CAPACITY BUILDING IN WATER RESOURCES SECTOR OF INDIA

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Abstract

With mounting water scarcity, the priorities for the water agencies of the country have broadened from mere water development to encompass water allocation and water resources management. But, the institutional capacity building of the agencies responsible for water resources and services management hasn't kept pace with the changing times. Building institutional capacity warrants primarily the following: i] framing the right kind of water policies; ii] crafting the right kind of rules and regulations, institutions and instruments; and, iii] fostering the needed organizational changes among the agencies concerned for water allocation and sustainable water resources management.

The paper highlights three sets of key issues facing them. They are: a] team building of professionals with multi-disciplinary skills, to provide research and expert inputs for policy formulation, institutional design and design of economic instruments; and, b] mobilizing resources and skills for creating new organizations including development of local institutions, and restructuring wherever needed; and, c] augmenting the overall strength of technical staff in various departments engaged in water resources management and water-related services. Availability of multitude of professional agencies which can undertake tailor-made capacity building activities for various stakeholders is a critical issue. The paper argues that focus of the state and central governments should now be on building world-class human resource base, with trainers, researchers and water management professionals with multi-disciplinary skills.

1. Introduction

The water management challenges in India are far many. As on 2008, nearly 88% of the population has access to improved water supplies, with the percentage being below 84% in rural areas. But, as per the data from 2001 census, the number of "tap" connections, which is indicative of good access to safe water, was as low as 24.2% in rural areas in 2001. In urban areas, however, the number of tap connections was 66.65%. But, the service quality is very poor. In the 35 metros of India, water supply is available only for a few hours in a day. As regards tariff, nearly 62% of the urban consumers in metros having more than one million population have metered connections, the percentage being 50% in smaller towns. In many cities and towns, the domestic connections are not metered at all. In order to achieve 100% water security, India has to make significant progress in terms of strengthening the sector agencies.

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Though India boasts of having the largest irrigated area in the world with 85.78 million hectares (m. ha) in 2006-07 as gross irrigated area from all sources, 59% of this area is irrigated with groundwater (in terms of net area irrigated by wells). The groundwater pumping is to the tune of 234 billion cubic meters (BCM) as on 2004 as per official estimates (GOI, 2005). But, attempts for direct control of its development and use through state regulations or water rights, or indirect control through the use of economic instruments such as electricity pricing, energy rationing or groundwater tax are not visible on a large-scale, while some states such as Gujarat, Orissa and West Bengal have recently made some progress in metering and pro rata pricing of electricity in farm sector.

Though there has been steady growth in net surface irrigated area in the country over the past five to six decades (Planning Commission, 2008; Kumar et al., 2009), the inadequacies with respect to management of water distribution and delivery systems and pricing of irrigation water are amply visible (Kumar and Singh, 2001; Kumar, 2010). India is facing a major water crisis (Amarasinghe et al., 2008; Kumar, 2010). For instance, Kumar (2010) projected the gap between water demand from various competitive use sectors and supply to be around 26.2 m. ha m (i.e., 262 BCM) by the year 2025. There are increasing evidences to suggest that growing water insecurity would check the advancements in social development and economic growth (Shah and Kumar, 2008). There is now a growing consensus in the development fraternity that capacity development of stakeholders concerned with water resources sector is one of the important drivers for water security (see for instance, Sullivan, 2002; Laurence et al., 2003). Further, in the face of current economic, environmental, political, and social conditions, developing state and societal capacities to design and implement strategies for improvement in water resources sector is considered critical for achieving the objectives of sustainable development.

UNDP (2009) defines capacity development as the "process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time". To put in simple words, if capacity is the means to plan and achieve, then capacity development describes the means to achieve the ends. Brown (2004) described three mutually interactive spheres of capacity building, namely: a) Human resource development; b) Organizational change; and, c) Directive reforms. These spheres have well known capacity development interventions but the relationships within and between these spheres are important for continually improving current capacity. Further, UNDP (2009) points four core issues that seem to have the greatest influence on capacity development, and they include: a) Institutional arrangements, b) Leadership, c) Knowledge, and, d) Accountability.

2. Capacity Building Issues in Water Resources Sector

In developing world, capacity building has become a buzz word for sustainable development of water sector. But the current attempts to enhance capacity suffer from numerous conceptual and operational constraints (Biswas, 1996). Experiences show that institutional weakness and malfunctions are a major cause of ineffective and unsustainable water services in the developing countries like India (World Bank 2004; Saleth, 2005; TERI, 2006). For instance, the existing institutions in the India's water sector are designed and equipped to appropriate and develop and not to allocate and manage the resources. They lack institutional capabilities to efficiently allocate water amongst competing uses such as irrigation, rural domestic uses, industrial uses and municipal uses) or to alter the socio-economic systems to manage the demand for water. A major reason is the lack of property

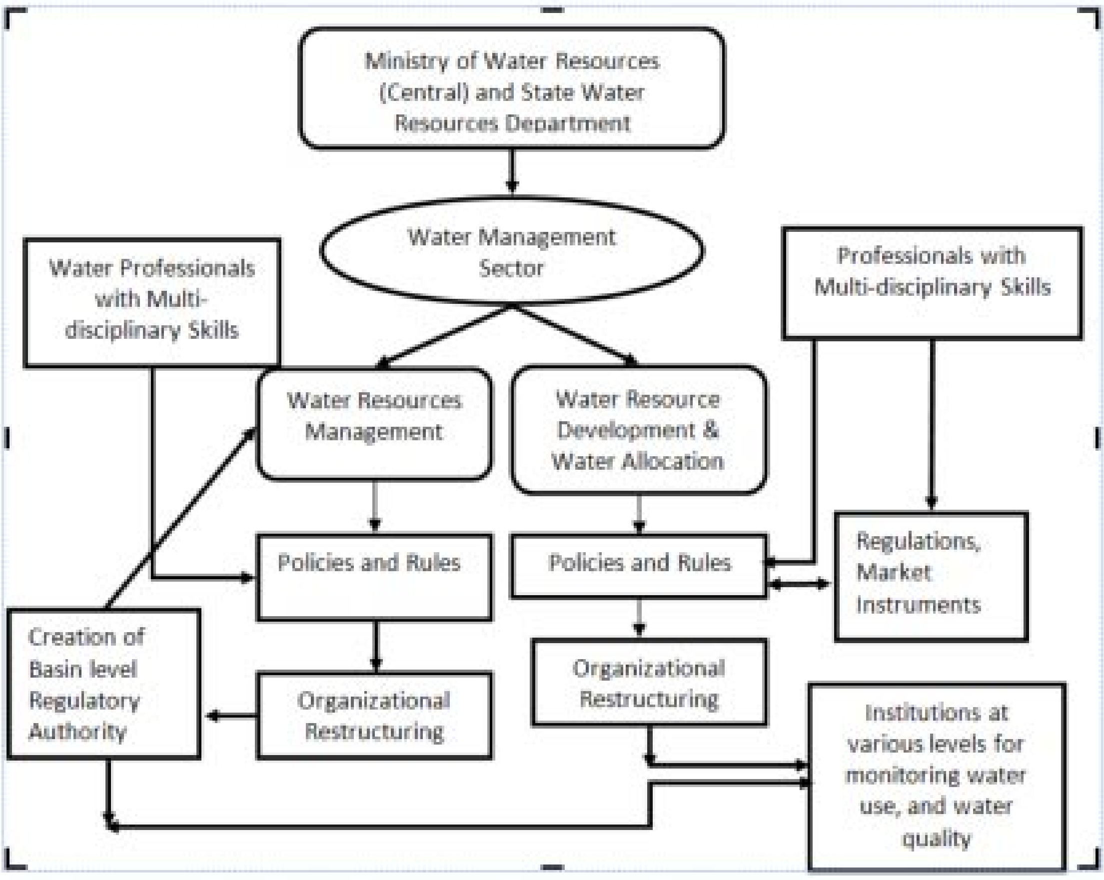

Figure 1: Framework for Capacity Building in Water Resources Sector

rights in water for different sectors in volumetric terms and users within each sector, and inefficient pricing of water in different sectors (Kumar and Singh, 2001; Saleth, 1997; Kumar, 2010). Insufficient exposure to the concept of "allocation efficiency" and lack of adequate knowledge about productivity of water in various uses and its links with market instruments such as property rights is a major issue.

With growing water scarcity, the priority of water bureaucracies has shifted from water resources development to water allocation and water resources management (Saleth and Dinar, 1999). The need to better manage overall water resources coherently and to facilitate allocation of water among all users requires an expansion and integration of national water resources planning. Thus, the major institutional challenge is to develop policies, rules, organizations and management skills which address both, i.e., water resources management and water allocation, needs simultaneously (Hamdy et al., 1998). While addressing these challenges, right processes have to be followed. Figure 1 presents the framework for capacity building in water resource sector which is discussed in detail in the subsequent sections.

3. Developing Policies, Rules and Organizations for Water Resources Management

Policies and Rules

The task of framing of policies and rules on water resources management requires comprehensive and integrated understanding of the hydrological, social, economic, ecological, and institutional issues. They concern: the interactions between various physical systems influencing water availability at the level of river basins; various socio-economic systems affecting water demand; interaction between ecological system and hydrological system (Kassem, 1996; Klomb, 1996); factors influencing the economics of management actions, including the cost of various resource management interventions and value of the resource; the factors influencing the transaction cost in resource management; and institutional design principles.

This implies that there is a need for skilled professionals in the field of agricultural sciences, public health, basin and catchment hydrology; environmental hydrology; hydro-chemistry, water resources economics; natural resource accounting; institution building; organizational behaviour and institutional economics, with particular reference to water resources management. Barring the first two, the skills in other disciplines are not readily available. Let us take the example of catchment hydrology, which is the least understood when talked about water harvesting. Most rivers in India are not gauged for stream flows and siltation. Scale problems in hydrology are well documented (Sivapalan and Kalma, 1995; Wood et al., 1990). Applying rainfall-runoff relationship of large river basins to small catchments would result in over-estimation of runoff (Kumar et al., 2006). In the absence of knowledge about catchment hydrology and effective storage capacity of structures, cost calculations of water harvesting structures become superfluous as well (Kumar et al., 2006).

Organizations for Water Resources Management

The agencies engaged in water resources development such as the irrigation department, water supply department, and minor irrigation (groundwater) department are entrusted with the mandate of water resources planning and water resource management. Hence, there is a multiplicity of functions with which these line agencies are engaged in. This is against the principle of institutional design for sound water resources and water-related environmental resource management (Frederiksen, 1998). These agencies have no special incentive to manage water resources, including water quality management. This is because their performance is evaluated in relation to the amount of water they supply, coverage in terms of area irrigated or number of habitations covered, and the revenue collected from the same, and not in terms of the water available for environmental flows in the basin, or the quality of water in the river or the aquifer. As a result, they compete with each other and over-appropriate water from the basin. These objectives are in conflict with the larger objective of water resources management. This inherent trade off, which is because of defective institutional design, reduces the effectiveness of line agencies.

Problems are also with organizational structure of line agencies. There is an explicit relationship between organizational structure and functions (Kumar et al., 2000). While structure does not guarantee performance, inappropriate structure is a virtual guarantee for sub-standard performance (Hunter District Water Board 1982:24). As Kumar et al. (2000) notes in the context of Sabarmati river basin, the governance is based on ad hoc norms of minimum design command area--for Circles, Divisions and Sub-divisions--rather than hydrologic system considerations such as basin boundaries. The net result is that different Circles are looking after the irrigation schemes falling in one sub-basin. Similarly, the same Circle is looking after irrigation schemes in different sub-basins. The fact that there is no coordination among different circles of irrigation department working in the same sub-basin greatly reduces the ability to take into account the hydrological system considerations in planning water systems leading to piecemeal approach to water development.. The consequence is that, water in the basin gets over-appropriated (Kumar et al., 2000).

The minor irrigation wing of irrigation department undertaking large-scale construction of small water harvesting structures in the upper catchments of large reservoirs in states such as Rajasthan, Gujarat and Madhya Pradesh is a glaring example of a malfunction, which happens because of lack of coordination between various wings within the irrigation department. As Kumar et al. (2000) noted in the context of Sabarmati river basin, in addition to the major and medium irrigation schemes, several hundreds of small structures were built throughout the basin. They are basically meant to serve as water harvesting and groundwater recharge schemes. Though the storage and recharge capacity of individual schemes is very low, put together they make a significant reduction in the flow of available surface water, which could be tapped by other schemes. But, the planning of large reservoir and diversions schemes in the basin do not consider the impact made by these small structures, which were planned and built by the Panchayat Irrigation Circle based on demand from villages.

Lack of ability to integrate knowledge from disciplines other than hydrology into water resource planning compounds the problem. For instance, the irrigation departments, which deal with the bulk of developed water resources in the country, do not have professionals qualified in environmental hydrology, hydro-chemistry, agricultural sciences and irrigation economics. Often, observations are made by experts to change the curriculum of technical degree courses. Training institutions by far also lack an integrated approach. This is considered to be one of the reasons for the inefficient performance of irrigation sector in the country even after huge investments both by government and international agencies (roughly Rs. 167,384crore on developing major and medium irrigation schemes alone till tenth five year plan).

The absence of a regulatory authority for water resources at the level of river basin or at the state level is another major issue. The very fact about the economic costs as induced by over-appropriation of water in the basin, owing to reduction in stream-flows for ecological and social uses represent major social costs and these costs can be treated as opportunity costs of not having institutions for regulating basin-wide water development (Kumar, 2010). But, such approaches of creating regulatory institutions are criticized by some scholars for the "huge" transaction costs involved (see for instance, Shah and van Koppen, 2006). There is little realization of the fact that as water becomes scarcer, such opportunity costs tend to exceed the transaction cost of creating them (Saleth and Dinar, 1999; Kumar, 2010). Maharashtra is the only state in India which has a water resource regulatory authority. But, how far this agency is effective needs careful examination as it is still in the formative stages. In Tamil Nadu, for instance, 'river basin boards' were created for Palar and Thamiraparani rivers in the year 2000, but they became defunct within two years.

4. Developing Policies, Rules and Organizations for Water Allocation

Policies and Rules for Water Allocation

Developing policies for water allocation calls for a good understanding of the factors influencing: the demand for water and the human behaviour with regard to water use, including pollution, or the factors that are capable of altering the socio-economic systems determining the demands for water. For instance, what kind of policies in inter-sectoral water allocation is required at the basin level if water is very scarce at the aggregate level? People having a sound understanding of physical (agro-meteorological and climatic), socio-economic, institutional and cultural factors influencing the water demands are required here.

The institutions for water allocation can include state regulations as well as market instruments such as property rights in water; water tax and pollution tax, water and electricity pricing etc. Deciding the nature of regulations (whether "top down" or enabling and location specific) and designing effective regulations require sound understanding of laws, and the complex social systems and cultures apart from the characteristics of the water-related ecological system which is to be co-managed with water.

Designing the second type of instruments (market-based ones) requires thorough understanding of environmental economics, institutional economics and agricultural economics along with technical aspects of water productivity, water use efficiency and water quality management. For instance, designing a farm power tariff regime, which is not only capable of producing the desired outcomes of efficient groundwater use in agriculture but also remaining to be economically viable for farmers and financially viable for state electricity boards, would need good understanding of economics of energy production and supply on the one hand and farming conditions and water use efficiency requirements on the other.

Therefore, doing such analysis would require multi-disciplinary skills. Such knowledge and skills are mostly not found with civil engineers and electrical engineers, who manage water and electricity supply agencies, respectively. This stops them from being advocates of policy instruments. More importantly, there are political and social challenges facing introduction of these instruments, which are required for achieving water demand management. For instance, electricity pricing is found to be one of the best strategies to improve the efficiency and sustainability of groundwater use. But, initiative for power tariff reform by ruling party is often fraught with resistance from farming lobby, which is patronized by opposition parties (Kumar, 2005 & 2009; Shah et al., 2004). Similarly, some civil society groups, which promote popular approaches such as community management of water, decentralized water governance, etc., are also lobbying against the introduction of market-based instruments.

Agencies for Water Allocation

There is very little understanding about the nature of organizations which are required for ensuring water allocation that is sustainable, equitable and efficient. This is particularly true in the case of groundwater, given the fact that the resource boundaries are not well defined; there are hundreds of thousands of users accessing water from the same source, who are scattered over large geographical areas; and who are not connected to public systems such as power distribution network as the case with diesel pump owners.

When problems are of great magnitude affecting large geographical areas, the government agencies have questionable ability to create such institutions. The current experience of government agencies and NGOs is mostly with building local organizations, which operate at the level of villages and watersheds, such as the water users' associations and watershed management committees. These organizations are very limited in numbers. There are also problems with the quality of these organizations, which were created to perform certain management functions. The focus of the agencies which are promoting these organizations often is on achieving the targets, rather than facilitating the processes which are essential for institution building (Farrington et al., 1999).

More importantly, research has already shown that most of these institutions are ineffective in internalizing some of the negative externalities (both physical and socio-economic) the local management actions are subjected to. Institutions are required at various levels, and they need to be integrated at the level of basins or aquifers (Kumar, 2000; Kumar, 2007). However, such institutions are absent both at the local level as well as at the basin and aquifer levels.

Private sector participation in carrying out various functions is being suggested as a paradigm shift to improve the performance of water resources agencies. There are evidences from many parts of the world to the effect that private sector participation leads to improved performance of public sector institutions in water (Biswas and Tortajada, 2003). But, there is growing skepticism among civil society organizations in India about the impact of private sector involvement in water management including water resources management and provision of water related services. Political decisions to involve private sector in water management are often unpopular and face staunch opposition from opposition parties and the public alike. However, informal private water markets have emerged in a big way in agriculture as well in urban sector, in response to growing scarcity. While they generate some benefits, they also induce large social cost in terms of over-exploitation of groundwater, provision of poor quality drinking water, etc. The civil society organizations voicing concern over private sector participation are silent on the informal water markets.

5. Human Resources Development

As per one estimate, the water economy in India is growing at an annual rate of 18 per cent and the services in the sector are worth Rs 60,000 crore per annum. It is predicted that at least one million job opportunities are likely to be created in water sector in the next three years in India, as the demand has picked up for wastewater treatment plants and desalinization plants apart from the engineering and design of water applications (Source: Deccan Chronicle, May 6, 2011).

The importance of human resource development in managing India's water economy cannot be over-stated. This is quite clear from the fact that during pre-Independence era, the British, who wanted to run irrigation as a business rather than as a welfare measure, started the first irrigation training college in India. One major issue related to human resource development is the availability of adequate staff in water utilities. Over the years, the irrigation departments across states in India union, which is the largest employer of civil engineers, have been reducing their technical staff strength. While the old staff retires, they are not replaced by newly recruited staff. Many state water departments (irrigation and water supply) have progressively stopped new recruitment. One of the underlying assumptions seems to be that since no new additions to the infrastructure, particularly for irrigation, lesser number of staff should be able to manage the routine works of maintenance and repairs, thereby, improving the staff efficiency. In fact, with both central and state governments allocating substantial amount of money for undertaking land and water management works under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) in a decentralized format, there is a huge demand for trained technical staff to plan, design and execute such works.

While "staff efficiency" is considered to be a major indicator of management performance in various related services, the problem is with the narrow technical criterion being used to evaluate staff efficiency without giving any due consideration to the quality of the service. In the context of irrigation, it is the area irrigated per staff, and in case of public water supply, it is the number of water (tap) connections per staff. Now in the context of irrigation, what is equally important as the area irrigated is the quality, which comprises adequacy, reliability and timing. In the context of public water supply, the per capita supply levels (litre per day), quality of the water supplied, duration, reliability and timing are as important as the number of connections. Obviously, a water supply system, which provides 24 X 7 water supplies, would require much more staff to run and manage the system than one which provides supply for limited hours a day.

The analysis of data on performance of urban water utilities belonging to different categories, viz., metros, Class I cities and Class II cities, shows that the metros, which show remarkably higher physical performance, are characterized by better staffing (in terms of number of staff per 1000 people) and staff composition and greater investment for operation and maintenance. Therefore, if we take the metros as the benchmark for performance improvements of urban water utilities, the smaller towns would need to be equipped with more staff. But, the tragedy of not evolving a composite criteria for measuring staff efficiency is that as the tendency to reduce the staff continues, the services deteriorate to such an extent that the "staff efficiency" itself lowers.

Table 1: Comparison of Average Physical, Financial and Economic Performance and Human Resource Profile of Utilities under Different Classes

Sl. No	Variable	Performance Indicators	Status in		
			Metros	Class I	Class II
1	**O&M Charges**	Per capita WS (lpcd)	160.2	111.9	86.3
		O & M cost per MLD (lac Rs)	8.9	6.9	10.1
		O & M cost per capita (Rs)	518.6	274.9	322.3
2	**Water Supply (%)**	% of population covered	94.6	90.2	89.2
		Demand achieved (%)	96.4	78.4	78.6
		Supply gap (%)	3.6	21.6	21.4
3	**Sanitation**	Population covered (%)	51.7	47.4	51.1
		Area covered (%)	45.4	40.7	48.5
4	**Solid Waste Management**	Waste generated (ton/annum)	1598.0	136.4	27.2
		% of waste collection	88.9	86.3	79.5
5	**Staff**	Water supply staff for 1000 people	0.73	0.55	0.63
		Staff per 1000 connection	12.4	9.3	8.8
		Technical staff in WS (% of total)	21.8	19.1	17.2
6	**Metered Connections**	Total tap connections	4667326	3303030	608735
		% of metering	51.9	40.9	33.6
7	**UFW**	Water Supplied(MLD)	603.7	45.1	7.7
		UFW in %	22.9	13.1	10.9
8	**Treated water**	No. of Treatment plants	92	255	78
		% of towns covered	95.5	62.1	47.7

Source: Analysis based on data from NIUA (2005).

In the context of public irrigation, Uphoff (1991) had pointed out that management of irrigation functions requires many more professional staff than that is required to plan and execute the projects (Uphoff, 1991). This is particularly in view of the fact that irrigation development is no longer restricted to just planning and building infrastructure, but encompasses water allocation decisions, its execution, training of lower level staff of irrigation management concepts, undertaking system operation, and regular maintenance (Kumar et al., 2000). In the context of drinking water supply, the challenge today is more of water quality monitoring for checking water contamination, carrying out regular checks for theft and pipeline leakage, installation of water meters and regular reading, and operation & maintenance of the water supply system, and water quality management. All these require not only more engineering staff, but with additional skills and capabilities in water quality management and water treatment.

The country's ability to deal with future water challenges can be seriously doubted if one looks at the number of engineers that all the institutions in India put together produce. According to one estimate, India produces nearly 200 engineers per million population, against 750 in the United States, and 500 in China (Source: study by Duke University, North Carolina, USA). There are no break-ups available to arrive at a correct estimate of the actual number of civil engineers produced. But, some recent estimates show that nearly 35% of India's graduate engineers are from information technology (IT) and a further significant fraction of the civil engineers move to IT sector in search of greener pastures.

If we make a reasonable assumption that one out of every four remaining engineers are from civil engineering (with the rest belonging to the other core engineering branches such as mechanical engineering, chemical engineering and electrical engineering), a one million population has a total of nearly 32 civil engineers. This is an abysmally low figure, if we look at the requirements in India's rural and urban areas. Again, a large number of them today work in the construction industry, building roads, bridges, fly-overs, railways and airports. Let us assume that fifty percent of them are engaged in construction industries, thereby making the number actually available for water sector to be 16.

India has nearly 2.56 lakh villages. The fact is that every village has some provision for water supply by a publicly managed system, or if absent, is expected to have one in the near future. These water supply systems can be bore well/tube well/open well with overhead tanks, distribution system and stand-post, or a few hand-pumps, or distribution system of a regional water supply system. The communities are not equipped to manage these systems on their own, though there are a few fine examples of community management in certain pockets in the country. We can reasonably assume that a water supply engineer caters to a population of 10,000 people, with one or two technicians under him/her for undertaking the tasks of repair and maintenance. This means, we need at least 1.2 lakh engineers with approximately one for a group of two villages.

Similarly, for public surface irrigation, which cover a net area of around 25 m. ha would require at least 2.5 lakh engineers based on a simple norm that one qualified engineer would be sufficient to cover a total net irrigated area of 100 ha, which includes all tasks related to planning, project execution, operation and management of the irrigation system, India would require a total of at least 2.5 lakh irrigation engineers. In addition, if we want to manage millions of ha of watersheds, which become the catchment of river basins, additional qualified engineers in the field of soil and water engineering would be required. Let us assume that a total watershed area of 5,000 ha (50 sq. km or 10 average micro watersheds) would require one soil & water engineer for tasks related to watershed planning, execution of watershed treatment activities, and supervision of maintenance of watershed structures. Let us also assume that nearly one third of the geographical area of India form good, well-defined upper catchment watersheds of major river basins (20 of them), which require treatment for erosion prevention, soil moisture conservation and runoff regulation. This means, we would require at least 22,000 soil & water engineers. Hence, annually, India would require 3.92 lakh engineers, who can be trained to perform water management related functions. This means, India would require on an average, 325 civil engineers for a population of one million people. What is probably available from the market annually is just 1/20th of this requirement.

Further, one should believe that the technical manpower in public sector agencies in India's water sector currently falls far short of this requirement. One could also infer that this staff deficit would continue for many years to come. The following arguments support this. First: the public sector in India employed only 75,921 engineers (including 33,331 diploma engineers) in 2002 (based on responses from 73.1% of the public sector establishments in India, GOI, nd). Second: the number of employees retiring every year from government departments is nearly 20% of the total number of employees. The public sector agencies advertised for a total of only 17,507 vacancies for engineers (including 4663 diploma engineers) in 2005 (GOI, 2008). If we make the optimistic assumption that the number of new recruits is equal to the total number of employees retiring annually, the total strength of civil engineers employed in public sector would be in the range of 85 to 100,000.

6. Training in Water Sector

There are many training institutions catering to the needs of the country's water agencies such as irrigation department, water supply department, ground water planning & evaluation agencies, and water and land management institutions. But, these institutions were equipped to deal with the issue concerning development of water resources. For instance, groundwater prospecting, geo-hydrological surveys, drilling technologies, and water level and quality monitoring are some of the areas on which these agencies undertake training. Hence, they have largely a technical orientation.

[1] The CPCB network covers 250 Rivers, 78 Lakes, 6 Tanks, 26 Ponds, 8 Creeks, 19 Canals, 19 Drains and 382 Wells. Among the 1245 stations, 695 are on rivers, 86 on lakes, 19 on drains, 19 on canals,6 on tank, 26 on pond (a total of 851 for surface water), 12 on creeks/seawater and 382 are groundwater stations. Water samples are being analyzed for 28 parameters consisting of physiochemical and bacteriological parameters for ambient water samples apart from the field observations. Besides this, 9 trace metals and 28 pesticides are analyzed in selected samples. Bio-monitoring is also carried out on specific locations.

The challenge is to prepare these institutions in handling some of the emerging themes in the sector, such as water resources management, water allocation and water demand management, which have strong ecological, economic and social focus.

For instance, because of resource and staff constraints, the CGWB monitors very few wells periodically across the country, and the Central Pollution Control Board maintains very few stations for water quality monitoring . This severely limits their ability to put together timely management responses. But, proper engagement of civil society groups in resource monitoring can help increase the density of observation stations for water levels and water quality, in a cost effective manner. With the vital database on water resource availability and water quality accessible to the local community, the concerned actors (like the municipality or an industrial unit) would become more accountable to them, thereby directly impacting on water governance. But, this would require many soft skills in managing people.

That the world of professional water resource planners, decision makers and managers is no longer the same as that in the past has been noted by many scholars. As Priscoli and Wolf (2009:8) reiterate in their recent work on Managing and Transforming Water Conflicts: "Today, especially in the context of new demands for integrated water resources management (IWRM), the water planners and managers have to work in teams involving multiple disciplines, rather than just engineering and associated technical fields." Hence, revamping these institutions, with multi-disciplinary focus, to meet the future challenges is a critical issue. Though this has started happening in limited cases, they are rather exceptions than the rule .

Building skills for managing water resources is not limited to building the human resource capabilities of the line agencies alone. It is also essential for the primary users of the resource such as farmers, urban water users and rural drinking water users. This is crucial for capacity building in the water sector.

Capacity building of primary stakeholders can be achieved through training. But, the issue is one of creating adequate number of institutions which are capable of handling this unique task. There is not much clarity on the nature of institutions which can handle these tasks. Whether civil society institutions can handle these tasks, if equipped with adequate resources and skills, needs to be reviewed. Further shortage of essential field equipment for monitoring/extension activities along with lack of funds at the operational level put constraints on carrying out essential capacity building interventions.

That said, the types of skills that the primary water users require for managing their affairs are drastically different from those required by official agencies. For instance, the agency concerned with institutional financing for micro irrigation (MI) systems needs to know, where MI systems produce the intended benefits; and what is the system design that will make MI more effective. Whereas the farmers who want to use the system need to know what type of system (whether a drip system or a micro sprinkler or an overhead sprinkler) is most suitable for his crops. Similarly, the agency managing groundwater needs to know the ways to estimate the sustainable levels of extraction for the aquifers. But, the farmers would be interested in knowing the depth to which the well should be drilled to get good yields and good quality water. Hence, the contents of the training will have to be different for different stakeholders and even across areas.

In sum, the strategies for human resource capacities needs to be tailor made so as to suite respective stakeholders possessing different degree of knowledge, skills, responsibilities and needs. But, there is a major concern on the limited number of skilled professionals and technicians to train, educate, and transfer knowledge and experience to different stakeholders.

As a national and local level capacity building efforts, there is need to develop policy dialogues with all stakeholders in water resources and water services, especially local communities, consumers, public and organizations that relates to water but are outside the water sector proper, decision makers and politicians. These efforts shall be able to increase their awareness and knowledge about their prospective role in water management issues and policy, especially where these affect their future (Alaerts et al., 1999). But, for effective capacity building and awareness creation among stakeholders, information exchange, communication and data-sharing are prerequisite.

The social, cultural, technical, economic and natural environment of the water sector is in constant flux (Wihuri et al., 2003). It must also be recognized that each country and region has its specific characteristics and requirements with respect to its water resources situation and its institutional framework. Therefore, operational strategies for water sector capacity building shall be long-term, with the main objectives of improving the quality of decision making, and sector efficiency in terms of managerial and operational performance in planning and implementation of water sector projects (Hamdy et al., 1998). Thus, there is a need for careful planning, designing and implementation of capacity building activities in order to achieve substantial success in integrated water resources development and management.

Laying Down the Road Map in Training for Capacity Building

Quickly, the Ministry of Water Resources, in collaboration with the state water resources departments should engage in regional consultations with various stakeholders, including officials of government agencies concerned with water resources planning and management, irrigation, water supplies, watershed management, environment, power supply and hydropower generation. The government should consult further the NGOs engaged in water sector, private agencies dealing with drinking water supply, micro irrigation system manufacturing and irrigation pump manufacturing, consulting firms in water, energy and hydropower sectors, academicians and scholars in water, energy and ecology, and representatives of primary stakeholders.

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[2] One example is the Sardar Sarovar Narmada Nigam Ltd., the agency, responsible for implementing the multi-purpose Sardar Sarovar Project in the Indian state of Gujarat, which consists of forest management professionals, agricultural economists and ecologists in its senior management. These professionals are involved in key decision making with regard to project implementation. The agency works closely with several grass root NGOs, for resettlement and rehabilitation of the project affected people (Iyengar, 2011), and for promoting farmer participation in irrigation management in the canal commands (Kumar and Bassi, 2011).

The aim of these exercises will be to identify the training needs in the sector, based on the priorities and concerns expressed and knowledge gaps identified by them. Simultaneously, two or three research/consultancy organizations need to be identified to finalize the training need assessments of personnel engaged in different line functions within water sector.

Based on the assessment of training needs and knowledge gaps, national and state level training institutions could be mandated to design teaching curriculum for professional colleges, and training modules and training materials on various themes. Subject matter experts also need to be involved in preparation of training modules and training materials. The organizations existing to impart training in the specific sectors are often criticized for lack of advanced technical knowledge and skill orientation to impart training. Wherever knowledge/skill gaps exist, new research studies have to be commissioned. No doubt, this would be a long-drawn process, but worth making a beginning.

7. Conclusions

With the advancement of time and growing water scarcity, the priorities for the water agencies of the country have broadened from mere water development to encompass water resources allocation and management. Whereas the challenge facing the primary stakeholders of water is to manage the demand for water, i.e., reducing the demand for water without compromising on the social, economic and ecological benefits derived from its use. But, the institutional capacity building of the water agencies has not kept pace with the changing times. On the contrary, the approach of agencies concerned is becoming largely construction centric. The recent years have seen humungous investment in the water sector for rehabilitation of millions of existing tanks and ponds, and construction of small water harvesting systems under various government schemes. But, there is no focus on capacity building of the agencies which are mandated to undertake this work, which is necessary for physical, economic and environmental sustainability. By saying this, we do not rule out the need for building world-class infrastructure for storage, conveyance and distribution of water, which is essential for solving problems of water shortage facing many parts of the country.

The key to building institutional capacity is framing the right kind of water policies; crafting the right kind of rules and regulations, institutions and instruments; bringing about the needed organizational changes in the agencies concerned for water resources management and sustainable water allocation. The issues faced in this context are: a] building teams of professionals with multi-disciplinary skills, which can provide research and expert inputs for policy formulation, institutional building and design of economic instruments; b] mobilizing resources and skills for creating new organizations including the development of local institutions, and restructuring some of the existing ones; and c] raising the overall strength of technical staff in various departments engaged in water resources development, management and water related services. Finally, availability of sufficient number of professional agencies which can design and implement capacity building programmes for various stakeholders is a critical issue.

Yet, another important factor is the choice of heads of institutions. They could be from any discipline like public administration, engineering, agricultural sciences, public health, ecological sciences or social sciences. But, it has to be ensured that they have proven professional acumen and leadership qualities and are given enough autonomy in their functioning.

The focus of the state and central governments should be on building world-class human resource base, with trainers, researchers and water management professionals with multi-disciplinary skills, engineers and technicians to face the future water management challenges. These challenges lie in framing sound policies and building institutional capacities. Simultaneously, the non-performing institutions, functioning as centres for patronage, punishment and rehabilitation of non-performing professionals, need to be closed down. Further, there is an urgent need for a comprehensive assessment of the available human resources base in the sector in terms of their strengths and weaknesses, which could prepare the base for an effective capacity building policy.

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