

Capacity Building of Public Health Engineering Services- An Analysis

**Research Report
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Introduction

Public Health Engineering Services is a field that broadly deals with provision of clean and safe water supply, sanitation and environmental health services to populations. Capacity building is associated with inculcation and strengthening of skills, instincts and capabilities in order to efficiently manage and utilise resources that help to bring out an outcome that translates into welfare maximising gains. Water is essential to sustain life and capacity constraints individually as well as in aggregate in the stages of provision of water supply both in the urban as well as the rural areas hinders an effective and timely access to this life-sustaining resource.

At a wider perspective, capacity also takes into account the ability to “perform multi-dimensional concept, encompassing financial, human resources, institutional, socio-political, and technical issues (Lebel and Reed,2010). In the present scenario it is capacity that can help solve the major developmental and environmental challenges that have ever widening catastrophic circumstances. Training, educating, assisting and community outreach and engagement will go a long way in bringing about a transformation that is sustained over a long period of time and goes beyond completion of task to bringing about behavioural changes in attitudes and people’s mindset. It is ultimately the behavioural changes that will help in the conservation of life sustaining water resources and its optimal utilisation.

Capacity building is a multi-faceted process and requires an active involvement of all the stakeholders in the process of water supply starting from the operators of water catchments to the final consumers. A holistic approach to identify and analyse the capacity constraints in the stages of planning, execution and implementation would help us to understand the gaps and use public policy and good governance in bridging them to realise an outcome that is desirable and public welfare maximising.

The sustainable development goal (SDG) 6 deals with universal and equitable access to drinking water with section 6A focussing to expand cooperation and capacity building in water and sanitation related programmes and activities specially in developing countries and section 6B aiming to support and strengthen local community participation in water and sanitation management by the year 2030. Capacity building is vital to effectively tackle current challenges both global and national, owing to climate change which leads to environmental, economic and social developmental setbacks affecting the quality of life of people. Achieving the sustainable development goal 6 will help ensure the adequacy of capacity to deal with water related risks and ensure a better access to and development of water resource which is sustainable. A capacity building

example from rural India put forward events to raise awareness at village level alongside introduction of Water Safety Plans, including preparation of leaflets particularly targeted at empowering women's groups (Rouse et al., 2010)

Our country is also characterised by heterogeneity in level of awareness, socio-economic development, education, poverty, traditional practices and rituals which add to the complexity

of providing safe water. These can be addressed through an inclusive capacity building exercise that includes the complexities of community dynamics.

In terms of public policy and governance, government policies and programmes has also undergone a series of transitions ever since independence. Initially, setting up physical infrastructure in form of handpumps was more emphasised. Thereafter there was a transition from technology measures to a socio-technological approach seeking close participation of people. For ensuring long termism and sustainability of the systems, steps were initiated in 1999 to institutionalise community participation in the implementation of rural drinking water supply schemes through the sector reforms project. This resulted in a paradigm shift from “Government supply oriented driven approach” to “People oriented and demand responsive approach”. People’s participation has led to numerous optimistic results. Also, Water quality monitoring has now become an important part of the government programme.

This paper has sections that first identify the capacity constraints across different stages involved in the provision of clean and safe drinking water across dimensions like stakeholders, level of implementation, rural or urban setting and suggesting possible solutions and best practices. It comprehensively analyses the capacity building programmes for a socio-economic aspect, analyses schemes and practices in the water sector and brings out a unique framework to incorporate the socio-economic aspects in addition to the technicalities involved in the process. Communities and people’s participation is also paramount.

It also looks at the Water safety plans implemented by WHO and progress of wash practices in making the process of water provision sustainable and minimises wastages.

Objectives

The paper has the following objectives

- To analyse and document the best capacity building practices across select policies, programmes and schemes and the analysis of their efficiency from a socio-economic point of view in the access and provision of safe water.
- To bring out a socio-economic aspect of water provision and make the best possible use of it in bridging the gap between public’s perception of the impact of policies and the actual impact.
- To understand the dual aspect of capacity building both from the point of view of the common people and the designers of policy and good governance.

Stakeholders involved in providing safe drinking water

The provision of safe drinking water involves multifarious stakeholders across different stages and may be targeted by capacity building to bridge the various gaps which diverges the efforts and the impacts of well thought of water policies and programmes from bringing about actual and welfare maximising returns to the society.

This paper aims to analyse the role of capacity building in improving the efficacy and social returns to the following stakeholders.

Operators of drinking water supply systems which may be small or large, a public or private utility or local government employees or contractors directly associated with the responsibility for operations and maintenance.

Local health agencies and national public health agencies act as regulators and are typically responsible for independent surveillance of drinking water supplies.

There is a lot of literature that recommends cooperation and coordination between operators and public health authorities and encourage training of health officers risk management methodologies (Gunnarsdóttir, 2012; Gunnarsdottir et al., 2012; Aghaei et al., 2017)

Technicians both skilled and semi-skilled help in installation of complex systems. In most cases, the responsibility to manage the operations and development are delegated to the Gram Panchayats and sub committees like Pani Samities. Community-based water supplies in high-income as well as low- and middle-income countries share common limitations such as limited access to skilled technicians. (Marks et al., 2018)

National and State authorities help in enabling the environment through policy designing, legislative support and developing welfare and health-based targets. They help in the facilitation and coordination of different experts and ministries and helps to manage scale and effective resource management. They also support water supply and safety initiatives financially.

Consumers are responsible for the safekeeping of the delivered water, preventing pollution and contamination during storage and handling and providing feedback on water quality and other constraints. Consumer feedback is important as it can lead to accountability mechanisms where consumers advocate for services and share their concerns with the authorities under charge.

Local and National Civil Society organisations include non-governmental organisations and not for profit organisations that work for the betterment of the societies and facilitate capacity building and mass awareness programmes. They also help in providing tools and documents which form an important source for developing national guidance and supporting resources.

Research Community works on multiple fronts which supports capacity building and training and works to minimise cost and optimise effectiveness of public policies relating to safe water supply in our case by conducting research and policy evaluation exercises.

Methodology

The methodology involves systematic literature review of both peer reviewed research papers and grey literature involving analysis of reports and articles from policy documents, popular media and other sources. It also includes insights from the Rural Wash Partnership Forum's session. This project has been taken up under the guidance of National Centre for Good Governance and Department of Drinking Water and Sanitation under Ministry of Jal Shakti, Government of India.

A systematic search approach was adopted to review scientific literature on capacity building and training pertaining to drinking water supply. Identification of grey literature as well as peer reviewed articles and research papers was done using Google scholar search limited to first 200

results. The keywords and search terms used were drinking water supply, capacity building and development, sustainability of drinking water supply individually as well as together. Insights from various discussions with my mentor Shri Ranjith Kumar are also included indirectly in the report.

Data Collection and Limitations

The data presented in the analysis and policy evaluations is majorly secondary data collected from the Jal Jeevan Mission Dashboard and IMIS dashboard which presented data on a real time basis.

Limitations

- It was difficult to collect data or find appropriate proxy variables from secondary data for some variables in the stages of the water supply. Thus, data has been taken in the form percentages in relative terms from reliable data sources like World Bank, UN agencies and Niti Ayog reports.
- On some instances it was difficult to draw comparisons and establish conclusions because some data was collected on a yearly basis while some on real time basis.
- The results have been presented as percentage comparisons or tabular forms in the appropriate sections.
- A lot of potential of the paper could not be harnessed to its optimal scope due to time and other constraints.

Stages involved Provision of Safe Water Supply An analysis of capacity constraints and possible solutions

1. Planning and Design of Programmes

A comprehensive design of a water supply management system which is nearer to reality and is flexible to address the capacity constraints in the process is a critical first step. Without the identification looking for solutions would never be a possibility.

Planning and Designing of a system for provision of safe drinking water requires considerable preparation, coordination and cooperation from all the stakeholders and they should work in harmony to complement each other. Water safety issues are multidimensional and need interventions from diverse stakeholders ranging from the local communities to those involved in the fields of research, science and technology. These form the primitive foundation of policy and legislative framework development process which regulates the system's water source, treatment and distribution processes.

Involving people and communities goes a long way in bringing actual results and making sure that the policies are accepted by the public as they feel that their grievances are heard and there are efforts to resolve them. On the other hand, a lot of issues relating to inequality, social mobilisation of resources is sometimes witnessed which sometimes leads to inefficiency but to bring in a system that brings about a substantial improvement in the lives of people in terms of access to clean drinking water, better health outcomes and a better quality

of life. In order to bridge the gaps in capacity building in this stage widespread awareness programmes which helps the public to understand the relevance of the programme and the benefit that a particular policy or scheme would have on their everyday lives to bring the local communities on the same page as the policy designers would go a long way in making sure that the policy makes a difference in the society and actually trickles down to the grassroots level.

2 Funding and Resource management

Some schemes regulating the provision of safe water supply are regulated by the respective State Governments while for some there is cost sharing on a predefined ratio basis. In some schemes the cost of pipeline over 25 feet distribution pipe has to be borne by the household. A lot of constraints are faced at this stage which hampers the efficient implementation of ambitious schemes which hold a lot of potential to make a difference. There are sometimes no clear guidelines about the capital expenditure contribution either in cash or in kind. Recovery of water tariff is a challenge and sometimes there are a lot of obstacles in the collection of water tariff too. This is a necessity so as to manage the cost of motor operator, electrician, repair and management costs and thus there is an active need to address and work on bridging this gap through efficient awareness programs.

The schemes also sometimes do not clearly point out the contribution of operational expenditure from the community. Research and discussion have brought to light the fact that there is a lack of on ground well-functioning institutional arrangements for tariff collection.

Also, in case of State funded schemes and policies, the State is deficient of funds to address the problems of scale and efficient implementation. The Jal Jeevan mission has recognised and attempted to bridge these gaps and ensured water coverage on a large scale.

3 Technical Aspects and the Social Aspects

The majority of technicians who supervise the operation and implementation of provision of safe water are civil engineers and as it is evident from the characterisation of the Indian Labour Market, there is a huge wave of unemployment affecting the fields of civil and mechanical engineering. Consequently, a majority of the students opt for fields like information technology and computer science which are booming in terms of jobs markets in the present day.

This has led to a dearth of skilled technicians as most students make a switch to booming fields and this has become a major capacity constraint. On the other hand, the curriculum of civil and environmental engineering involves a lot of technical aspects and the aspect of dealing with people is often overlooked. Thus, on the ground level, the technical skills and training just work towards the functioning of the water systems from the catchment to the consumers. The aspect of making it work from the point of view of involvement of final consumers and communities that go a long way in making a plan long term and sustainable and convinces the communities that it is their own water supply system. These capacity constraints have been addressed to an extent in the implementation of Jal Jeevan Mission and also some state sponsored schemes like Gujarat's WASMO model.

4 Operations and management

One fundamental pre requisite for a smooth functioning of operation and management of safe water supply through pipelines or otherwise is community engagement and outreach. While analysing the salient feature of a few States sponsored programme, we found out that the main parameter for success in a majority of the schemes was involvement of the public and community Participation Inclusion of women from self-help groups and awareness creation helps in effective implementation. Lack of prioritization of funds for operations and management, falling groundwater levels in dry regions or otherwise and contamination of ground water due to chemicals used in agriculture activities are serious problems brought out by existing literature and research surveys.

Capacity constraints under Operations and Management affect the delivery of service. This is termed as a governance issue. Some governance structures especially the decentralised models are not perfectly operational in terms of devolution of power and capacities.

There is a challenge to identify appropriate governance structures to develop appropriate information, education and Communication systems to enhance capacities of the community as a whole. Another capacity constraint is a fragmented approach and absence of coordination between different agencies for supply of water.

5 Quality Testing

Quality testing is an essential stage which requires the intervention of experts who are well experienced and skilled technicians to carry out water quality tests with efficiency. It also requires well equipped laboratories. The lack of both these factors adds to capacity constraints and calls for training of personnel and technicians. In addition to this, the final consumers of water also need to be sensitised and made aware of the need and relevance of being vigilant about the water quality and getting the water they use for domestic purposes to make sure it is of the prescribed quantity and quality.

The Jal Jeevan mission lays special emphasis on quality testing and has advocated and supported the setting up of laboratories for the same. Data about the number of labs in the countries and the number of tests carried out by the team assigned to this task. The table below summarises the data from the Jal J

LAB TESTING STATUS				FIELD TESTING KIT (FTK) STATUS			
Active Laboratories	Samples Tested in Laboratories	Total Villages where testing has been done	Number of contaminated Samples found	No. of Women trained for testing water samples using FTK	No. of villages where women have been trained for testing using FTK	Samples tested using FTK	Total no. of Villages where FTK test has been done
2,087	2423516	331641	150526	2258697	478959	3438232	225441

Fig: Real time data on water quality from Jal Jeevan Mission Dashboard as on 7th August

6 Final Delivery and Sustainability aspects

An effective service delivery marks the completion of the journey of safe water from the catchment to the final consumer. An unsustainable service delivery of WASH (Water, Sanitation and Hygiene) is called slippage. It is gaining attention at the policy level recently though this problem is as old as the coverage of water supply services. This can be termed as a governance issue and is influenced by multifarious factors ranging from geo-hydrology of the place, climatic conditions and socio-economic perspectives.

In terms of service delivery, some systems start slipping almost immediately from the moment they are installed others are fine for a while before they start to slip. Also, the rate of slippage is erratic and non-uniform. Some systems slip at an increasing rate initially and then at a diminishing rate. The majority of existing literature on water supply and management deals with the constraints in the supply side of water economics, while these are important and have been given much significance, it is the demand side factors like community engagement, decentralisation of drinking water management responsibilities to gram panchayats and absence of feasible solutions of governance issues that have been overlooked since years.

Public policy and governance relating to drinking water often goes unrecognized and thus the strategies preferred for addressing slippage tends to be inclined towards the supply side. These include providing and encouraging rainwater harvesting structures, Rejuvenation of old schemes which are functioning below the capacity efficiency, source strengthening measures, combining of efforts of relevant Departments in watershed development, extending new pipelines and providing regional schemes from alternate safe sources.

While all these strategies are crucial in dealing with slippage, they are one sided and do not majorly incorporate the demand side. They therefore do not provide comprehensive solutions to the problem. They focus on supply augmentation through various mechanisms and thus there is a demand supply mismatch. In the long run source sustainability can be assured only with better governance of source structures and not merely structures like rain water harvesting structures, percolation tanks, watershed development. These structures are necessary but not sufficient for sustainable resource management and protection.

The problems people experience with water supply and sanitation are numerous and complex. The Sustainability, in the sense of continued delivery and uptake of services is threatened by numerous attitudinal, institutional and economic factors. There is need for comprehensive understanding and management of governance in water resources in an integrated manner incorporating supply, demand and institutional approaches. The problems faced by people and their experience with water supply and sanitation are multifaceted and complex.

The Sustainability, in the sense of continued delivery and uptake of services is threatened by numerous behavioural, institutional and economic factors. Therefore, supply sided or demand sided or community participation approaches on their own are no guarantee for success. There is need for comprehensive understanding and management or governance of water resources in an integrated manner incorporating supply, demand and institutional approaches.

Best Practices under various schemes introduced by the centre and the states- A brief overview of Jal Jeevan Mission

Good Governance involves people's participation and inclusion of communities to ensure that the benefits of public policies reach the grassroots levels and bring about a positive change in the lives of everyone in the process and lead to productive transformation in the society.

In the last few decades, governance reforms in the water sector have pushed for greater community involvement in water supply and distribution, adoption of various demand responsive approaches by states and civil societies leading to strengthening of community capacity, skills, quality of leadership and willingness of the community members to pay for water.

Various schemes and programmes have incorporated the community models and have been successful to some extent in developing piped water infrastructure in rural areas and improving coverage levels

We briefly analyse some best practices and the lessons that can be drawn from the past programmes

1. Gujarat's Water and Sanitation Management organisation (WASMO).

The Salient features of the programme are

Technical Assistance

It provided technical assistance and support in addition to the necessary technical assistance by contributing 90 percent of the funds. It conducted training and workshops to build the capacities of communities and Pani Samities to construct, operate and implement the scheme.

Decentralised Institutions - the decentralised approach focuses on the demand side which has a great involvement of community participation in planning, designing, site selection and implementation. This led to social inclusion and led to reliable and assured services.

Intensive Capacity Building- Stakeholders were trained in construction, supervision, financial management, surveillance of water quality and maintenance and operation of village water supply system. Awareness generation and capacity building initiatives were taken up by NGOs that were involved as support organisations.

Implementation and follow up period-The programme was implemented in three cycles Community mobilisation (first cycle of 3-6 months). Execution and completion of the project (second cycle of 12 months). Post implementation and follow up (third cycle of 12 months). This ensures regular, adequate and safe water to all the communities.

Support- WASMO provided ongoing support in operation, maintenance and capital maintenance support task whenever a Pani Samiti requested it

Source Sustainability - WASMO promoted roof rainwater harvesting to deal with poor water quality due to salinity in coastal areas.

2. Jal Nirmal

Jal Nirmal is a world bank assisted, a community based rural water supply project by Karnataka Rural Water Supply and Sanitation Agency (KRWSSA) and was implemented between 2001 and 2014. Its three key principles were capital-cost sharing, integrated approach to water and sanitation and operation and maintenance by the community.

The salient features of this scheme are

Training and capacity building of Village Water and Sanitation Committee (VWSC)

VWSC were formed as support committees and trained on various aspects on operation and management of the project. To build and facilitate flow of knowledge, information and communication activities within the communities. Training was also provided through workshops and technical support for operation and tariff collection. The water distribution responsibilities were delegated to the gram panchayat.

Capacity Development of institutions

A Social Development Unit was established at the cluster and district level for capacity building of communities and VWSC on different aspects of planning, execution and infrastructure maintenance of water supply under the Jal Nirmal Project. There was a close coordination between the social development experts and technical engineering team.

The communities were adequately trained and educated in record keeping, administrative duties, maintenance tasks and quality testing.

Community Engagement

The sub committees like VWSC were authorised to fix user charges, tariff collection and was empowered to recruit maintenance staff locally. Eventually the community was able to bear the recurrent costs of labour, materials, fuel and salary of pump operators. The VWSC have played a significant role in service delivery, service expansion and sensitisation of village leaders with respect to service provisioning and system operation. Other good practices that led to the success of this project were social intervention design, its implementation, software support to community, community engagement and capacity development and training and evaluation of performance.

Innovative solutions in Technology, Metering, Pricing and sustainability

Technological innovations like use of solar energy, groundwater recharging mechanisms to improve source sustainability, introduction of metering systems and restricted service delivery in high consumption seasons like summers as decided by the communities helped in water management and sustainability of source and systems.

3. Jalanidhi, Kerela

Jalanidhi was a World Bank-assisted Rural Water Supply and Environmental Sanitation Project implemented in Kerala between 1999 and 2008. The project was inspired by principles like demand responsiveness, community ownership and sustainability of investments through cost recovery and participatory operations and management.

Salient features

Community involvement and engagement

The users of final services themselves were fully involved in all the stages from identification of sources, decision on the technology to be used, community contracting and implementation of operation and management aspects of the schemes. For this adequate training was provided and appropriate guidelines were made available.

Strengthening of Gram Panchayats

This project aimed to and involved the empowerment of decentralised planning and was implemented through Gram panchayats. In the socio-economic scenario in the state of Kerala there was a special emphasis on rural local governance and this played a pivotal to bring out an equitable, inclusive and decentralised rural water delivery system and thus the benefits did reach the grassroot level.

4. Basudha, Orissa

The Buxi Jagabandhu Assured Drinking Water to all Habitation (BASUDHA) scheme launched in November 2018 is a renewed version of the Government of Odisha's water scheme for universal access to drinking and domestic water to all rural people on a sustainable basis. the scheme ensures that all households should have access to safe and adequate drinking water within a reasonable distance, enables communities to monitor and keep surveillance on their drinking water sources and ensures potability, reliability, sustainability, convenience, and equity. The government also launched the grievance helpline number 1916 for BASUDHA.

Impetus on use of renewable energy

Under this scheme, Mega pipe water scheme (PWS) projects are being brought to energy scarce areas using renewable energy. To ensure consistent and regular water supply from existing handpump/tube-well solar dual pump water supply in thinly populated areas, remote and energy starved habitations.

Role of State Government in Financing of Rural Pipe Water Supply (PWS)

The Panchayati Raj and Drinking Water Department of Orissa issued a government order on February 28th,2017 making it mandatory to use 30 percent of the funds from the 14th Finance Commission and 4th State Commission for rural water indicating the pivotal role of state government in public financing of water supply in rural areas.

A brief Overview of Jal Jeevan Mission

The Government of India has recently set a target and aimed to provide clean drinking water to all rural households by 2024. This mission will focus on the integrated management of demand and supply side at the local level and encouragement of source sustainability through rainwater harvesting, recharge of groundwater and household wastewater management for reuse in agriculture and other activities. It also aims to create local infrastructure. This mission is under the Department of Drinking Water and Sanitation and has been christened as the Jal Jeevan Mission.

This mission will converge with other Central and State Government Schemes in order to accomplish its objectives of providing sustainable water supply management across the country. The Department of Drinking Water and supply together with the State Governments has been working tirelessly to achieve the aim to provide functional piped water supply through

tap connections ('Har Ghar Jal') assuring water supply in adequate quantity and of prescribed quantity on a long-term regular basis to every household in India by 2024.

According to Ministry of Jal Shakti, Department of Water and Sanitation's document on "100 days Campaign to provide piped water supply in Anganwadi Centres, Ashramshalas and schools" states that in one-year of JJM, 2.40 crore rural households have been provided new tap water connections. Around 1.61 lakh habitations have 100 percent coverage of tap connections. Goa became the first state in the country to have achieved 100 % Household tap water supply connections.

Training and capacity building

In order to meet the training management need of the National Jal Jeevan Mission (NJJM), JJM Training Portal has been created.

The portal acts as a consolidated platform for trainees, trainers and NJJM to know demand and supply and undertake the intermediate processes like registration, alerts, nomination, attendance of trainees in a course, feedback for a smooth record and coordination.

The main functions of Key Resource Centres (KRC) are as defined below:

Training Need Assessment (TNA): Assignments will be given to empanelled agencies based on the requirements and procedure defined by the NJJM, DDWS. Based on the assignment given, the KRCs are required to identify the training needs before designing the training programme.

Content creation: Based on the TNA, necessary materials, modules, manuals are developed by KRCs. Emphasis is fairly more on online modules, course and contents.

Annual Action Plan (AAP): The KRCs will be required to prepare an Action Plan for the year with details of all proposed activities. This will be examined by the NJJM, DDWS and approved accordingly.

Selection of participant list: The selection of participants will be done by the NJJM, DDWS/ State Governments/ SWSMs / DWSMs as per the specific type of training programme. The task of coordinating with the participants and local authorities for diverse training and logistics purposes also lies with the KRCs.

Assurance of quality of training: After completion of each training programme, the KRCs are required to obtain credible and well-structured feedback from the trainees and incorporate the same in updating and making relevant changes in the subsequent training modules and sessions.

Other than training and capacity building activities, the KRCs will also be required to take up other activities as part of Human Resources Development and JJM 'Knowledge Network' as per the requirements of NJJM, DDWS:

a) The KRCs are required to organize national, regional and state level webinars, workshops and seminars which will also be supported by the NJJM, DDWS.

b) KRCs are expected to take up field exposure visits to States/ districts and even other countries for cross-learning from best practices. For international exposure visits, KRCs have to research and have an idea of relevant international experience and institutions, efficiently network with them and demonstrate a value addition to the substantial knowledge and experience that already exists in the country.

c) KRCs will also perform documentation of case studies and best management practices on topics pertaining to drinking water service delivery, monitoring and surveillance, for further dissemination of knowledge.

d) As and when needed, KRCs will conduct research and evaluation on various issues pertaining to drinking water and organise events like hackathons, quizzes and others to promote the goals of the Jal Jeevan Mission from time to time.

Jal Jeevan Mission as a rational amalgamation of the best practices of the State water schemes

The central goal of the Jal Jeevan Mission is to improve quality of lives of people by ensuring potable water in their households. This will help in ensuring the basic right to water to all citizens. The mission also aims to forge partnerships with diverse organizations for smooth implementation and better outcomes of JJM. Thus, Department of Drinking Water and Sanitation (DDWS), Ministry of Jal Shakti has sought interest from foundations, trusts, NGOs, Community Based Organizations (CBOs), academic institutions to work closely with the mission as ‘Sector Partner’ so as to have a better social outreach and work proactively in sectors water, sanitation and hygiene, natural resources management, community engagement, capacity building & awareness generation, education, health, tribal development and gender & equity.

The Sector assist the States to adopt appropriate Operation and maintenance mechanisms to ensure long term sustainability of sources with special focus on water quality. Further, providing capacity building support to different stakeholders, identification of successful models in community mobilization for replication, field visits to understand social inclusion, social audit/ monitoring under JJM also fall under the scope of responsibilities of the Sector.

JJM aims to harness the huge potential of the local communities by engaging organisations working at the local level and are enthusiastic to work towards mobilizing and enhancing the capacities of the communities.

The mission aims at capacity building of Gram Panchayat and/ or its sub-committee, i.e., Village Water & Sanitation Committee (VWSC)/ Paani Samiti on managerial, technical and financial aspects. Communities are also to be enabled to take up surveillance of quality of water supplied by training five persons, preferably women, in every village for quality through Field Test Kits (FTKs). To take forward these activities, role of organizations working in rural areas will be very vital especially in mobilizing the community as well as handholding them.

The mission has also engaged the private and corporate sector to optimise the best outcomes to the society through Corporate Social Responsibility initiatives. In order to achieve the ambitious target of water security for all, all the organisations will have to work together and build a synergy for efficient outputs.

Employment Generation Through the Jal Jeevan Mission

A report titled an assessment of employment potential of Jal Jeevan Mission by Centre of Public Policy under IIM Bangalore has analysed the potential of employment generation at various stages of the implementation of the Jal Jeevan Mission in the country. It also includes the aspects of direct employment through construction and allied employment like long-term engagement for operation and maintenance activities of pipe drinking water supply systems and the labour employment in the generation of the requisite infrastructure for the implementation. Indirect employment is also created through transportation are also being generated.

The funds invested under the Jal Jeevan Mission is facilitating the construction of public assets and creating direct, allied and induced impacts on employment in the country. The production of inputs used for construction as well as operation and management stages also lead to employment. The study adopts both micro and macro approaches to understand the impact of the investment on employment generation across industries as well as states.

According to the findings of recent publication of Nobel Laureate Professor Michael Kremer, availability of safe drinking water has the potential to avert 1.36 lakh child deaths (below 5 years) in the country leading to almost 33.33 percent reduction in child mortality rates. In terms of the impact of Jal Jeevan Mission on public health, the World Health Organisation has recently published that an estimated number of 4 lakh diarrheal deaths can be averted which effectively translates into economic savings of more than 8 lakh crore on account of 14 million DALYs (Disability Adjusted Life Years) averted thereby. This will be a feat in terms of public health outcomes and lead to a better quality of life. The Jal Jeevan Mission has played a pivotal role in improving the lives of rural women and helping them reduce the time spent by them in travelling to collect water for domestic purposes. The overall structure of the Jal Jeevan Mission has spillover effects in terms of better health & more economic opportunities for people, especially for women.

Capacity building – A review

Capacity building involves training, awareness, development of skills and other on the spot decision making skills that help to facilitate the provision of safe water to all the people within a specified area.

The training approach selected must give adequate emphasis to stages of learning. A phased and a step-by-step approach helps in breaking up of activities into activities and skill sets. Provision of safe drinking water is a crucial subject and a one which carries huge potential to make a difference in the life of the people by improving their standards of lives, improving health outcomes and empowering people socio-economically.

The involvement of students pursuing education in the water relevant fields can be focussed on and after adequate training and capacity building, water professionals can be recruited on site for their respective roles and responsibilities.

Even if emphasis is on education rather than training, universities and higher education institutions have a pivotal role in developing capacity and preparing water professionals to contribute in the water sector. Through simplified stages of learning like introduction, practice and reinforcement the technical skills can be honed and interdisciplinary interactions in active learning environments will lead to awareness of the multidimensional aspect and sensitization about drinking water safety and issues across multiple disciplines.

The different stages of learning will enable the learners to move from basic knowledge to a deeper understanding and more amount of autonomy in the process.

In the introductory phase the learners will help the learners to start from the fundamental awareness of the need of water safety and supply mechanisms in the urban and the rural areas and steadily move towards hands on practice and reinforcement. On site visits and a supplementation with technological advancements and innovations will help to bridge the gap between learning the principles of water sector and their on-ground implementation.

The process of learning should continue through phased processes wherein after the introductory phase learners should be given freedom and flexibility to assume and carry out their responsibilities and improve their learning outcomes through experimental learning. Moreover, to inculcate problem solving skills among the learners, appropriate guidance about dealing and coordinating with a variety of stakeholders should be encouraged.

In order to make the capacity building exercise sustainable and improve the relevance and longevity of it, regular updating, introduction of social skills of communicating and understanding the needs of the communities, refresher courses, peer reviewed policies and practices in water supply and technical assistance to overcome challenges will be required. To add to it, further training and rounds of feedback and revision could help in addressing the gaps identified in the monitoring and review process. *Peletz et al. (2016)* stresses at the importance of continuing to process and apply monitoring data to enable re-evaluation of the program.

Capacity building of consumers and communities through community engagement in the stages of provision of clean and safe drinking water, consumer education in mitigation of water pollution and safeguarding of the final water being delivered and undertaking methods to improve the quality of data collected specially from the rural areas will go a long way in translating the water relating public policies and governance practice from documents to reality.

Sustainability of capacity building for provision of safe water supply is likely to be different depending on the types of supplies, their size, location and the governance. For example, some literature considers training for capacity building more challenging in rural areas because of the local traditions, language barriers, greater attention and additional resources. In order to achieve sustainable capacity to efficiently implement skilfully designed policies till it actually benefits the final users, the prerequisites are community engagement, sustainable financing and iterative re-evaluation. *Kayaga (2013)* suggests that a memorandum of understanding (MoU) be made as a formal document where the mutually discussed and agreed roles and responsibilities of utility and the community members should be tracked. It is hence recommended to include all target groups in capacity building and training activities at the local level.

Also, with the water supply and safety practices there is a strong risk of tokenism where documentation of best practices is developed but it does not successfully trickle down to the grassroots via culture and practices.

The capacity development components that require strengthening depends the roles of different stakeholder groups involved in implementation, scaling up. Specifically in case of small systems, selection of materials, approaches and training customisation should reflect the target group, local language and preferred mode of learning. Customizing training and capacity building according to size, location and governance structure will catalyse long term sustainability.

The urban scenario

Ministry of Urban Affairs has undertaken several initiatives under Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and other programmes to augment the capacity development of urban local bodies to implement projects and reforms. They are enumerated below

Hubs and Networks:

In order to meet and fulfil the training demands on ground six empanelled regional hub institutions (RHIs) and a range of Network Institutions aligned to them have been schematically arranged.

A Rapid Training Program (RTP)

This has been launched focusing on the slow performing cities in accessing JNNURM funds on prioritised module of Governance and Reforms, Supervision/Preparation of Detailed Project Reports Project Management and Implementation.

The Peer Experience and Reflective Learning (PEARL) programme

This programme has been launched to facilitate cross learning among cities and institutions in order to learn from their experiences in implementing different schemes. These cities and institutions have been clustered into five groups based on similar and common socio-economic profiles. Every group has a knowledge manager assigned who coordinates and facilitates technical support to organise events of common welfare relating to relevant areas and value addition with the support of Ministry of Urban Development.

Capacity Building for Urban Development (CBUD) Project under the assistance of World Bank:

This Project has been put forward as a Central Scheme to intensify capacity building and strengthening at an institutional level of selected Urban Local Bodies to implement urban reforms mandated under JNNURM, with World Bank credit on IDA terms. The Project would also provide capacity building support to select cities for urban poverty reduction and livelihood opportunities.

Public Health Engineering (PHE) Training Programme:

Started by the Ministry in 1956, the public health engineering training programme has been set up with the objective of providing training to Engineers in service and Para Engineering Staff of the various State Public Health, Engineering Departments, Water Supply and Sewerage Boards, Urban Local Bodies and others. The details are as follows:

• Post Graduate Course in Public Health Engineering/ Environmental Engineering

Institutions offering the Program
All India Institute of Hygiene and Public Health, Kolkata, West Bengal
Veermata Jeejabai Technological Institute, Mumbai
Anna University, Chennai
Visvesvaraya National Institute of Technology, Nagpur
Motilal Nehru National Institute of Technology, Allahabad

Duration of the postgraduation course: 24 months
Stipend offered: Rs. 2000/- per month for outstation trainees.

Shri Jayachamarajendra College of Engineering, Mysore
Jawaharlal Nehru Technological University, Hyderabad

Short Term Courses in Public Health Engineering

This programme helps working professionals like Diploma Engineers working in State Public Health Engineering Departments and Water Supply gain adequate exposure and improve their capacity in accordance with the requirements of the present day. The duration of the short-term courses is 3 months. There is also an extension of financial support in the form of grants, stipend, tuition fee and field visit expenses

The institutions offering short term courses are:

- 1) Anna University, Chennai and
- 2) Shri Jayachamarajendra College of Engineering, Mysore.

Refresher Courses

In addition to long term and short-term courses, several refresher courses on various specializations are conducted by the Ministry through different academic, research & professional institutions and State Departments. Financial assistance is also extended in the form of honorarium to lecturers and expenses on field visits.

Conducting of workshops, conferences and research studies

The Ministry has been extending full support for workshops and conferences related to urban issues. In order to promote excellence in specific areas of urban governance, Centres of Excellence have been proposed to be set up in reputed institutions in the country to create the necessary knowledge infrastructure for improving municipal service delivery and management. Each of the centres will be unique in its area of research and all COEs will foster, capacity building and technical knowledge base.

Institutional Arrangements

Regional Centres for Urban and Environmental Studies

These have been set up by the Ministry of Urban Development, Government of India in Mumbai, Lucknow & Hyderabad. These centres help in skill-building and capability development of elected and official functionaries of Urban Local Bodies by improving knowledge, work and exposure required for good urban governance and provide impetus to novel thoughts around thematic issues in a conducive environment.

National Institute of Urban Affairs

This is a prestigious and premier institute focussing on research, development, training and information dissemination in the field of urban development and management.

All India Institute of Local Self-Government

The central focus of this institute is to promote and support the research and training in municipal administration. This focusses on the capacity building of urban local bodies.

Administrative Training Institute

The Administrative Training Institutes are set up at the State level to disseminate knowledge on different aspects of good governance. These institutes also impart training in effective manpower and financial management to State Government, Local Bodies, Autonomous Bodies, and Public Sector Undertaking employees.

Major Capacity Constraints in the urban scenario

1. Dearth of appropriately skilled personnel

Urban planning and management are in urgent need for identification as a formal and regular stream of training and professionalisation in academic institutions. The concerned personnel involved in urban management affairs are under trained and lack the required skill sets. Socio-economic planning, urban planning, financial accounting and management are major areas which require attention and skilled manpower for efficient functioning. Trained manpower is also needed for plumbing and mason services.

3. Insufficient up skilling of employed personnel

The employees already employed for various services in the water and public health engineering sector and urban local bodies have majorly not received any training throughout their career as per the experience of training and capacity building programmes. This problem is grave in smaller urban local bodies where training programmes are hardly present.

Water Safety Plans and WASH

The United Nations General Assembly recognised the essential human right to water and sanitation in 2010. Seeing the vitality of the right to sufficient, continuous, safe, acceptable, physically accessible, and affordable water for personal and domestic use, this was the need of the hour.

Water Safety Plans are an inclusive approach that focusses on a comprehensive risk assessment and management covering all the levels from a catchment to a consumer. They aim to be consistent in their assurance of safety and acceptability of a drinking water supply.

A comprehensive guide for small drinking water supplies and an encouragement of the application of water safety plans for the provision of safe drinking water is promoted by the World Health Organisation at the global level. The use of water safety plans is considered a proactive approach to identifying and managing the potential risks and taking precautions as necessary (WHO, 2012). According to WHO report, 2012, page 9, the World Health Organization defines the following six tasks to develop and maintain a water safety plan

- Community engagement and team assembling
- Description the community water supply
- Identification of and assessment of hazards, hazardous events, risks, and existing control measures
- Development and implementation of an improvement plan
- Monitoring of and control measures and verification of the effectiveness of the water safety plan
- Documentation, review and improvement of all aspects of water safety plan implementation

WHO produces a series of guidelines on water quality, including on drinking-water, safe use of wastewater and safe recreational water environments which are based on risk management and assessment. At the global level, WHO also supports countries to implement the drinking-water quality guidelines through the development of practical support and materials to enlighten and facilitate the provision of direct country support. The development safe drinking water quality regulations which also go well with the principles prescribed by the WHO guidelines and are of relevance locally are also developed by WHO. These regulations catalyse and facilitate the development, implementation and auditing of Water Safety Plans and strengthening of surveillance and monitoring practices.

Now focussing specially on the Water Safety Plan implementation in India, WHO has been extending support and guidance to key stakeholders involved in the betterment of drinking water quality, development of regulations and guidelines to help overcome the loopholes in the implementation. It also supports research activities, development of training manuals and capacity building of stakeholders and providers of safe water supply. It also helps in the promotion of best sustainable practices

WHO has facilitated the testing of a Water Safety Plan in the Indian cities of Hyderabad, Nagpur, Bengaluru, Chandigarh and Surat. In order to provide a formal framework for cooperation in the areas of water quality monitoring and assessment activities, a memorandum of understanding has been signed with the Water Quality Assessment Authority, Government of India.

Poor sanitation can also have a ripple and vicious effect when it hinders national development because when workers are suffering from illnesses, they live a shorter and a fairly unproductive life, they produce and earn less, and thus are unable to afford education and stable future income for their children. Inadequate water, sanitation and hygiene (WASH) services in India's affects the public health adversely for instance India's neonatal mortality rate is currently 24 deaths per 1000 live births as per WHO data which is high. Provision of safe drinking water and effective Water Sanitation and Hygiene will help in curbing mortality owing to contaminated water practices and will go a long way in improving the public health.

Chemical contamination of water, mainly through fluoride and arsenic, is present in the majority of dwellings. Moreover, less than 50 percent of the population has access to safely managed drinking water which is located on-premises, available when needed, safe and free of contamination.

Moreover, two-thirds of India's districts are affected by extreme water depletion and scarcity, and the current lack of water safety and security planning is a major concern.

Collaboration and convergence are the vital features of the UNICEF's Country Programme in India are collaboration and convergence and WASH is positioned in such a manner that it supports development of an overall aspect of a child's survival, growth and development.

The WASH programme is also aims and works to prevent malnutrition and preventable diseases, reduce neonatal mortality, and enhance education outcomes. This will lead to better health outcomes, secure a stable future, overall mental and physical development and eventually better national development ensuring a better standard of living for the citizens.

UNICEF supports the Government of India's flagship programmes like Swachh Bharat Mission, the Jal Jeevan Mission and WASH in schools to develop sanitation and hygiene etiquettes among children right from the start.

In addition of schools, UNICEF also supports WASH in health care facilities, supporting planning and implementation and incorporating behaviour change into state and national guidelines and costed plans.

UNICEF, supports the Government in the technical aspects, assists in alternative service delivery approaches, and mobilizes public institutions and partners, including the private sector to contribute to and support WASH services.

WASH programming is grounded in empirical data collection through well-structured surveys, rigorous research and insightful analysis. To ensure community participation, gender mainstreaming, and efficient programming, all water, sanitation and hygiene (WASH) interventions get supported by social and behaviour change communication (SBCC)

The interventions are also supported by monitoring and evaluation (M&E) and knowledge management (KM) frameworks.

India has accelerated its efforts over the past five years to assure its citizens, especially children, the right to WASH services.

The process includes external monitoring and system monitoring and the support extension of government partnerships for setting up monitoring systems like management information systems, online applications, and dashboards for smooth access and functioning.

Lessons from Abroad

Source water protection is the development and optimal utilisation of institutional arrangements like municipalities assessing a drinking water safety risk and managing them with relevant stakeholders to minimise pollutants from contaminating drinking water sources which can be used for drinking water purposes. (Ivey et al.,2006)

It is the most effective and efficient practice for water safety and a lot of literature concludes that cost of treating contaminated water is 30 to 40 times the cost of source protection from pollution (Minnes,2017)

The outcomes of inadequate protection of drinking water sources can be devastating as evident by various contaminated water incidents in Canada and elsewhere.

Canada's Ontario Quality management standards ensures compliance in various aspects areas of the water system operations by focusing on technical components and delegation of responsibilities for regular operation (MOECC,2015) but it lacks social dimensions like community capacity and safe drinking water awareness. Source water protection plans, complementing the water management framework of Ontario's community water systems have been successfully implemented.

In case of New Zealand, a significant drawback is the exclusive focus on the technical and environmental parameters where community outreach and engagement processes, training opportunities and financial planning are not adequately taken into consideration. The central theme of Water Safety plans is risk assessment and management.

The European Union strategy lacks several important components, such as training requirements, source water protection, financial planning, and community awareness.

Conclusion

Now as we move towards the concluding remarks of this paper, we will quickly review the aspects that we have discussed and shed a considerable amount of light on. We started with what public health engineering services are and narrowed our study to specifically the provision of safe drinking water, stakeholders involved in the process, the possible and currently faced capacity constraints in the different stages of provision of safe drinking water that needs redressal, State and Central schemes and best practices in terms of capacity building, demand side and supply side governance as implemented by the state level schemes and the Jal Jeevan Mission which incorporated the good practices and accomplished stupendous and ambitious results. We also undertook a very detailed review of the capacity building in the rural water supply and urban drinking water supply sectors. Towards the end we had briefly touched upon the Water Safety Plans implementation and WASH services undertaken by WHO and UNICEF respectively.

A very detailed analysis of the literature review helped us to understand the basic problems faced in the provision of this life sustaining resource, water. For the citizens these small problems have an everlasting and hazardous impacts on their livelihoods and quality of life. The solutions to these crises lie in behavioural, attitudinal and governance pattern shifts towards more realistic and efficient models.

State, cities, districts and villages where the literacy levels were high seemed to have better health outcomes. Awareness about drinking water and sanitation hygiene as people adopt to healthy conservation practices and realise the importance and impacts of the implementation of good policies and thus end up having better health outcomes. Thus, improving the educational outcomes and working on a large-scale provision of access to education would help in overall development and add to the public acceptability of policies.

General improvement in the status of literacy would go a long way in minimising slippage. Higher literacy also helps in a stronger and decentralised service delivery of WASH services. This emphasises the need for strong IEC activities at different levels for building their capacities in ensuring functional efficiency of the program. Water quality is also an important aspect that needs policy attention.

The policy should also address resource sustainability, conservation and behavioural change goals instead of relying upon a one-sided target driven approach. The effective implementation keeping a central focus on these aspects needs to be ensured.

Water, sanitation and hygiene services are significant and central to addressing social issues of poverty, livelihoods and health. They are also critical in addressing the needs of poor communities and in achieving the Sustainable Development Goals (SDGs). The efforts of Government to reach these targets are often subjected to many challenges and obstacles.

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