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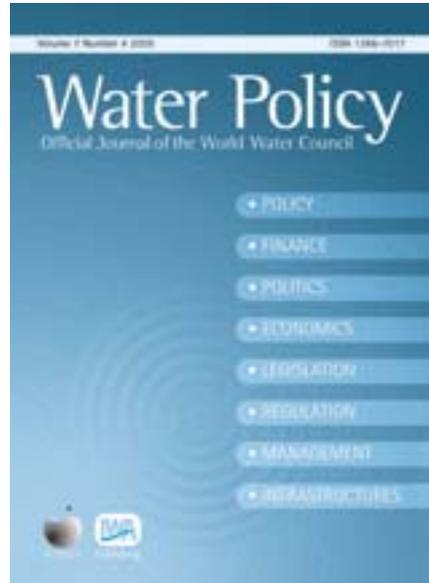
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Water in India: situation and prospects

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Abstract

Although significant progress is being made in the development of water resources in India, problematic management issues remain despite increased funding, a sizeable resource base (though with remarkable spatial and temporal variation) and a vast land resource. A large population and increasing demand pose challenges for water resource professionals, and mean that India continues to struggle to meet its water requirements. A comprehensive review of the water sector was undertaken to provide perspectives on the way forward. Based on an extensive review of the secondary literature and five regional consultations with key stakeholders, the pressures and drivers in the sector were examined. These included changes in water availability and access, and the role of the State and water programmes, the community, market and civil society in providing access and control over water for the people. Recommendations are made and compared with two other significant sector reviews at a national and regional level. There is a broad consensus emerging from these three major reviews, in terms of the focus on key actions proposed; these are in the areas of water resources, drinking water and sanitation for health, data and knowledge, policy and institutions, and capacity and disaster management.

Keywords: India; Water quality; Water resources

1. Introduction

'*What is common to many is taken least care of, for all men (sic.) have greater regard for what is their own than what they possess in common with others.*'

(Attributed to Aristotle)

India is home to 1.2 billion (1.2×10^9) people (GoI, 2011). With 16% of the global population, it has only 4% of the world's water resources (GoI, 1999). India has made significant progress in developing water resources and supporting infrastructure, yet rapid industrial and agricultural development, population

growth and unequal water distribution have resulted in demand for water exceeding supply. Consequently, management of demand across all market segments is extremely challenging (UNICEF *et al.*, 2013). Currently, water availability per capita is around 1,170 m^3 per person per year (NIH, 2010), emphasizing that India is only just above the water-stressed criteria of 1,000 m^3 per person (WRI, 2007), based on GoI (1999).

Issues of concern in the water management domain include: the erratic distribution of rainfall and resulting floods and droughts; inefficient water use; unregulated groundwater extraction; water pollution; and poor water quality due to open defecation, poor waste management laws and inter-state river disputes. These, together with spatial variation in the water resource endowment coupled with poor management, have resulted in a severe water shortage in some communities and led to a growing number of conflicts between agricultural and industrial users, as well as those in the domestic sector (Joy *et al.*, 2011). The situation is exacerbated by climate change, with future predictions suggesting a worsening of the situation due to disturbed hydrological cycles and regional climatic variability (Campbell-Lendrum & Woodruff, 2007).

Effective and efficient water demand management is also undermined by inadequate institutional reforms (Saleth & Dinar, 1999; Kumar, 2010) and the poor implementation of existing provisions that negatively impact on sustainable water service delivery (Cronin & Khosla, 2012). Poor institutional management and insufficient political will also extend to sanitation. India's failure to tackle the prevailing social norms that favour open defecation results in a woefully poor sanitation coverage, and so India shoulders one of the biggest environmental, social and health challenges faced globally.

This paper considers a number of perspectives, including those of resources and competing uses, and draws on three major reviews released in 2013. The first of these was a study, commissioned by UNICEF and FAO, which reviewed India's water sector (UNICEF *et al.*, 2013), the first time this has been undertaken by the UN in India. The study was based on an extensive review of secondary literature and five regional consultations with key stakeholders, and forms the basis for the recommendations made in this paper. These are then compared and consolidated with two other key references. First, Shah (2013) outlines the Government of India's planned approaches around water for the current Twelfth 5-year plan period while, secondly, the Asian Development Bank (ADB, 2013) looks at India within the larger regional water security context. Key thematic issues touched on in this paper that shape policy and implementation in this sector include agriculture and irrigation, industry use, drinking water, sanitation, equity and gender, stakeholder analysis, water governance and overall sector management. Conclusions are then drawn in this paper to inform water sector managers of the way forward.

2. Key intractable issues in the sector

The water sector in India is complex. The presence of sub-sectors coupled with the priorities of different key stakeholders has resulted in competing interests. Demand for water is somehow managed against a backdrop of population pressure, industrial growth, agricultural needs in a climate of water scarcity, climate change and inequitable distribution of drinking water.

2.1. Water scarcity and the need of new indices to measure water budget

Although differences exist in approaches to and estimates of current water supply and demand in India (e.g. Narasimhan, 2008; Addams *et al.*, 2009), there is widespread alarm at the increasing pressures on water resources, and at the disparities between supply and demand across regions (Kumar *et al.*, 2012).

For irrigation systems, the key issue is in choosing a suitable variety of crop, based on water availability and climate. Changing a cropping system to one that is not supported by water and climate leads to heavy reliance on groundwater and its indiscriminate exploitation to meet crop water demands. Water bodies and river systems are not protected, and pollution of water bodies due to indiscriminate disposal of industrial and municipal effluents is resulting in the decline of freshwater availability in many locations. There are legal and regulatory frameworks in place to protect water resources and ecosystems but these require robust institutional arrangements to enforce them, both in letter and spirit. Lack of political will, and social and economic constraints, are among the major hindrances leading to policy-divergent actions. A case in point is the lack of reform of power tariffs in the farm sector to achieve efficient use and sustainability of groundwater (Kumar *et al.*, 2011). Further, the focus of agricultural innovation is more on rice and wheat, whilst dry land agriculture has been neglected. Water demand in agriculture is directly related to choice of crops, and therefore this area needs special attention. The important role of irrigation must be considered – canal irrigation has been steadily declining while groundwater usage has rapidly grown in significance but it is alarming that both these sources are now beginning to hit an upper limit (Shah, 2013).

While it might theoretically be feasible to divert water resources from surplus to deficit regions, as examined in detail by the National Water Development Agency (NWDA, 2012), the ecological sustainability and affordability of such an exercise put major constraints on its implementation. For instance, the Ganga–Meghna–Brahmaputra basin covers a land area of 33% of the country and accounts for over 60% of India's water resources, while the catchment area of rivers flowing west is just 3% of the country but they account for 11% of the country's water resources; indeed 71% of India's water resources are available to only 36% of the land area (Verma & Phansalkar, 2007). There are clearly major technical, social, environmental, legal and financial challenges, apart from issues of economic viability and the protection of local livelihoods to be considered. Diverting rivers can create large dry regions with adverse impact on local livelihoods from fisheries and agriculture (Bandyopadhyay, 2009; Shah, 2013). Even in the areas where water is available, it is important to check sustainability by looking into supply service indicators and customer feedback rather than only supply indicators. As it is, ADB (2013) cites the rivers of Armenia and India as the least healthy within the Asia–Pacific region, and state that these countries are in urgent need of investment in remedial actions to regenerate ecosystem services as a basis for sustainable economies and better quality of life. In short, new ways of looking at water availability are needed, and these must incorporate the massive spatial and temporal variations in the distribution of water resources in India.

2.2. Climate change

Climate change coupled with increasing population pressure have massive implications for India, and Indian water resources already receive a low rating on the disaster resilience index (ADB, 2013). Studies including that by Mohan & Sinha (2009) and Hallegatte *et al*. (2010) indicate that climate change is being felt in the form of unprecedented changes in almost all major ecosystems in India, including adverse effects on the water balance in different parts of the country resulting from changes in precipitation and evapotranspiration. Rising sea levels are leading to increased saline intrusion into coastal and island aquifers, (GoI, 2004). Further threats to water resources include: the receding of the glaciers and snow-fields in the Himalayas; increased drought-like situations due to the overall decrease in the number of rainy days over much of the country; increased flood events due to an increase in intensity of rains, or

increase in frequency of rainfall events; and also the impact on groundwater quality in alluvial aquifers due to increases in flood and drought events (NWM, 2009). Resilient water, sanitation and hygiene (WASH) systems increase the country's ability to absorb shocks and also help to develop productive, stable livelihoods in the face of climate change (see Turnbull *et al.*, 2013).

2.3. Population pressure

In 1991 the per capita water availability was 2,309 m^3 (Sharma & Bharat, 2009); however, by 2001 this had dropped to 1,588 m^3 (CWC, 2010). It is estimated that by 2025 population increase will result in water availability scenarios (UNICEF *et al.*, 2013), which would possibly leave India to face a water scarcity rating of under 1,000 m^3 per person (WRI, 2007).

Demographically, the urban population has grown much faster compared to the rural population, and the challenges of urbanization are increasing. A projected 40% of the population will be living in urban areas by 2030; coupled with this shift, a rising per capita income is driving changes in purchasing power and consumption patterns which will impact the rate of food production, putting further pressure on existing water resources. GoI (1999) projected that India will have to produce 450 million tonnes of food grain by 2050, although Amarasinghe (2012) argues that shifting food consumption patterns mean only 380 million tonnes of food grain will be required; this is still a 75% increase on 2000 levels. For the projected 685 million tonnes of total food production in 2030, 175 million tonnes are expected to come from rain-fed agriculture, which means some 510 million tonnes will still be required from irrigation production (Addams *et al.*, 2009).

Urbanization is also seeing an increase in slum dwellers and it is estimated that some 24% of slums are located around open sewers, with 48% of slums becoming water logged during the monsoon (NSSO, 2010). This situation poses a massive public health and environmental threat. India accepts the regular disposal of untreated sewage into water streams; at most, only one-third of urban discharge is treated (CPCB, 2009), resulting in increased WASH-related disease, pests and (during the heat of the summer) obnoxious smells. Although these issues are recognized at a policy level, little is being done to manage the chronic situation (Planning Commission, 2008; Iyer, 2011). Shah (2013) states that Indian cities and industries need to find ways to grow with minimal water and minimal waste. Disparities in provision are resulting in the urban poor being deprived from not only essential facilities and water and sanitation services but also from the health and well-being benefits of living in a clean environment.

Despite investment in infrastructure and capacity, water utilities in India are not providing a 24/7 service and most urban areas only have a water supply for a few hours of the day (World Bank, 2006) – with the exception of some isolated metropolitan areas of cities like Nagpur, which are looking at new ways of water supply management. The health status of the urban population is further compromised by sanitation facilities. In 2010, only 58% of the urban population used improved sanitation facilities while a further 19% had access to shared facilities (WHO/UNICEF, 2012). According to estimates, beyond mortality and morbidity, the economic loss due to diseases caused by poor sanitation for children under 14 years living in urban areas amounted to Rs 5,000 million as early as 2001 (MoUD, 2009). The human face of this loss is even greater when one reflects that India still loses over 600,000 children every year due to diarrhoea and pneumonia alone (UNICEF, 2012).

Narain *et al.* (2013) describe the implications of urbanization for water security and human well-being in four peri-urban locations in South Asia and show how urbanization processes lead to an appropriation

of water resources at the periphery of growing cities, depriving peri-urban residents of their access to water, in terms of both quality and quantity. Prakash (2014) shows that, over time, an enormous informal groundwater market has arisen in several cities to bridge the demand–supply gap due to increasing urbanization and service provision gaps. Water is sourced from the peri-urban regions, which are usually richer in surface and groundwater, changing the way rural–urban water dynamics play and depriving the rights of people in rural and peri-urban areas close to the cities. The political economy challenges involved in reforming the urban water sector are significant (McKenzie & Ray, 2009).

2.4. Industrial growth

India is the world's 10th most industrialized country, with over 88 different industrial clusters scattered across it (CPCB, 2009) and, for each cluster, water is an integral component. The importance of water in sustaining India's gross domestic product (GDP) growth cannot be overstated. While the industrial sector currently accounts for only 2% of India's total freshwater withdrawals, this is expected to quadruple by 2030 (Addams *et al.*, 2009). An analysis of water use in industry suggests that efficiency of use by Indian industries is significantly lower than other developing countries (CSE, 2004).

The pulp and paper industry, thermal power plants, textile industry, and the iron and steel industry are highly water intensive and all produce waste. Industries in India are increasingly criticized for not taking adequate steps to comply with existing environmental standards and vast stretches of major rivers are severely polluted. In the metro cities and large towns especially, the current boom in the real estate sector has raised the demand for construction sand, leading to a dramatic and unsustainable increase in the mining of riverine areas. This has had a negative impact on the ecosystem as well as on the people dependent on it (Anappara, 2005).

The bottled water industry is one of the fastest growing industrial sectors in India, and the country ranks as the 10th largest consumer of bottled water in the world (Bhushan, 2006). Unchecked expansion of this industry has adverse repercussions for water security in many areas where groundwater is the only freshwater source. With liberalization and increased awareness of water quality, hundreds of bottled water brands have entered the market. This USD 250 million bottled water market is growing at the rate of 75–80% (EAW, 2012).

The issues around water and industry are not new but are urgent. Discourse and regulation in the industrial sector is needed because, although industry is making a significant contribution to economic growth, it also puts ever increasing demands on water resources. Non-compliance with pollution control measures alone is resulting in a disastrous and growing water pollution burden. Shah (2013) states that industry must reduce fresh water consumption and recycle wastewater, which should be incentivized via levies; water audits with oversight mechanisms and regulation are also essential to this strategy, otherwise, the *status quo* will continue as at present.

The price at which water is supplied to industries does not reflect the environmental value of the resource and a lack of implementation of pollution laws leads to industries polluting water in an unchecked fashion. The environmental regulatory framework with respect to soil and groundwater contamination in India is weak but progress in protecting the environment has been made through the application and extension of existing environmental laws, including the Water (Prevention and Control of Pollution) Act (1974) and the Environmental (Protection) Act (1986). There has been an application of proactive concepts, including the 'polluter pays' principle and the precautionary principle, as well as aggressive use of public interest litigation (Costa & Sampath, 2011). Of course, policy also needs

implementation apparatus and India needs to significantly boost its environmental monitoring and protection mechanisms. A model 'bill for the protection, conservation, management and regulation of groundwater' and a 'national water framework law' are proposed by the Government of India (see Shah, 2013) to essentially clarify responsibilities for aquifer protection and water management at the various levels; such initiatives will require strong commitment for their enforcement to be successful.

2.5. Water quality and pollution

Almost 70% of surface water and an increasing percentage of groundwater are being contaminated by biological as well as chemical, organic, inorganic and toxic pollutants (MoEF, 2009). The sources of such pollution include point sources (including industrial effluents and domestic waste) and non-point sources (such as agriculture). The health implications of poor water quality are enormous, and water and sanitation related diseases are responsible for 60% of the environmental health burden in India (Planning Commission, 2008).

The presence of pathogenic microorganisms in drinking water is an extremely important parameter of water quality. The world over, unsafe drinking water, along with poor sanitation and hygiene, are the main contributors to an estimated 4 billion (4×10^9) cases of diarrheal disease, causing more than 1.5 million deaths, primarily among children under 5 years of age (WHO 2011). Open defecation by over 600 million people (WHO/UNICEF, 2012) has been described as India's greatest national shame, and has been linked with under-nutrition and infant mortality (as cited in Shah, 2013).

Surveys have estimated that over one-third of rural ground water sources in India could be microbiologically contaminated, while geogenic (arsenic and fluoride) and anthropogenic impacts (including nitrate but also organic contamination) are also impacting on quality (UNICEF *et al.*, 2013). Much of this contamination is preventable through proper siting of sources and adequate operation and maintenance, coupled with safe sanitation practices (MDWS, 2011) along with integrated management approaches (Biswas & Mitra, 2010). Quite apart from the health and nutrition arguments, India needs to address these issues to accelerate growth to reach its economic potential (Goldman Sachs, 2008).

A uniform 'protocol for water quality monitoring' (2005) was introduced by the Ministry of Water Resources, and a positive recent initiative has been the production of a separate 'uniform protocol for drinking water quality monitoring', in view of increasing risks of geogenic and anthropogenic contamination (MDWS, 2013). Although the Government is working more proactively on the increasing threat of water pollution, it will take very significant political will for these actions to translate into concrete measures resulting in improved water quality (UNICEF *et al.*, 2013).

2.6. Water, gender and equity

In both rural and urban areas, girls and women are engaged in the collection of water for household needs. Evidence shows that this daily chore affects not only their overall health and educational status but also their productive work hours (Seaforth, 2001). Yet women across India do not have control over decisions concerning the planning, implementation and operation of water supply schemes. For example, the National Rural Drinking Water Programme guidelines state that village water and sanitation committee membership should be inclusive, with 50% being women, especially those belonging to scheduled caste, scheduled tribe and other backward classes (MDWS, 2010). However,

strong gender bias favouring men means this policy level guidance is hard to implement on the ground and difficult to monitor, and means in practical terms that there are insufficient gender-balanced inputs on decisions around drinking water site selection that influence access, etc.

In households, women are also primarily responsible for looking after family health and hygiene (ADB, 2009), and hence the burden of inadequate hygiene and sanitation facilities is also borne by them. The risks to women are acute. For example, women living in poor rural and urban settlements and without toilets have to walk ever longer distances in search of a private place to defecate. Each day, daughters, mothers and sisters risk harassment and rape, and the loss of most basic levels of dignity. Police reports in the State of Bihar estimate that over 40% of the incidents of rape in the state happen while women walk to defecate in the open (Times of India, 2013).

The class- and caste-based biases that disadvantage the poorest and most marginalized in society compound gender inequity: 65% of the richest 20% of the population of India have piped water on their premises, while in the poorest quintile only a mere 2% do (UNICEF, 2011). The NSSO (2010) household survey showed that 15% of the poorest quintile of the population has access to a toilet, as opposed to 58% of the richest quintile. Caste- and tribe-based inequity has resulted in deprivation due to social barriers in access and effective use – only 24% of tribal populations but 52% of 'others' have piped water access (UNICEF, 2011). As discussed in Shah (2013), the Government of India acknowledges that there are disturbing reports about social exclusion, with *dalits* and *adivasis* (marginalized low caste and tribal groups) being discriminated against. Furthermore, a huge disparity is evident between the water consumption patterns of the rich and the poor, for example in one part of Delhi, '92% of the water supplied goes to 20% of the population; and the remaining 80% of the population gets 8% of the total piped water supply' (Water Aid, 2006). Thus, access to water resources is governed by power relations in Indian society, with the poor often being differentially excluded from this process. All efforts to augment water supply and 'manage the scarcity' often concentrate only on the technical and managerial aspects, thereby reinforcing existing inequalities.

The safety and dignity of women and girls in India has social and political imperatives. In the water sector there is an urgent need to secure disaggregated gender information, because without such information it is difficult to conduct the required analysis beyond the headlines, or to be informed of the level of difference between genders, classes and castes. The lack of such information is a huge impediment to the way gender and equity issues are addressed in the sector.

3. Systemic challenges

3.1. Role and accountability of key stakeholders

The water domain has a number of key stakeholders, and determining the role and responsibilities of each and ensuring accountability is a complex challenge. The main stakeholders considered here are the government, market (i.e. the full range of private sector from local vendors to international corporations), community and civil society, and all are critical to resolving the challenges faced. Government encompasses state, national and local levels as well as intra-governmental interaction.

Water resources in India are a state subject, with the Union only intervening in issues of inter-state rivers: 'Regulation and development of inter-state rivers and river valleys to the extent to which such regulation and development is under the control of the Union, is declared by Parliament by law to be

expedient in the public interest' (CWC, 2013). However, issues around the role and accountability of government – at Union and state level – remain. Such issues revolve around regulation, and the political and public willingness to secure a robust approach to water governance. Furthermore, there are serious systemic shortfalls in approaches to the public health and environmental health dynamics of water, with little related convergence across the social sectors (Planning Commission, 2010, 2011). The Government of India also recognized this in developing a cross-departmental action plan on water, with technical experts acting as co-chairs (Shah, 2013). The need for robust systems of public health monitoring must extend to water, for water quality testing, for water use, and for the pressing need to improve living conditions through equitable and sustainable water and sanitation service provision. Poor water governance and lack of sanitation is also impacting the nutritional status of India's children, with over 40% moderately or severely underweight (NFHS-3, 2006). The need for an integrated approach to water management is particularly felt in the low performing states and tribal communities. That said, governments in India and beyond are often reluctant to act when there is no expression of public intolerance or demand.

The market is seen by many as a profit-making entity that may exacerbate equity and sustainability concerns (The Hindu, 2010). However, with the enforcement of proper regulations, markets can play a positive role in water service delivery, and in research and development leading to water-related technological solutions. In India, the climate has not yet matured to this point (Blanc & Botton, 2010). There are instances of small-scale private sector involvement, leading to some improvement in service delivery, via increased efficiency resulting from competition among service providers and through a close relationship with local communities. However, this is not the case in most areas given the availability of state aid and/or free water (Blanc & Botton, 2010). Market opportunities abound for water and wastewater treatment and distribution but lack of demand for safe water remains a challenge in rural India (UNICEF, 2010). Public–Private Partnerships (PPPs) can combine the relative strengths of both parties in terms of technology, capacity, local understanding and investment. Of growing interest are public sector water suppliers who become partners to develop their capacity to be effective and accountable public services – such arrangements are called 'public–public partnerships' or PUPs (Hall, 2011). However, PPP models have been criticized as a backdoor entry for the market, and any discussion is highly context specific and needs to be judged with a clear understanding of the current state of governance and the extent to which the roles and responsibilities of the market are clearly defined.

Community participation in a well-coordinated, structured manner is essential to achieve improved water access and management throughout the water life cycle (e.g. Narain, 2004; Kurian et al., 2009; GoK, 2010; Kumar, 2010; Biswas, 2012; UNICEF et al., 2013). However, communities in India are not homogeneous but divided by socio-economic class, caste, tribe, age and gender (Kulkarni, 2011). Models exist for a community's self-regulation, which need to be seen in an overall framework of people-centred development with more political and financial powers for the community to demand, implement, manage and monitor water-related projects. Indeed, such an approach is also called for in the National Drinking Water guidelines (MDWS, 2010), although a critical failing has been the lack of adequate mechanisms for redress (UNICEF, 2010).

Useful lessons can be learned from the substantial experience gained in Participatory Irrigation Management (PIM) in India. Meinzen-Dick et al. (2002) identified the factors affecting organizations and collective action among water users in major canal irrigation systems in India. Their results indicate that water user organizations increase the likelihood of collective maintenance work by farmers, but do not affect the likelihood of collective representation, or lobbying activities, which seem to happen

more spontaneously. Mollinga & Doraiswamy (2005) argued that the community involvement in the PIM programme in Andhra Pradesh was not impressive due to the lack of financial independence given to the community institutions. Vermillion (1997) also argued that the lack of financial and management devolution led PIM institutions to fade in their impact, even after showing some initial success in managing the canal system.

The role of civil society becomes important here as it helps a community to build its capacity, thus enabling community members to manage resources in a decentralized resource management framework. The community may also support other gaps in technical capacity at the level of the resource, delivery, distribution and operation and maintenance (O&M) (Baby & Reddy, 2013), the lack of information about policies and plans, and also help buffer political interference. Their role in having a close watch on the water management process is also important for equitable water distribution and sustainable management of the resource, and the sector would benefit from incorporating them into concurrent monitoring roles (Cronin & Thompson, in review).

These points are borne out from feedback from sector specialists and practitioners from all parts of India (Table 1) who categorized these issues at three levels: upstream, dealing with policy gaps (e.g. dealing with water policy); midstream, dealing with ground-level implementation; and downstream, dealing with the grass-roots perspective. One of the major gaps identified is between a policy and its implementation, with different bodies addressing irrigation, tank systems, watershed development, pollution, etc. This calls for an innovative institutional framework, such as the Water Users Associations being federated into organizations at the micro-watershed, watershed, sub-basin and river basin levels, or Village Health and Sanitation Committee and village level (e.g. Narain, 2004; Kumar,

Table 1. Key gaps at government, community and institutional level in implementation of 'water for all'.

Levels of gap	Government	Community	Institutions
Upstream (policy)	• Multiple ministries (convergence required) • Administrative constraints/transfers • Political interference	• Demand driven government policies • Participation/ representation of community in policy framing	• Water as common pool resource • Multiple demand of water resource
Midstream (implementation)	• Disconnect between policy and implementation; better feedback loop and data consolidation for checking on implementation • Slow progress due to civil strife	• Capacity building and skill development of youths • Linkage of communities with implementers	• Conjunctive use of water • Selection of NGOs/ CBOs
Downstream (grass-root level)	• Policy to reflect on local context • Involvement of indigenous peoples and marginalised people	• Limited involvement of community in planning • Communication needs to be in their own language	• Awareness generation/ IEC should precede implementation • Indigenous practice of water conservation

Source: Compiled from five multi-stakeholder regional consultation workshops held in 2011 (UNICEF *et al.*, 2013); over 150 participants gave their views with participants from government (one-third), academia (almost one-fifth) and the remaining from civil society, ranging from small local organizations to international specialist agencies.

2010). These multi-level institutions emanating from below may be helpful in taking the issue of equity and sustainability further if appropriate decision-making powers are given to them.

Two points emerge: first, it is clear, given the scale and diversity of the challenges facing India's water sector, that all stakeholders need to work together in a focused manner; second, the roles of the different stakeholders are shifting in today's changing scenario. The prime role of the state is to formulate people-centric policies thus ensuring parity but it is also to bring in strong directives for those who violate the existing laws and regulations. The market can support public health messaging or social marketing to create the demand for market products but this needs long-term vision and close working with the institutions holding this responsibility. It is clear from all three sector reviews that communities are key to grass roots success but they also need to be more involved in demand generation, planning and maintenance. When local governments overcome gaps in terms of clear systematic planning and implementation approaches, and communities are sufficiently involved that their collective concerns and suggestions have been addressed, then water supply projects have been successful (see examples in Chapter 7 of UNICEF *et al*. (2013)).

3.2 . Governance deficit

India has a significant governance deficit while dealing with its changing water scenarios. With a sharper vision for water governance, the pressures and drivers that stem from demographic shifts and socio-economic changes, and from industrialization and urbanization processes, could have been better dealt with (UNICEF *et al*., 2013). Governance of water is divided between the central and state authorities with further divisions at sub-state level, with categorization of rules and responsibilities, yet it can be seen that the overall sustainable vision for water development, conservation and management remains weak. There is a dire need for convergence of laws and regulations; too many laws exist and this in turn dilutes the water issue. The coordination and synchronization between departments/implementers and regulators is fragmented, leading to each department acting in isolation and sometimes at cross purposes. Regulatory bodies have not been strict in controlling, for example, the appropriation of water bodies or industrial pollution. There is also a lack of data disaggregation and aggregation in important decision making by the body involved in water planning. Data are generated by different bodies and is sometimes contradictory in nature. The importance of data and their input into management and regulation have been stressed in the Twelfth 5-year plan (Shah, 2013). Much stronger monitoring and corrective oversight, along with political will, are equally essential for finding sustainable solutions to water problems and reducing the current governance deficit in water. As part of the Twelfth 5-year plan, a model bill for state water regulatory system has been drafted which will incorporate water governance at state, river basin, sub-basin and local levels (Shah, 2013) and enforcement will be essential to success.

India's poor water and governance record is well acknowledged by ADB (2013), which sees national water security as being defined by five components: household water security, urban water security, environmental water security, economic water security and resilience to disasters. In a composite index, India is ranked at the lowest level, with national water security being defined as 'hazardous' – which is to say that the national government have in place some legislation and policy on water and the environment but with inadequate levels of public investment, regulation and enforcement. India is thus ranked among the bottom eight of the 49 countries making up the Asia–Pacific region. Interestingly, in general, the better the governance assessment (World Bank, 2012) the higher the water security

assessment, with India being mid-tier in the former and bottom tier in the latter. On a positive note, the issue of WASH and governance is being looked at in more detail by decision makers, with a discussion forum examining this in more detail (Bisht & Cronin, in review).

4. Providing water for all – key actions

Today, the desired policy level outcomes for water in India are not being realized, due to the lack of a coherent and inclusive framework for managing water (UNICEF *et al.*, 2013). Rather, current approaches seem disjointed, isolated and lacking integration. Even holistic approaches such integrated water resource management (IWRM) have had mixed success when attempted due to the complex institutional and technical interests (Shah & Prakash, 2014) which are not currently being coordinated via an oversight mechanism.

Responsibilities for service delivery have been shifting to local bodies, although often these local bodies are unable to adequately cope with the additional responsibilities, due to the paucity of human resources and a lack of awareness and understanding of planning water resource development and management activities. In most states, institutions created for water management at the community level are not accountable and therefore do not have any legal identity. They also lack capacity in merging multiple programmes and schemes (Cronin & Khosla, 2012).

The right to water is acknowledged in the India Constitution (Entry 17 of List-II). However, at the state level, legislation and policies for the different dimensions of the right to water do not get adequate support. In addition, there have to be stronger disincentives for polluting water sources which accentuate the scarcity situation while polluting freshwater resources, and infrastructure for waste water management needs urgent investment. The structures and mechanisms for conflict resolution between the sector and states need urgent attention. Unless these concerns are met, the fact of a citizen having the right to water, even if this is guaranteed in policy or law, will not bring fundamental changes in the way that this water is conserved, managed and delivered.

A key component of a rights approach is the implementation of strong disincentives to jeopardizing citizens' attainment of their rights, for instance by over-extraction or pollution of the water source which would accentuate the scarcity situation, so that ultimately even those suffering from the poorest service provision benefit (e.g. Singh *et al.*, 2012). The Government of India has called for a State regulatory authority to ensure sustainability and meet environmental needs, and 10 key areas for action are identified (Table 2) (Shah, 2013). Shah (2013) stresses that these actions should draw heavily on participatory approaches and that there is a dire need for data collection and analysis to inform evidence-based management. ADB (2013) identifies 12 key areas for the Asia–Pacific region to strengthen national water security (Table 2). The recommendations from the three reports considered here are grouped under five broad categories (see Table 2) and, although the recommendations vary across level, setting, strategy and specificity, key common elements are clearly discernible.

Specifically for India, ADB (2013) stresses the need to build the capacity of those responsible for providing water and sanitation services, especially around sustainability, including effective functioning, financing and demand responsiveness. It highlights this as worrisome because India is increasing investment without building the capacity to adequately maintain systems. It notes that such poorly designed investments may reinforce existing inequities and exacerbate social injustice.

Table 2. Comparison of the key recommendations from UNICEF et al. (2013), Shah (2013) and ADB (2013).

Broad category	UNICEF et al. (2013)	Shah (2013)	ADB (2013)
Water resources (overall responsibility: MoWR)	• New indices are needed to reflect available water resources and take disparity in water allocation and access into account • Water demand is far exceeding supply and leading to inter-sectoral conflicts	• Watershed restoration and groundwater recharge strengthening • Large irrigation reform needed • Breaking the groundwater–energy nexus • Conjoint water and wastewater management in urban India • Reduce/reuse industrial water with water audits and regulation	• Start managing groundwater as a valuable and limited resource • Revitalize irrigation institutions for transformation of irrigation services • Optimize already developed water resources by investing in and incentivizing 'reduce, reuse, recycle' systems • Embrace the challenge of the water–food–energy nexus • Make integrated water resources management a priority • Mobilize additional resources to clean up rivers
Drinking water and sanitation for health (overall responsibility: MDWS, MoUD)	• The time bomb of increasing water pollution is ticking	• New approach to rural drinking water and sanitation required; must be demand driven and participatory	• Need to invest in better sanitation
Data and knowledge (overall responsibility: MoWR, MDWS and MoUD)	• To achieve any headway in gender-sensitive policies, data disaggregation is urgently required	• Development of a water database development and management	
Policy, institutions and capacity (overall responsibility: Planning Commission and oversight mechanism)	• Reorientation and capacity building required for technocrats for a new vision for water management	• New Institutional and Legal Framework, (Ground water law, National Water Framework Law) • Participatory Aquifer Management	• Corporatization of water utilities • New problems demand institutions crafted for current challenges
Disaster preparedness (overall responsibility: NDMA working with line Ministries)		• Renewed focus on non-structural mechanisms for flood management	• Forewarned is forearmed: implementing integrated structural and nonstructural approaches to disaster risk management improves preparedness • Create insurance mechanisms to minimize reliance on disaster relief

Sources: Authors' compilation; Ministry of Water Resources (MoWR), Ministry of Drinking Water and Sanitation (MDWS), Ministry of Urban Development (MoUD), National Disaster Management Agency (NDMA).

5. Conclusions and key recommendations

India's water future is in peril if current management practices and trends persist. The magnitude of the challenges is daunting and a lack of a sharp vision to address them has hindered progress.

Three major recent reviews of the water sector in India have been undertaken. UNICEF, FAO and SaciWATERs (UNICEF *et al.*, 2013) conclude, from an evidence review and regional consultations across India, that approaches to measuring water availability in India must take the disparity in water allocation and access into account. This is needed as water demand is increasingly exceeding supply, leading to more water-related conflicts. In terms of water quality, advocacy for key protection measures is required, sanitation being a critical one. An understanding of gender's importance in water programming is essential and so disaggregated data are needed in this respect. Finally, capacity enhancement for those managing water is urgently needed so that new concepts and approaches, not least participatory approaches, can be integrated into implementation. The Government of India's Twelfth 5-year plan outlines 10 areas to strengthen the sector (Shah, 2013). ADB (2013) takes a regional water security viewpoint from which India does not emerge well. The three reviews identified five broad categories (water resources, drinking water and sanitation for health, data for management, institutional strengthening and disaster preparedness) that need urgent attention. This has helped concrete follow-up actions to be specified, which can be clustered into three overarching headlines:

1. Government should harness community participation, especially for sanitation and for a safe, sustainable water supply.
2. A radical shift is needed by society and local decision-makers to recognize the right to equitable services, especially to ensure improved water and sanitation services for women and girls.
3. Institutional reshaping and strengthening is urgently required with a much stronger institutional and policy regime for the new challenges that India's water sector is facing. This must result in a management and enforcement regime that is evidence-driven.

All stakeholders need to work together to achieve these goals, and there is space for new roles within today's changing scenarios. Positive moves are evident in the Government of India's current planning process but what lies ahead is the even more difficult task of implementing these new planned approaches (Shah, 2013), and ensuring the required monitoring for impact and mid-course corrections happen. This will require strong commitment and an overview mechanism for the various Ministries and Departments to report progress towards impacts that is evidence-driven and addresses the challenges to achieve this. The creation of a high level oversight mechanism is essential to such progress. Much is possible but this requires people and their politicians to be accountable, responsible and willing.

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