1. Introduction
As global water demand grows over the next two decades, India will be one of the most severely affected countries. Its potential supply shortfall could be 50% of possible demand two decades from now (2030 Water Resources Group, 2009). The reasons behind this severe probable shortfall include rapid economic growth, relatively low per capita water availability, and an underdeveloped infrastructure, both physical and organizational.

Absent mitigating responses, much of the projected shortfall will be manifested in agriculture. Traditional rain and river fed agriculture has been supplemented by water storage, surface irrigation and groundwater pumping. The resulting ability to use water in a more assured manner has combined with new seed varieties and use of chemical fertilizers and pesticides to increase yields. However, the current pattern of input use is not sustainable, not only because its use of water is inefficient, but also because of negative long-run environmental impacts.

Economic growth will also lead to changing demand patterns with respect to food, in addition to sheer increases in output. This can potentially increase water requirements, but, as will be discussed below, may also provide opportunities for shifting to more socially optimal water use practices. Increased industrial and urban residential demand for water will also need to be met with new infrastructure.

A further complicating factor in India’s water future is the specter of climate change. Climate change may affect patterns and levels of temperature and precipitation. In turn, these changes can affect groundwater recharge, productivity of prior investments in storing and channeling water, and other investments in agriculture that complement water as an input.

Given these current and looming challenges, water management has assumed greater importance than ever before. Throughout history, agriculture has been a mainstay of India’s economy, especially in providing employment to large sections of its population, and water has therefore been an important resource. Local and state-level disputes over water allocation for agricultural

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use have been common in certain regions, in particular. Nevertheless, the scale and complexity of issues revolving around water as an economic resource have increased very rapidly in just a few years.

A constant thread in discussions of water management in India has been the nature of institutions of governance. At the local level, such institutions can be traditional *panchayats*, reflecting long-standing local power structures, or their modern elected counterparts. State-level institutions of governance include Departments of Water Resources and of Irrigation, and the occasional river basin organization. These state institutions have often displaced traditional local management practices. At the national level, the central government has a Ministry of Water Resources, a Ministry of Agriculture, a Planning Commission, and several other organizations that can affect how water is managed. The center has the constitutional authority to shape the management of river basins that encompass more than one state’s territory, though its past role has often been little more than a referee or mediator in inter-state disputes as they have arisen. This role has been evolving rapidly, as climate change and economic growth together increase the need for a more integrated and forward-looking policy toward water management.

This paper therefore aims to summarize and assess the status of India’s water management in the context of multiple layers of governance. These multiple layers are embedded in a formal constitutional framework of federalism. The division of authority under federalism has advantages in terms of increasing the efficiency of allocation of public goods, by better matching their supply and demand in diverse jurisdictions, as well as supporting non-economic motives for diversity. At the same time, decentralization increases the potential for inefficient externalities, conflicts of authority, and loss of scale economies. This is an inevitable tension in federal systems, and is not amenable to any general resolution. However, at the margins, and contingent on specificities of a particular sector or set of resource allocation issues, there can be possibilities for institutional reform within the federal system that are potentially Pareto improving. The paper seeks to develop policy suggestions along those lines.

Accordingly, the rest of the paper is structured as follows. To set the stage, Section 2 discusses India’s situation with respect to availability and use of water resources. Complementing this stage setting on the institutional side, Section 3 summarizes India’s federal institutions, both general and those specific to water management. Section 4 provides a selective review of past analysis of federal issues in India’s water management, drawing heavily on my earlier work with M. Govinda Rao and Alan Richards. Much of this earlier focus was on inter-state river disputes, though the link to local agricultural use was also tackled. In particular, this work made recommendations for institutional reform to make dispute resolution more efficient. Section 5 provides an update, discussing recent and potential future institutional innovations in managing inter-state river disputes, but going beyond them to consider more microeconomic issues as well as ways of “changing the game,” so that the focus is overall water management, rather than dispute resolution. Section 6 is a summary conclusion.
2. Water Issues

A good place to start in assessing India’s water situation is simply gross availability of water. India has 2.4% of the world’s total area and 16% of the world’s population, but only about 4% of the total available fresh water. The Indian Planning Commission (Government of India, 2008, Table 2.1) reports domestic estimates of 1869 billion cubic meters (bcm) of total water resources, of which 1123 bcm are utilizable. This latter figure includes 690 bcm of surface water, which figure assumes that the requisite storage is built. On the other hand, the 2030 Water Resources Group (2009) reports current availability of only 740 bcm. In this context, the Planning Commission reports per capita storage of 213 cubic meters, less than one-fifth of China’s per capita figure, and an even smaller fraction of that in major developed countries.

On the demand side, the Planning Commission reports current requirements of 813 and 710 bcm, from two different government sources, growing to 1447 and 1180 bcm respectively by 2050. The latter figure assumes substantial increases in irrigation efficiency. The 2030 Water Resources Group, assuming slower increases in such efficiency, estimates demand at about 1500 bcm by 2030, or 20 years sooner than the higher Indian estimate. Both sources emphasize that the position is worse than the aggregate figures indicate, since water availability is uneven. Close to half, or possibly more, of India’s 20 major river basins serve populations who are already effectively facing water-stressed conditions.

Within the context of aggregate and regional water scarcities, there are numerous issues that concern policymakers in India. For example the Planning Commission (Government of India, 2008, p. 43) lists ten manifestations of a perceived “water crisis.” These are, organized by category:

**Supply and Access**
1. Limited hours of drinking water supply in almost all cities.
2. Lack of progress, or even backsliding, in rural drinking water availability, with chemical contaminants an increasing problem.

**Irrigation**
4. Failure to complete larger scale irrigation projects, with cost overruns as well.
5. Lack of maintenance eroding capacity of existing systems.
6. Irrigation investment not leading to commensurate increases in irrigated area.

**Floods**
7. Recurring floods of increasing intensity due to changes in land use.

**Quality**
8. Pollution of rivers and lakes from inadequately treated urban sewage.
9. Contamination of surface and groundwater by industrial effluents.

**Conflicts**
10. Increasing water conflicts of greater complexity, involving different types of uses and sources, as well as quality issues,
Clearly, these problems can be dissected and expanded further. For example, the problem of industrial effluents is multidimensional, reflecting the variety of activities and locations. Similarly, flooding is affected by changes in the hydrological cycle associated with climate change, as well as industrialization and increased agricultural use of land, so that many processes are at work. In other cases, multiple problems are interrelated effects of fundamentally the same causes, as is the case with the irrigation issues. All of these are manifestations of deficiencies in the way that irrigation infrastructure is built and maintained, in turn traceable to deficiencies in the institutions of governance, including, but not limited to, corruption. In fact, an important cause of inefficiency is simply lack of incentives for efficient actions, whether of design, maintenance, pricing, or other aspects of irrigation infrastructure.

If we set aside conflicts, which are in some respects a symptom of the other nine issues, we can also separate them into problems of provision of water infrastructure, maintenance of that infrastructure, efficient pricing, and regulation of externalities. Looked at in this manner, the economics of water issues becomes somewhat clearer. This approach also indicates that the issues highlighted are themselves symptoms of a system that does not provide proper incentives, whether for construction, maintenance, usage or externality control. In turn, the solutions may need to be sought in redesigning the system rather than trying to do more of the same, or to spend more, or try to increase supply through engineering solutions alone.

**Figure 1**

*India – Water availability cost curve*

Before we turn to what system redesign might mean more concretely, the “engineering approach” deserves further elucidation. What we mean by this is technical solutions that neglect issues of human behavior, but not issues of costs and benefits. For example, the 2030 Water Resources Group (2009) report suggests that no-till farming is one of the most cost-effective measures for India to meet its projected future demand-supply gap. Such changes in farming practices may require overcoming behavioral inertia and inconsistencies – doing so would go
beyond the usual “technical” solution. At the same time, technical or engineering approaches ought to take account of costs and benefits – this is often not done in weighing policy alternatives with respect to water issues in India. In this context, Figure 1, reproduced from the 2030 WRG report, is instructive.

Figure 1 shows an estimated marginal cost “curve” for increasing water availability in India. The left hand part of the curve represents interventions that are most cost-effective. On the other hand, the right hand side of the curve has the costliest policies. Interestingly, these include large infrastructure, municipal dams and river interlinking. Therefore, even without considering behavioral and incentive issues, one can come up with a very different perspective on the challenges faced by India in managing its water resources than that provided by the Planning Commission and other government bodies.

The water marginal cost curve and the set of policies and actions on its least-cost left hand side bring out another important point. Agriculture accounts for over 80 percent of India’s water use. Even though industrialization will increase that sector’s demand for water, agriculture’s share will not fall significantly, absent the kinds of changes incorporated in the cost curve. In fact, since agriculture’s absolute water consumption will continue to rise, driven by increasing demand for food and changing consumption patterns as incomes rise, the biggest challenge and the most critical solutions with respect to water management lie in agriculture. In brief, they all involve increasing the water-efficiency of agriculture, as well as overall productivity (conventionally equivalent to land-efficiency). This is very different from augmenting water supply through dams, canals or pumps.¹

Now we can see that system redesign essentially includes changing the nature of agriculture in much of India. Many of the measures on the left hand side of Figure 1 involve process improvements. These changes in processes do not necessarily – or perhaps not even at all – increase overall labor intensity. Therefore this would not be the source of barriers to adoption or innovation. Rather, the issue is presumably one of knowledge and training. These alternative or improved farming techniques have to demonstrated and taught. In other words, the constraint is likely to be human capital rather than raw labor.

All changes in operations can involve switching costs, which may act as barriers to adoption. If there is some randomness in outcomes, due to exogenous factors, it can be difficult for farmers to be convinced of the gains from switching. These problems are compounded if changes in cropping patterns or crop choices are also part of the shift in techniques. That can mean dealing with new kinds of market uncertainties, and new suppliers and buyers. Production choices (outputs, inputs and processes) can also be affected by behavioral inconsistencies, particularly with respect to time. This phenomenon has recently been convincingly demonstrated for Kenyan farmers’ fertilizer choices (Duflo, Kremer and Robinson, 2009). Policies must therefore be designed to overcome these behavioral phenomena.²

¹ It should be emphasized that dams and other measures may be appropriate for flood control. Also, water quality issues require a quite different set of policies, though better farming practices can also help control contamination through excessive or inappropriate fertilizer use.
² In the Kenyan experiment, farmers were given convincing demonstrations of the net gains of increased fertilizer use. However, many failed to follow through on fertilizer purchases, because they spent money on other things
Another perspective on system redesign comes from noting that many of the issues with respect to water management, as well as the cost-effective solutions captured in Figure 1, do not require inter-state coordination. Hence, at the level of center-state relations, one might view the federal aspect of water management to be minimal. Of course, many of the problems and solutions cross local jurisdictions, making state-local relations an important feature of water management. In fact, a recurring theme in discussions of general natural resource management (including forests as well as water and other potential common pool resources) is the relative merits of state versus local (community) management, with incentive efficiency seeming to favor decentralization as much as possible.

One aspect of improved water management that favors higher-level governments is the informational requirements of innovation. State governments ought to be more efficient in trying out, refining and demonstrating new agricultural practices that improve water efficiency and overall agricultural productivity. There are successful precedents in the past, through state-level agricultural extension services and agricultural universities. Unfortunately, the political economy of state policies toward agriculture has favored subsidies that lead to inefficient and wasteful water use, distorting farmers’ incentives and locking the system into an equilibrium that cannot be sustained in the face of economic growth. In this case, it is possible to make an argument for central policies that improve water management. However, these must be considered in the context of India’s federal assignments of authority, and we return to these issues in Section 5, after describing India’s federal framework, and considering how it has worked in the past, both with special reference to water management.

3. Federal Institutions

India became an independent democratic nation in August 1947 and a constitutional republic in January 1950. The Constitution explicitly incorporated a federal structure, with states as subnational entities that were assigned specified political and fiscal authorities. At inception, the Constitution clearly laid out the areas of responsibility of the central and state governments, with respect to expenditure authority, revenue-raising instruments, and the legislative processes needed to implement either. Expenditure responsibilities are specified in separate Union (i.e., central) and State Lists, with a Concurrent List covering areas of joint authority. Tax powers of these two levels of government are specified in various individual articles.

At the state level, revenue authority falls well short of what would allow governments to independently meet their expenditure responsibilities. To some extent, this is a natural outcome of the different driving forces for assigning revenue authority and expenditure responsibility.

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before the time came for applications. The experiment found that free delivery with an upfront commitment of funds was essentially as effective as a 50% subsidy, in overcoming the present-bias of the farmers’ decision-making. Legislative procedures for both national and state levels, particularly with respect to budgets and appropriations, are spelled out in detail in the constitution, and are similar to parliamentary democracies elsewhere, having followed the British model. The quality of functioning of legislative institutions has been criticized, but it remains the case that rules of process are followed quite well.
This mismatch is dealt with through significant intergovernmental transfers. The intergovernmental transfer system involves multiple channels of funding, some ad hoc and discretionary, and others implicit (e.g., subsidized loans). The Constitution provided for the sharing of the proceeds of certain centrally levied taxes with the states, as well as grants to the states from the Consolidated Fund of India. Recent constitutional changes (the 88th amendment, passed in 2000) have simplified the sharing arrangement, replacing it with an overall share of the Consolidated Fund. The shares of the center and the states, and their allocation among different states are determined by a constitutionally-mandated Finance Commission, which is appointed by the President of India every five years (or earlier if needed). This Commission’s recommendations effectively govern the bulk of center-state transfers.

In 1993, after decades of debate on decentralization, two constitutional amendments (the 73rd and 74th) gave firmer legal recognition, enhanced political status, and potentially greater expenditure responsibilities to urban and rural local governments. The amendments reduced state governments’ discretionary control over elections to rural local government bodies. Local government reform also changed the nature of tax and expenditure assignments to local governments by specifying their authority and responsibilities more fully, and it instituted a system of formal state-local transfers modeled on the Finance Commission component of the existing center-state system.

Inter-state river waters involve joint central and state responsibilities, while most other water issues are technically (according to constitutional assignments) state responsibilities. Local water infrastructure is now a local government responsibility, since the passage of the constitutional amendments in 1993. With respect to water, the main relevant provisions of the Indian Constitution are:

- Entry 17 in the State List,
- Entry 56 in the Union List, and
- Article 262.

The first provision makes water a state subject, but qualified by Entry 56 in the Union List, which states: “Regulation and development of inter-state rivers and river valleys to the extent to which such regulation and development under the control of the Union is declared by parliament by law to be expedient in the public interest.” Article 262 explicitly grants parliament the right to legislate over the matters in Entry 56, and also gives it primacy over the Supreme Court in such cases.

In practice, parliament has not made much use of Entry 56. A River Boards Act was passed in 1956 to create river basin-level organizations. Various river authorities have been proposed, but not legislated or established as bodies vested with powers of management. Instead, typically

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4 Two generic problems with government action in India are underfunding of the level of government that has responsibility for action, and lack of clarity of assignments. These problems affect water as well as several other public goods and services. In theory, de jure intergovernmental transfers are supposed to deal with imbalances between expenditure responsibilities and fiscal capacity at lower levels of government. In practice, transfers do not prove to be adequate. The problem is partly due to distortions of incentives created by the method of transfers, reducing incentives for own-revenue-raising. There are also political economy-driven distortions at each level of government, which work against adequate taxation, or lead to subsidies for water and electric power. Finally, some of the problems of effective government action lie simply with inefficiencies in budgeting and fiscal management.
Federalism and Water Management in India – Nirvikar Singh, UC Santa Cruz

river boards with only advisory powers have been created.\(^5\) As a result of the center’s forbearance in this arena, the state governments have dominated the management of river waters. Since rivers cross state boundaries, disputes are inevitable. The Inter-State Water Disputes Act of 1956 was legislated to deal with such conflicts, and included provisions for the establishment of tribunals to adjudicate where direct negotiations had failed. There have been over 100 documented inter-state river disputes in India (Radha Singh, 2003), and only a handful or two have been referred to tribunals. However, these have involved several of the largest river basins, and have proved to be quite intractable, even after lengthy tribunals and supposedly final awards. Details of the issues, prior recommendations, and recent developments are discussed in the next section.

Given the potential importance of innovations in agriculture for managing water resources more effectively, one must note that agriculture is also in the State list of the Constitution. The separation of water issues from broader agricultural issues can present challenges, however, at the state level. Agriculture ministries are typically larger and more powerful than departments of water resources. To the extent that changes in farming practices are required for cost-effective improvements in water efficiency, water policy has to integrally involve agriculture policy makers. Instead, agriculture in most states is being driven by extreme subsidies for water and electric power, which heavily distort water use (the latter by making it inefficiently cheap to pump groundwater). Cropping patterns are distorted as well, and perpetuated by the political power of downstream buyers of water-intensive crops such as sugarcane.

Interestingly, if one examines a document such as the 11th Plan (Government of India, 2008), the first two chapters of the third volume deal with agriculture and water management and irrigation respectively. The first chapter, on agriculture, is replete with discussions of water management issues, including water user associations and other mechanisms for local governance of water resources. Yet the second chapter does not reference the earlier discussion at all, reflecting the tendency to treat water management effectively as management of large scale irrigation works or flood control schemes. It is possible that this dichotomy between approaches at different scales of water management prevents efficient strategies from being implemented. There is also a vertical dimension to this problem, since local governments are responsible for local water infrastructure, but this is not integrated well with authority over other aspects of agriculture, which remains a state government responsibility.

In the broader arena of water management, the central government has been taking a greater role, through its increased attention to rural development, climate change, and, especially, “inclusive growth.” We next describe several aspects of central government policy that are shaping how lower level governments can act. The central government has been asserting itself through national schemes and missions. There are, at any one time, over a hundred central or centrally-sponsored schemes, and these are often fragmentary and poorly implemented. More recently, the central government has attempted to consolidate schemes, or create new ones that subsume, but also extend, older efforts. One example of a new national scheme is the National Rural Employment Guarantee Scheme. Other important national-level efforts have been the Sarva

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\(^5\) River boards include the Tungabhadra Board, Bhakra Beas Management Board, Brahmaputra Board, Betwa River Board, Bansagar Control Board, Ganga Flood Control Commission, Narmada Control Authority, and Upper Yamuna Board all formed by Government notifications or resolutions.
Shiksha Abhiyan (Education for All Mission), National Rural Health Mission (where health is constitutionally a state subject) and Jawaharlal Nehru National Urban Renewal Mission (JNNURM). In agriculture, specifically, a National Policy for Farmers (NPF) has been articulated, and a National Mission for Sustainable Agriculture (NMSA) has been launched. The latter, together with a National Water Mission (NWM), is also part of a National Action Plan on Climate Change (NAPCC). These newer developments will be discussed in Section 5.

Earlier attempts at central attempts to coordinate and guide water management had also been made, though they were somewhat less than successful. The central Ministry of Irrigation, the precursor of today’s Ministry of Water Resources, outlining a proposed study of India’s national water resources in 1980. This led to the formation of the National Water Development Agency (NWDA) in July 1982, to “carry out the water balance and other studies...for optimum utilization of water resources....” This agency is a Government of India Society in the Ministry of Water Resources, and not a body with any statutory authority. Furthermore, its scope is technical, and separate from the institutional realities of water allocation. In 1983, the National Water Resources Council (NWRC) was created by a central government resolution. Its membership includes chief ministers of states, lieutenant governors of union territories, several central government ministers, and the Prime Minister as chairman. This group met first in October 1985, and adopted a National Water Policy in 1987. This policy emphasized an integrated and environmentally sound basis for developing national water resources, but provided no specific recommendations for institutions to achieve this. Though the council was created out of disenchantment with the adjudicatory process for inter-state river disputes, it did not provide concrete proposals to improve that process, nor the useful alternative that was hoped for in its creation.

4. Analytical Review

The traditional approach to analyzing water rights and water disputes is based on legal philosophy and doctrines. More recently, economic arguments have been featured more prominently, while behavioral factors such as identity and emotions (prominent in news accounts of conflicts, and popularly viewed as giving water a special “non-economic” status) have also been incorporated in academic analyses (e.g., Anand, 2004). Richards and Singh (1996, 1997, 2001, 2002), in a series of papers, attempted to reconcile legal doctrines with economic analysis, to examine the causes and consequences of water disputes. They also applied the analysis to the Indian case, as well as others. The discussion here draws on those papers.

Conceptually, there are perhaps three major positions on the principles by which property rights to water could be allocated. These positions have been characterized (Richards 1994) as “Harmon, History, or Hobbes”. “Harmon” refers to the Harmon Doctrine, widely used in the U.S. West, in which the rights of those who own land at the source of the water (e.g., where the rain falls, or upstream actors generally) take precedence over others. The polar opposite doctrine, “History”, refers to the position that the rights of historical users of water, wherever they may be

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6 Again, local governments are a state subject, and technically transfers to local governments must be made by the states. Hence the JNNURM also skirts around these constitutional federal assignments.

7 Gundimeda and Howe (2008) is a recent example that compares Indian and US experiences. See also Gosain and Singh (2004).

8 Behavioral factors also underpin views that the fundamental problem of disagreements is one of lack of “goodwill” (e.g., Iyer, 1994; Mohan et al., 2007).
located geographically, should take precedence over others. Unsurprisingly, Israeli spokesmen often adopt such a position, arguing that since they made the investments and developed the water systems, their rights should come first. Needless to say, these principles of Harmon and History are diametrically opposed in many cases. The third allocation principle dispenses with any concept of prior rights to water. It says that rights to water are what the interested parties agree to; the allocation of water rights is the outcome of a negotiation, a bargain, in which, inevitably, relative strengths will matter. This is the “Hobbes” principle, which asserts that the only way to decide the allocation over property rights is to “do a deal.”

The philosophy of the Hobbes principle is translated into the economics of the Coase Theorem, which says that the efficient allocation of resources is, in certain circumstances, independent of the initial allocation of property rights. The two necessary conditions for the Coase Theorem to hold are:

- “wealth effects” do not exist, and
- there are no transactions costs.

In practice, these conditions are not satisfied in practice, and Richards and Singh (2001) discuss at length the extent of deviation in the case of water disputes. The simple conclusion is that the initial allocation of property rights in water matters. Goodwill will not solve situations of pure conflict, and non-economic behavioral factors assume secondary importance in such “zero-sum” contexts, unless these translate into pure altruism, which is unlikely, especially at a large scale. Therefore, the conclusion of Richards and Singh (2001) is that the conflictual nature of disputes is central to the disputes. In the context of India’s inter-state river disputes, for example, arguments that referring disputes to tribunals creates an adversarial situation miss the point of inherent conflict.9

Given the zero-sum nature of bargaining over water rights, a further complication is that these rights have multiple layers. In the case of inter-state rivers, the focus has been on national and state rights over water, with the center mostly playing a role in trying to resolve or mediate disputes, rather than asserting rights. What is often neglected, except in a piecemeal or periodic manner, is that the users of water are individuals, organizations or localities, and their rights are often ill-defined. Using the example of inter-state river disputes in India, Richards and Singh (1997) formally explore two-level bargaining games, and analyze conditions under which the sequence of bargaining matters. In the inter-state context, the two levels can be the states and localities within the states. This analysis shows that dealing with water rights at the sub-state level may lead to more efficient bargaining at the state level. This shifts the focus to intra-state water management as an important stepping stone to more efficient resolution of inter-state disputes.

One of the problems thus highlighted is the poor state of local water management. Individual states have not created institutions or policies for good water management practices. While there has been some work on water markets and water user associations in India (e.g., Shah, 1993; Saleth, 1998), and there is well-developed general theory on local management of natural

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9 More broadly, when there is a zero-sum bargaining situation, the driver of agreement is often the costs of delay in agreement, such as in Rubinstein’s (1982) seminal analysis of non-cooperative bargaining. Both parties balance costs of delay against their current best options. For example, the party that will lose more from delay will effectively have less bargaining power, and accept a smaller share of a given economic surplus.
resources (e.g., Ostrom and Gardner, 1993; Bardhan, 1995), policy attention in India seems to still be in its infancy (Government of India, 2008, Chapter 1). Theoretical analyses focus on issues of monitoring, enforcement, equity and norms, and essentially on how to overcome free-rider problems inherent in these kinds of collective action situations. There are diseconomies of scale in such cases, reinforcing the need for microeconomic solutions as a basis for state-level dispute resolution. Richards and Singh (2001) point out some of the challenges for creating water markets, including the need to recognize the asset nature of water, and the fact that spot markets must be built on the foundation of asset rights. They discuss problems of information and uncertainty, and the need for regulation to create and enforce the rules of the game.10

In addition to recognizing the zero-sum nature of allocating water rights, as well as the multiple layers of rights, Richards and Singh (1997) emphasize the significance of investments that affect the productivity of water. These can include dams, irrigation canals, tube wells, and even agricultural and supply chain infrastructure. Stories of water-related investments exacerbating disputes, or being held up by the uncertainty associated with ongoing disputes, are common in discussions of inter-state water disputes in India. The Richards and Singh analysis shows that investment by one party in a dispute, by changing the relative productivity of water use across parties, affects the efficient allocation of water rights, even in the absence of direct externalities. Several implications emerge from their analysis, including the benefits of agreement on rights allocation prior to investments, the benefits of cooperative decisions on investments even where there are not direct externalities, and lack of efficient investment as an additional source of costs of delay.

Based on their analysis, Richards and Singh (2002)11 examined several of the major inter-state river disputes in India, including the Krishna, Godavari, Cauvery and Ravi-Beas. These disputes have been the subject of many other studies, and have continued to evolve in the last decade. We discuss some of that evolution in the next section. Here we note the recommendations based on the analysis. First, they emphasize that processes and institutions for resolving inter-state river disputes are not sufficiently well defined or definite. There are too many options, and there is too much discretion at too many stages of the process. They note that, since water is being more and more fully utilized, the possibility of disputes of the conflictual nature arising increases. They recommend that the dispute resolution mechanism be better defined, in terms of the order of the steps to be taken. Another recommendation was automatic and immediate referral of any dispute to a tribunal if requested by the center or any party to the dispute,12 with the tribunal bound to ratify any agreement reached by negotiation before it had delivered its decision.

A second point concerned the extreme delays that have been a very costly feature of the process of resolving inter-state water disputes in India. Richards and Singh identify three components or dimensions of delay: in constituting tribunals, in the time taken for tribunals to decide (including data gathering as well as hiatuses created by attempts at political solutions), and in notifying the

10 An analogy comes from financial markets, where regulators such as the Securities and Exchange Commission in the US, and organizations such as the New York Stock Exchange, manage rules of participation, trading, disclosure and so on.
11 The analysis was originally presented in Richards and Singh (1996), along with the recommendations that are described below.
12 The ability of the center to refer a dispute to a tribunal, rather than waiting for a state to request it, was a modified version of a proposal in the Sarkaria Commission’s 1988 report.
orders of tribunals in the Government of India’s official gazette. The third of these is a general problem with implementing laws as well as tribunal decisions. The first of these would be dealt with by Richards and Singh’s first recommendation. The second source of delay had been addressed by previous bodies such as the Administrative Reforms Commission report of 1969, and the Sarkaria Commission in 1988, and the recommendation, repeated in Richards and Singh, for time-bound decisions was incorporated by amending the ISWD Act in 2002.

The ISWD Act was amended in another manner at the same time, to clarify that tribunal decisions have the same force as Supreme Court orders. Earlier, this had not been explicit, although the original language proscribed the Supreme Court from overruling inter-state river tribunals (Richards and Singh, 1996). The strengthening of tribunals’ legal standing was meant to address concerns raised by the Sarkaria Commission. The commission's report had suggested that the center could not enforce the tribunal award if a state government refused to implement the award. It noted that an amendment of the act in 1980, inserting a section that provided for an agency to implement a tribunal award, was not sufficient, because such an agency could not function without the cooperation of the states concerned. Even with the 2002 amendment, however, it is not clear that enforcement is straightforward. The issue is one of how to ensure compliance, in the absence of feasible penalties. The center can theoretically deal with a recalcitrant state by dismissing the state government, but this is an extreme action that has become less politically acceptable over time, though it was used frequently in the past. Our argument is that if the rest of the process is politically charged, ambiguous and non-transparent, it is more difficult to have the outcome viewed as a neutral judicial order. Richards and Singh (2002) offered recommendations for institutional reform, extending beyond inter-state water disputes, to simultaneously address issues of multiple levels of negotiation and rights, the need for coordinated and timely investments, and the political problems of enforcement. These recommendations are discussed in Section 5.

5. Current Developments

Over time, water issues have become more important in the overall policy agenda, and feature in agricultural policy, urban policy, and climate change policy. An overall comparison of recent government documents with those from the 1980s, for example, suggests a broader perspective on, and more integrated approach to water management. In particular, the NWM offers a comprehensive approach to water management issues in India, framed in the context of the challenges of climate change. The executive summary of the Comprehensive Mission Document describes the goals as follows:

- The main objective of the National Water Mission is “conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management”. The five

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13 State governments have sometimes rejected tribunal awards, as in the case of Ravi-Beas Tribunal and the Punjab government. In this case, the central government avoided notifying the tribunal's award, to prevent further deterioration of a severely conflictual political situation in Punjab. In the case of the Cauvery dispute, the Karnataka government sought to nullify the tribunal’s interim order through an ordinance. Though the Supreme Court pronounced that the ordinance was unconstitutional, the Karnataka government showed no inclination to implement the tribunal’s interim order, until a compromise was reached through political negotiations behind closed doors. These examples can be taken as supporting the position of Anand (2004) that depoliticization is impossible in such cases. However, we offer an alternative perspective in Section 5.
identified goals of the Mission are: (a) comprehensive water data base in public domain and assessment of impact of climate change on water resource; (b) promotion of citizen and state action for water conservation, augmentation and preservation; (c) focused attention to over-exploited areas; (d) increasing water use efficiency by 20%, and (e) promotion of basin level integrated water resources management.\(^{14}\)

Overall, the NWM’s projects are meant to be coordinated with the national and state planning exercise, which amount to an indicative exercise in defining priorities and budget allocations, though often without effective follow-through in implementation. The implementation strategy of the NWM envisages passage of state-level legislation, as well as capacity building at the level of local governments and local water user associations. Plans to improve data collection and national-level efforts in this respect through a dedicated Mission secretariat are more likely to make progress than a top-down process of reaching down to the local level. This is simply because of an attenuation of incentives as national efforts move down the layers of elected governments and bureaucracies. However, a specific two-tier (national-state) coordinating mechanism has been proposed, with various new committees of politicians and bureaucrats, presented here as Figure 2 (Government of India, 2009, Box 2, p. 22).

The NWM itself is under the Ministry of Water Resources, but issues such as watershed development, micro-irrigation, and “water planning for agriculture” would come under the Ministry of Agriculture, so coordination across ministries is also necessary in the NWM. Several other ministries also have charges that impinge upon water management. The NWM proposes incorporating representatives from the various ministries, as well as the Planning Commission, in a high-level steering committee. Probably more challenges lie in the vertical aspects of coordination, and the NWM document notes that much of the expenditure and management required will have to take place at the level of the states. One of the sub-committee reports (Government of India, 2009, Volume 2, p. I/65) floats the idea of incentives to state and local governments for implementing reforms in water management, with a set of possible criteria for evaluation, including subsidy reduction and creation of new regulatory institutions. Clearly, these ideas are in a formative stage.

The main NWM document also makes a mention of engaging with local governments and water user associations, but the discussion is brief and general: “The first and foremost action is to put in place appropriate mechanism for coordinated actions followed by intensive capacity building and awareness programme up to lower most level of management i.e., Panchayati Raj Institutions, urban local bodies, Water User Associations etc.” (Government of India, 2009, Volume 1, p. iv). However, the sub-committee reports in Volume 2 provide some more detail on local level participation and water user associations. The sub-committee on efficient use of water goes back to the exhortations of the National Water Policy of 2002 for “effective and decisive involvement of stakeholders particularly Water Users Associations (WUAs), local bodies and gram Panchayats in various aspects of management of irrigation system,” (p. V/18) and recommends funding for WUAs, as well as a discussion of operational models and supporting legislative changes.\(^{15}\) The sub-committee on groundwater management also emphasizes the

\(^{14}\) Government of India (2009), p. iii.

\(^{15}\) According to the report, there were 41,200 WUAs in India covering 8.68 million hectares at the time of writing. The area covered is a relatively small fraction of India’s total irrigated area, however.
importance of WUAs, and gives examples of successful cases, especially where canal irrigation is jointly managed for groundwater recharge. This integrated perspective on groundwater and surface water management is particularly relevant for India, which relies heavily on groundwater for irrigated agriculture.

**Figure 2**

![Diagram of Institutional Setup for National Water Mission](image)

One weakness in the NWM discussions is the relative disconnect between national and state policies on the one hand, and local implementation on the other,\(^\text{16}\) particularly with respect to linking all the way down from river basin to local level management. Richards and Singh (1996, 2002) had specifically discussed the idea of developing a hierarchy of specialized water management organizations (Government of India, 2009, Volume 2, p. III/25).

\(^{16}\) This is not to say that there is no attention to this issue. For example, the sub-committee on groundwater management explicitly recommends delegation mechanisms from state to district to local governments and water management organizations (Government of India, 2009, Volume 2, p. III/25).
management associations. They had argued that a key deficiency in water management institutions, especially at the river basin level, was the subsuming of inter-state water disputes into the general political process. They argued that in India, federalism, and perhaps the political economy in general, has been characterized by an over-reliance on discretionary allocation, and high influence costs as a result, with the pattern of inter-state water disputes as a prime example of this problem. The solution they proposed was the creation of specialized permanent institutions to regulate the allocation of water across states, including the resolution of water disputes. These institutions would respect the federal structure of the country, but with a greater degree of independence and transparency than the current situation.

Richards and Singh noted that the idea of developing a hierarchy of specialized water management associations had been developed in the context of local water user associations, and federations of such associations (e.g., Meinzen-Dick et al, 1994). They proposed state and national level institutions as linking up and continuing this kind of hierarchical, federated structure, with a national level institution providing an umbrella for actual river boards or river basin authorities. The legislative framework for such bodies exists, and the NWM appears to provide policy thinking that can proceed along these lines. One challenge would be the concern of state governments that they would be ceding too much power to such bodies, and, indirectly, ceding control of their water resources to the center. The proposed solution would uniformly remove a set of decisions with respect to water sharing and use outside the general political orbit, without tilting power towards the center. Thus, the hierarchy of water management institutions, with river basin authorities being the next step down from the national commission, would continue down to WUAs. This multilayered approach can be contrasted with the two-level NWM hierarchy in Figure 2, though the purposes are different (roughly, planning versus operational management).

The Richards and Singh proposals on national and river basin level institutions are still relevant today. Subsequent developments in the major river basins, and the disputes associated with them, have shown that imposing time limits and strengthening tribunals’ statutory authority, as was done in 2002, have not been enough to defuse the most contentious conflicts (e.g., the Cauvery, Ravi-Beas, or reopened Krishna disputes). The idea here is not one of complete depoliticization, but of separation of water management and allocation from broader political maneuvering. As an analogy, the Finance Commission, which decides on center-state transfers from the Consolidated Fund of India, is subject to lobbying and political influence, but also has a reputation for technical approaches, independence and creating and respecting precedents. The linkage to local user management and efficiency increasing measures is also a crucial part of a potential reform of India’s water management institutions.

Returning to the overall NWM report, water recycling, groundwater recharge and rainwater harvesting all receive attention, as do river interlinking and desalination. At this stage, there does not appear to be any prioritization of these methods of water management, based on the kinds of cost calculations performed by the 2030 Water Resources Group, or any other calculations for that matter. There are proposals for significant new research on technical options with respect to managing water resources and use (Government of India, 2009, Chapter 5). The additional funds estimated to be needed under the NWM during the Eleventh Five Year Plan (2007-12) are approximately US$ 6.3B. Half of this amount is for “expeditious” completion of irrigation projects, including extension, renovation and modernization of existing irrigation infrastructure.
To benchmark this figure, the five-year amount is about 2.5% of the central government’s annual expenditure. Micro-irrigation would receive approximately an additional US$ 220M under the NWM scenario. Agricultural practices that make up almost the entire list discussed in the previous section are not part of the NWM funding framework, though they show up in the Eleventh Plan as Ministry of Agriculture efforts, albeit with relatively low allocations.17

Turning to the NPF (Government of India, 2007) and NMSA, it is unsurprising that they both cover issues related to improved farming practices, including better water management. Again, there is little that seems to be concrete in terms of priorities, and unlike the NWM, these documents do not provide any budgetary guidance, or much in the way of institutional responses, beyond noting the importance of local action. These two documents do not appear to be well-coordinated with the NWM document.

Perhaps the government proposal that has received the most attention and caused the most debate has been that for interlinking India’s rivers. The proposal in its best-known form involved two components, one linking the northern rivers flowing from the Himalayas, and the second linking southern, peninsular rivers. The entire plan was projected to cost US$ 125B, and was formulated under the NDA government in 2002, but received continued consideration under the UPA government that came to power in 2004 and was re-elected in 2009. While the plan in its full form has been dropped (Dancewithshadows.com, 2009; Indianexpress.com, 2009), the possibility of implementing some of the links remains alive. Specific river-linking projects in the south have been approved, and Tamil Nadu’s DMK, a key UPA constituent party, has argued in favor of river linking projects that would bring more water to that state. In keeping with our earlier discussion, it seems there are unanswered questions about the cost-benefit analysis of interlinking, even for the most water-stressed regions, especially without considering the alternative of conservation measures and measures for increased water efficiency.

Finally, we discuss urban water use and infrastructure. The JNNURM is concerned with urban infrastructure generally, including roads, though excluding power and telecommunications. Through this effort, the central government is providing project-based assistance to cities. Again, this is technically through state governments, to respect the constitutional division of powers (local government being a state subject), but effectively another example of centralization in the working of the Indian federal system. General urban renewal also includes water supply and waste management infrastructure:

“(1) Urban renewal, that is, redevelopment of inner (old) city areas [including widening of narrow streets, shifting of industrial and commercial establishments from non-conforming (inner city) areas to conforming (outer city) areas to reduce congestion, replacement of old and worn out pipes by new and higher capacity ones, renewal of the sewerage, drainage, and solid waste disposal system etc.].”18

The Mission also includes water and sewerage more specifically:

“(2) Water supply (including desalination plants) and sanitation.
(3) Sewerage and solid waste management.
(4) Construction and improvement of drains and storm water drains.”19

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17 Government of India (2008), Appendix.
The Mission also covers community baths and toilets in urban slums, these projects also having a water supply component.

In terms of mitigation options for India’s potential water shortages, urban water supply and sewerage is a necessary corollary of growth, but at the same time is not a critical contributor to future potential shortfalls. Sanitation and waste management are vital needs in urban India, where access to water is below the levels available in cities in comparable developing countries. The JNNURM channels funds to municipal governments that may not have adequate tax revenues of their own, and which are often not receiving adequate transfers from their respective state governments. Some of the larger cities are in a position to raise funds for investment through municipal bonds, but that channel is relatively underdeveloped in India. Overall, while measures that are enabled by the JNNURM are not the most cost-effective in terms of India’s aggregate water-marginal cost curve (Figure 1), they make sense based on a broader economic and social calculus. Finally, the driver of the JNNURM is the need to prepare India’s cities for continued urbanization of the country, and issues of water availability are peripheral from that perspective, though ultimately actions elsewhere in the economy will be required to release enough water for urban expansion.

6. Conclusion

India faces severe but manageable challenges with respect to water resources, over the next two decades and beyond. Overall, government responses to current and future water challenges in India have been broad, and display the beginnings of an integrated approach to water management. The quality of analysis of specific issues with respect to managing water resources is higher than in the past, but prioritization and rigorous cost-benefit analysis remains to be accomplished.

Translating national policies and strategies into state and local action remains a challenge, as it has been in several other sectors. Local management of water resources is making progress, but only covers a small fraction of the nation’s water resources. One of the biggest gaps is in connecting river basin management with local management, through a chain of institutions that achieves vertical coordination as well as incentive efficiency through decentralization. Inter-state river disputes continue to present challenges for India’s polity, and probably are best addressed by shifting the focus to continuous management and away from dispute resolution.

Coordination across ministries, particularly those responsible for agriculture and for water resources, will also be difficult challenge in formulating and implementing national-level water policies. Although the Planning Commission provides mechanisms for sectoral views across ministry-level boundaries, and for national-state coordination, its ability to influence and monitor implementation remains severely limited. Getting funds down to the level where they are best spent, building the capacity for appropriate spending decisions, reducing spending distortions due to rent-seeking, coordinating complementary innovations, and policy design to appropriately influence behavior are all significant challenges. These are general problems of Indian federalism, and the management of water resources from national down to local levels exemplifies these structural challenges of India’s federal system.
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