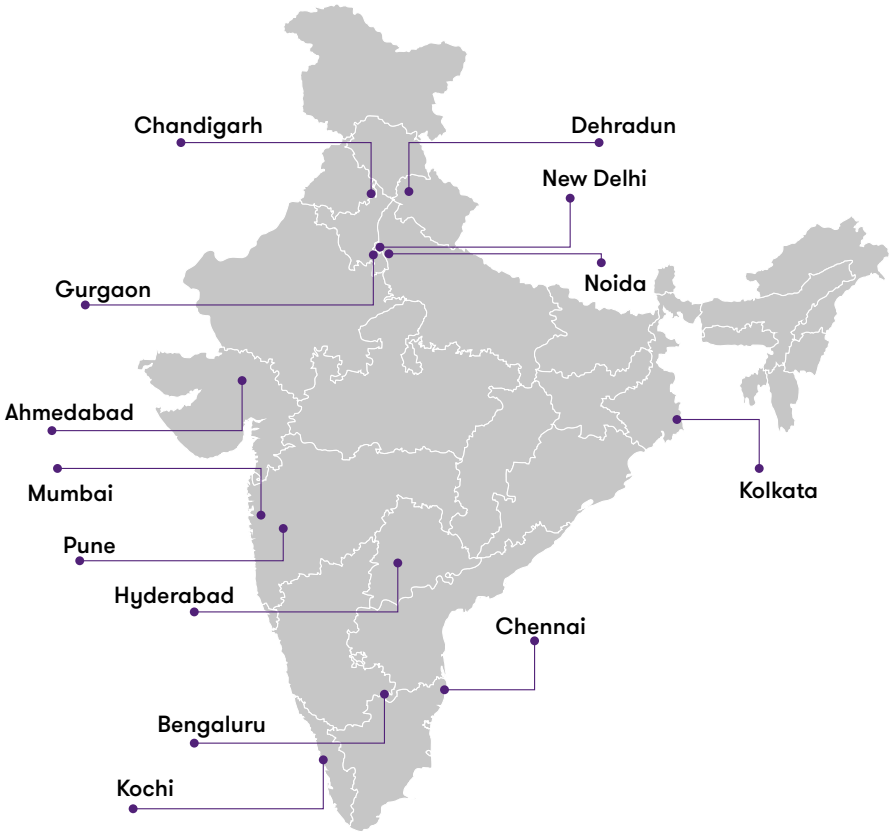

# Acknowledgements


**Authors**

**Utkarsh Singh**
**Mamta Swarnakar**

**For media queries, please contact:**

**Spriha Jayati**
E: spriha.jayati@in.gt.com
M: +91 93237 44249



| Editorial review | Design |
|---|---|
| Shambhavi Modgill | Gurpreet Singh |



**For further queries, please contact our experts:**

**Vikesh Mehta**
E: vikesh.mehta@in.gt.com

**Rohit Bahadur**
E: rohit.bahadur@in.gt.com


# Notes

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# Contact us

To know more, please visit www.grantthornton.in or contact any of our offices as mentioned below:


**NEW DELHI**
National Office
Outer Circle
L 41 Connaught Circus
New Delhi 110001
T +91 11 4278 7070

**NEW DELHI**
6th floor
Worldmark 2
Aerocity
New Delhi 110037
T +91 11 4952 7400

**AHMEDABAD**
7th Floor,
Heritage Chambers,
Nr. Azad Society,
Nehru Nagar,
Ahmedabad - 380015

**BENGALURU**
5th Floor, 65/2, Block A,
Bagmane Tridib, Bagmane
Tech Park, C V Raman Nagar,
Bengaluru - 560093
T +91 80 4243 0700

**CHANDIGARH**
B-406A, 4th Floor
L&T Elante Office Building
Industrial Area Phase I
Chandigarh 160002
T +91 172 4338 000

**CHENNAI**
7th Floor,
Prestige Polygon
471, Anna Salai, Teynampet
Chennai - 600 018
T +91 44 4294 0000

**DEHRADUN**
Suite no. 2211, 2nd floor Building
2000, Michigan Avenue,
Doon Express Business Park
Subhash Nagar, Dehradun - 248002
T +91 135 2646 500

**GURGAON**
21st Floor, DLF Square
Jacaranda Marg
DLF Phase II
Gurgaon 122002
T +91 124 462 8000

**HYDERABAD**
7th Floor, Block III
White House
Kundan Bagh, Begumpet
Hyderabad 500016
T +91 40 6630 8200

**KOCHI**
6th Floor, Modayil Centre point
Warriam road junction
M. G. Road
Kochi 682016
T +91 484 406 4541

**KOLKATA**
10C Hungerford Street
5th Floor
Kolkata 700017
T +91 33 4050 8000

**MUMBAI**
16th Floor, Tower II
Indiabulls Finance Centre
SB Marg, Elphinstone (W)
Mumbai 400013
T +91 22 6626 2600

**MUMBAI**
9th Floor, Classic Pentagon
Nr Bisleri factory, Western
Express Highway, Andheri (E)
Mumbai 400099
T +91 22 6176 7800

**NOIDA**
Plot No. 19A,
7th Floor
Sector – 16A
Noida 201301
T +91 120 485 5900

**PUNE**
3rd Floor, Unit No 309 to 312
West Wing, Nyati Unitree
Nagar Road, Yerwada
Pune- 411006
T +91 20 6744 8800


For more information or for any queries, write to us at contact@in.gt.com

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