Chapter 2
The Precept and Practice of Integrated Water Resources Management (IWRM) in India

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Abstract Integrated Water Resources Management (IWRM) has been advanced as a response to growing problems of water scarcity in the developing world. While the precept of the IWRM process is unexceptionable, its practice has meant a package of interventions. The trouble with the 'IWRM package', and indeed the global water governance debate as a whole, is its intent to transform, all at once, a predominantly informal water economy into a predominantly formal one—something that would normally be the result of a long process of economic growth and the transformation that comes in its wake. In the IWRM discourse, formalizing informal water economies *is* improving water governance. But evidence across the world suggests that there is no shortcut for a poor society to morph its informal water economy into a formal one; the process by which this happens is organically tied to wider processes of economic growth. When countries try to force the pace of formalization, as they will no doubt do, interventions come unstuck. Interventions are more likely to work if they aim to improve the working of a water economy while it is informal.

Keywords Informal economy • Governance • Institutional arrangement • Economic growth • Groundwater

2.1 IWRM: A Response to Water Scarcity

Water scarcity has emerged, especially during the past decade, as an important theme in discussions on India's socio-economic future. Indeed, by 2025, by many accounts, much of India is expected to be part of the 1/3rd of the world destined to face

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absolute water scarcity (Seckler et al. 1999; Cosgrove 2003; Cosgrove and Rijsberman 2000; Rosegrant et al. 2002). The intensification of water scarcity is expected to play out in myriad different ways with variegated consequences. A major consequence will be the deepening of 'water poverty', a phrase used to indicate difficulty people face in securing adequate and reliable access to water for productive and consumptive uses. A related concern is also the deterioration of water environment, reflected in drying up of wetlands, deterioration in water quality, desertification.

Global discussions over the past decade have resulted in a variety of viewpoints about how best developing countries can cope with this imminent condition. At one extreme, researchers suggest that crying need is for honing even more than in the past the social capacity of communities and societies to *adapt* to water scarcity (Ohlsson and Turton 1999; Wolfe and Brooks 2003). However, a more widely shared view is the urgent need to make a transition from water resource *development* mode—in which countries like India have been steeped since 1830s when Arthur Cotton rebuilt the grand anicut on Cauvery—to water resource *management* mode by embracing Integrated Water Resources Management (IWRM).

At one level, IWRM is a philosophy. Global Water Partnership (2000) for instance defines it as "a process which promotes coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems". This is hard to find fault with. However, at an operational level, IWRM even though fuzzy (Biswas 2004), is centrally about *integrated* and *direct* management of sectoral and aggregate water *demand*, something which is absent in most developing countries. As distinct from the supply-side focus of public policy action in water sector—of governments as well as donors—on 'developing' the resource by investing in infrastructure, IWRM discussions emphasize the need to embrace demand-side management. In many low-income Asian and African countries where it has been aggressively promoted by international agencies in recent years, the 'IWRM package' has basically included a clutch of following instruments:

- ***A National Water Policy*** so that there is a cohesive, well-understood normative framework to guide all players in the sector.
- ***A water law and regulatory framework*** for coordinated action for sustainable water resources management;
- ***Recognition of the River basin as the unit of water and land resources planning and management*** *and creation of River Basin Organizations* in place of territorial/functional departments;
- ***Treating water as an economic good*** *by pricing water resource as well as services*, especially outside life-line uses, to reflect its scarcity value so that it is efficiently used and allocated to high value uses;
- ***Creation of water rights***, ***preferably tradable***, *by instituting a system of water withdrawal permits*;
- ***Participatory Water Resource Management*** with involvement of women so that 'water becomes everybody's business'.

In dozens of developing countries, adopting IWRM has essentially meant implementing variations of the above package. India's various enunciations of National Water Policy, including the latest in 2012 (Government of India 2012) have sworn by several of these principles. In Sri Lanka, for instance, the 2001 draft water policy and water law provided for establishing state ownership of all water, the institution of water use rights through withdrawal permits, pricing of water in all uses, transferable water permits to encourage trade in water rights, replacement of existing water organizations by river basin organizations (Samad 2005). Embracing the above, it is implied in the IWRM discourse, will help alleviate *water poverty* by improving access to water and minimizing environmental ill-effects associated with current patterns of water resources development in developing countries like India (Lawrence et al. 2003). Among several things, IWRM involves working to improve the potency and effectiveness of three pillars of the water institutional framework: water policies, water laws and water administration in managing the water affairs of a society through a new emphasis on direct water demand management (see, e.g. Bandaragoda and Firdousi 1992; Merrey 1996; Frederiksen and Vissia 1998; Holmes 2000; Saleth 2004; Saleth and Dinar 2004).

This new class of concerns has put on the backburner an earlier class of yet-to-be-resolved concerns about the limitations of 'supply side initiatives' with which India and many other developing countries struggled during the 1970s through the early 1990s. These had to do centrally with the need for and the efficiency of appropriate water infrastructure and services, promoting their financial and social sustainability, improving the performance of irrigation, and water supply and sanitation projects along several dimensions and at multiple levels: techno-economic efficiency; cost recovery; spatial and social equity in access to project benefits; investment in operation and maintenance, and so on. There were major issues of institutional reforms in public irrigation projects as well as rural and urban water supply and sanitation projects with emphasis shifting back and forth between reforming the bureaucracy to user-participatory management to public-private partnerships. In these discussions, the focus of analysis and action was squarely at the level of the user, community or a project; and the concerns of researchers and practitioners were about techno-economic efficiency, equity, socio-economic and environmental sustainability of infrastructure investments. Even before these issues have begun to get resolved, the IWRM paradigm has begun to shift the locus of policy discussions from improving *water infrastructure and services* at community and project levels to improving the management of *water resources* at the level of river basins.

2.2 Water Poverty: Is It Caused by Water Scarcity?

A critical implicit assumption underlying the IWRM discourse is that water poverty—reflecting lack of access to water for productive and consumptive needs for communities—is a result of the water scarcity and the failure of water institutions and policies to counter it. If this is indeed the case, then, embracing IWRM can be a big answer to water poverty of nations. But is this really the case?

The Water Poverty Index (WPI) covering 147 countries published by researchers from Keele University and Centre for Ecology and Hydrology, Wallingford, UK in 2003 provides a readymade global data base to explore the relationship between water poverty and water scarcity (Lawrence et al. 2003; Sullivan and Meigh 2003).[1] Table 2.1 below summarizes the results of multiple regression results that underpin our discussions in the above paragraphs. The data set for 147 countries used is the one compiled by Lawrence et al. (2003). The regressions use the WPI and component indices as dependent variables; Human Development Index (HDI) as well as Purchasing Power Parity (ppp) _-adjusted GDP are from UNDP 2003. Figures in round brackets below B-coefficients are standardized B-coefficients and represent the relative significance of included explanatory variables in explaining the variations in the dependent variable. Figures in square brackets are values of the t-ratio; for the sample size of 147, any value of t-ratio above 2.0 is significant.

Table 2.1 Determinants of water poverty of countries

	Dependent variable	Intercept	B-co-efficient for				
			Index of water resource availability (0–20)	Human development index (0–1)	Index of GDP/capita (PPP adjusted in '000 US$) (0–1)	Square of GDP per capita in US$)	R^2
1	Water poverty index (0–100)	17.761 (12.261)	1.086 (0.433) [13.048]	43.283 (0.796) [24.022]			0.842
2	Water poverty index (0–100)	20.646 [12.765]	1.205 (0.482) [12.508]		39.574 (0.764) [23.65]		0.788
3	Index of access to water (0–20) (WAP index)	−3.491 [−3.743]	0.037 (0.029) [0.691]	24.307 (0.867) [20.95]			0.754
4	Index of access to water (0–20) (WAP index)	−1.862 [−1.845]	0.103 (0.080) [1.721]		22.22 (0.831) [17.863]		0.691
5	Index of water environment (0–20)	7.215 [12.331]	0.138 (0.292) [3.962]		3.804 (0.388) [5.273]		0.227
6	Index of water environment (0–20)	15.09 [10.806]	0.149 (0.314) [4.773]		−23.778 (−2.425) [−5.191]	21.638 (2.842) [6.082]	0.387

[1] The approach and methodology used by these researchers were similar to those used for computing the Human Development Index (HDI) (see, UNDP 2000). The index was constructed by combining five component indices that cover water resource endowments, access to water, human capacity, water use efficiency, and quality of water environment. Each of the five component indices was given equal weight to generate the Water Poverty Index that takes values in the range of 0 and 100, the higher the value, lower the water poverty.

Like the global discussions, the authors of WPI too subscribe to the 'water-scarcity-determining-water-poverty' hypothesis when they say their aim was to 'express an interdisciplinary measure which … indicates the degree to which water scarcity impacts on human populations' (Lawrence et al. 2003). But is this hypothesis borne out by global database painstakingly compiled by the WPI authors themselves? A regression of WPI run on water resources per capita of the 147 countries suggests no direct relationship between the two. It might be argued that the real indicator of water poverty is "Water Access Poverty (WAP)" sub-component of the WPI suggestive of the levels of 'water welfare' achieved. However, the correlation between WAP index and water resource endowments too was found to be low. For nearly every level of per capita water resource endowments, we find countries which are at the bottom as well as top of the WAP index. A least-square line fitted to WAP index and per capita water resource endowment of countries turns out to be virtually flat, suggesting no relationship of quantitative significance between water endowments of nations and the water welfare of their citizens. Laos, Nicaragua, Cambodia, Bangladesh, Sierra Leon have much higher per capita water endowments compared to Egypt, Saudi Arabia, UK and Mauritius; yet the former are far more 'Water Access Poor' than the latter.

These analyses show that while water availability has only a weak relationship with overall socio-economic development, WAP index is strongly related to the HDI. The higher the HDI of a country, lower the water poverty, *regardless* of a country's water endowments. Our analyses support an even bolder hypothesis that WAP is strongly and positively related to per capita GDP (adjusted for ppp) (see regression 4 Table 2.1).

In exploring the relationship between the quality of environment and levels of economic development, researchers have already postulated and tested the 'Environmental Kuznet's Curve' which would suggest that as countries begin from low levels of economic development, the quality of their environment first declines as intensive economic growth uses natural resources as 'factors of production' (Bhattarai and Hammig 2001). However, as levels of living improve, growing demand for 'environmental amenity' generates pressures to seek avenues for economic growth that are light in the demands they make on scarce natural resources—what Gleick (2002) calls 'soft water path'. If this were true, an index of environmental quality would show an inverted U relationship with levels of economic growth. Our analyses based on data from 147 countries supports this inverted U relationship in regression 6 in Table 2.1 (note: the higher the value of the index, lower the quality of water environment). It suggests that as levels of material well-being improve for a majority of a country's people, need for clean water environment becomes a concern for the majority rather than just the environment groups, governments and international donors.

In regressions 1 and 2, besides HDI and GDP respectively, water resource endowment is statistically significant and has a large standardized B-coefficient, likely because water resource endowment is a component of WPI. In regressions 3 and 4, where WAP—the true measure of water welfare of a country—is the dependent variable, however, water resource endowment variable turns insignificant and its standardized

B-coefficients are very small, too. These suggest that water resource endowments have no relationship with the water poverty of nations. In these regressions, HDI and GDP per capita emerge as the key determinants of WAP with large t-ratios as well as standardized B-coefficients. Regression 5 suggests resource availability as well as GDP are significant determinants of water environment; but the overall fit of this regression improves greatly (as suggested by the increase in R^2 in regression 6 when the squared value of GDP is added; it emerges as highly significant, turns GDP co-efficient into a negative value thus suggesting better fit for a U-shaped relationship).

2.3 IWRM in an Informal Water Economy

There is a need to unpack this apparently neat relationship between water poverty and overall economic growth. Many people find it hard to accept these results because it apparently leads them to conclude that low-income countries like India have little or no scope to improve their water resources management; and that economic growth is the only path for them to reduce their water poverty. A more logical conclusion to draw from this analysis is that, in order to be effective, water resource management strategies of nations have to be *context-specific*; and the defining aspect of the context that matters is the position of a country in the evolutionary process of economic development rather than its water resource endowment (see also, World Bank 2005). This analysis raises questions about the usefulness of the one-size-fits-all frameworks—such as the IWRM paradigm—that dominate global discussions about how developing countries can put their water sectors in order. Use of economic pricing and withdrawal permits to encourage efficient allocation and use of water, transforming irrigation bureaucracies into river basin organizations for Integrated River Basin Management, enforcing laws to regulate groundwater pumping and controlling non-point pollution of aquifers are some of the stock policy reforms that are commonly recommended because these help orderly functioning of water economies in industrialized countries; however, evidence is mounting that many of these reforms are unimplementable in developing countries.

The constraint developing countries run into in implementing these arises from the highly *informal* nature of their water economies; and this has nothing to do with their water scarcity or abundance but has everything to do with their being at early stages of overall economic development. By definition, an informal economy is that part of the economy that remains outside formal mechanisms of governance—law, policy and administration (Fiege 1990). Incorporation of informal economies into what economic historian Douglass North (1990) called the 'modern transactions sector' occurs gradually as part of overall processes of economic growth. Until substantial proportion of a sectoral economy gets formalized, it would be well nigh impossible to bring it meaningfully within the ambit of formal structures of direct governance. In the context of developing countries like India, paradigms like IWRM—advocating direct demand management—are then fundamentally at odds with the highly informal nature of their water economies.

Take the case of India. Government documents claim that protected water supply[2] covers 95 % of the country's rural habitations. Yet a large nation-wide survey in 1998 that reached out to some 130,000 rural and urban households showed a different picture (NSSO 1999a: report 449) showed that nearly 80 % of India's rural households surveyed self-supplied their domestic water requirements—from domestic or irrigation wells, tanks, ponds, streams, etc—and were not in contact with *any* service provider or public or community agency in the formal sector. For urban households, the opposite held with over 75 % of the households 'connected'—which suggests that as India urbanizes, growing proportions of its population would come into contact with formal water service providers. Comparing the data across states suggests that in poorer states like Bihar and Uttar Pradesh, all or most rural households self-supply their domestic water, where as in somewhat better-off states such as Haryana, Punjab and Goa, domestic water supply gets increasingly 'formalized', suggesting that even rural households begin getting connected to some public water supply system as village economies grow, regardless of water resource endowments. Studies in six Indian cities during 2003 showed that economically strong households were much more likely to be connected to public water supply systems and poorer ones either self-supply or rely on informal sector service providers (Londhe et al. 2004).

The picture with irrigation is no different. Many researchers have shown that although under the control of government bureaucracies, at the grassroots levels, India's canal systems are barely functioning anarchies, with informal institutional arrangements ruling the roost. Even if we assume that farmers served with irrigation by canals are in some sense connected to the 'formal water economy', the National Sample Survey of 2002 (NSSO 2003) of 4646 villages throughout India showed that government canals have increasingly lost out in relative share of irrigators: over 80 % of sample villages used irrigation mostly from wells but also from tanks, and streams without being connected with, or under *direct* administrative influence of, either the irrigation bureaucracy or any other formal agency. This is village-level data; but much other evidence can be adduced from household level surveys in support of the fact that there is a great deal more irrigation going on in India than is acknowledged; and over 4/5th of this is in the informal sector. Similar impression emerges about the ownership and management of village water infrastructure. The NSS 54th round of survey (NSSO 1999b, report 452: 46) in 1998 of 78,990 rural households in 5110 villages throughout India suggests that 90 % of water infrastructural assets used by survey households were self-managed (and owned) by households; only around 10 % were owned and/or managed by government or local community organizations.

This predominantly informal nature of India's water economy raises questions about the reach of the 'three pillars' of water governance: water policy, law and administration. It also raises questions not so much about the need for but about the practicality of implementing water pricing, basin level water allocation, and water legislation in

[2] Which presumably means water supply through a local community-based or municipal body that takes some responsibility of quality.

the Indian context. How to collect a water service price or a water resource fee or use river basin agencies to allocate water amongst sectors and users if by far the majority of users self-provide their water needs without being connected to any formal agency? Likewise, how does any administration effectively enforce a groundwater law if 20 million farming households owning irrigation wells are strongly opposed to it, and the rest are indifferent or weakly opposed to it, especially when the administration is an instrument of a State that styles itself as a democratic welfare state?

2.4 IWRM Experience in Asia and Africa: Lessons for India

It is not surprising then that IWRM type policy interventions that many governments in Asia and Africa have adopted under the influence of global water discourse have produced doubtful outcomes, besides deflecting them from addressing here-and-now supply-side issues in their water economies. During the past decade, the government of Sri Lanka has made two bold but abortive attempts to push through aggressive IWRM-style reforms in the water sector. The latest draft water policy and water law provided for: (a) establishing state ownership of all water, (b) institution of water use rights through withdrawal permits, (c) pricing of water in all uses, (d) transferable water permits to encourage trade in water rights, (e) replacement of existing water organizations by river basin organizations—in sum, copybook IWRM reforms. The media and civil society however took to the turf bitterly opposing the very logic underlying the proposed reforms (Samad 2005). The government withdrew the reforms in a hurry; however, little thought was given to how exactly would their provisions be implemented had the new water policy and law got passed.

Many South East Asian countries—notably, Thailand, Indonesia and Vietnam—however, faced no such opposition from media and civil society and swiftly passed water laws that incorporated key IWRM instruments including formation of river basin organizations, registration of water users and issue of withdrawal permits as a mechanism for creating tradable water rights, participatory management of irrigation systems through service contracts between agencies and users, and so on (Molle 2005). Molle, however, found little match between the reality of the water economies of these countries and the reforms borne out of 'a global water discourse largely driven by international organizations'. His review of the experience with IWRM in Mekong led him to emphasize "a gap between formal and state-centered initiatives and reality on the ground, which proceeds at a different pace. Lessons learned elsewhere are certainly important but cannot be adopted indiscriminately and must not be allowed to crowd out the emergence of endogenous and condition-specific solutions." In brief, IWRM came unstuck.

A similar feeling was echoed in a 2005 African Water Law workshop about donor-induced IWRM style water policy reforms in many African countries (see Shah and van Koppen 2005). With the onset of the 1990s, many African countries took to IWRM wholesale. Almost everywhere, thinking about improving the functioning of the water economy involved little effort to fit policy reforms to the

local reality. Almost everywhere, water reforms: (a) declared water as state property, (b) instituted water withdrawal permits, (c) made water pricing mandatory for all but domestic uses, and (d) led to the formation of river basin organizations with water allocation mandate in water economies where the bulk of the water diverted is (and most of the water users are) in the informal sector with little or no direct contact with formal water agencies.

Institutional reforms take a long time to sink and produce desired impacts; in Africa, however, evidence is already piling to suggest that IWRM reforms seem to have done little to improve anything; instead, they created undue tension, hassle and in extreme cases, dispossession of the poor. In particular, the Workshop identified four problems:

(a) the aims that the water reforms seemed designed to achieve did not reflect the current water sector priorities of the countries as viewed by national policy makers, civil society and citizens;
(b) reforms touched only a small formalized segment of the water economy and a tiny proportion of water use and users; as a result, their impacts on the water sector were neither deep nor broad;
(c) however, they threatened disintegration of customary laws and institutions evolved and used by communities; these are never ideal, but they are time-tested, robust and perform their basic functions well; and
(d) they also created serious distortions, threatened dispossession of large numbers of poor, and created new vested interests; these potentially deleterious impacts were limited only by the fact that almost everywhere reforms failed to stick, laws remained largely unenforced, water prices remained uncollected.

What, then, went wrong with Africa's and Mekong countries' water reforms? Several things, it seems. Many countries just copied laws made elsewhere, just as several states in India have blindly copied Andhra Pradesh's law on participatory irrigation management, and Pakistan Punjab has copied the water law of the state of Colorado in the USA. In Africa too, countries did a 'copy and paste', for example, of parts of the South African National Water Act. Without consultation, public participation, and a serious attempt to fit reforms to the context, the impact of these reforms was bound to be negative if at all. And now, Ghana is having second thoughts on its reform strategy and going back to the drawing board.

In Africa, as in some Asian countries like Sri Lanka, international agencies and global thinking rather than analysis of local context and need has had a powerful influence on the design of water sector reforms. Tanzania is a case in point; its 1991 water policy identified water development and provision as a key national policy goal and argued for more water storage creation. However, creating new storage and infrastructure was anathema to international donors; so Tanzania ended up doing what donors would support: stock textbook IWRM, which included state ownership of water resources, water withdrawal permits, water tax, legal institutional reform, river basin organizations, Water User Associations (WUAs), but no attempt to get what its people need most, more and better-managed infrastructure. Tanzanians all along had plans to build storages but were secretive about it for the fear of donor

reprimand. In implementing the first phase of the IWRM project, however, the leadership figured that reforms could not deliver what Tanzania's rural communities need badly, i.e., better domestic water supply systems, improved irrigation water control and better hydraulic infrastructure rather than water withdrawal permits, water pricing and catchment organizations.

The only African country where water reforms have produced semblance of improved governance of water resources is South Africa, which has emerged as a model, exemplifying IWRM type water sector reforms in an emerging economy context. South Africa is interesting because of its first-world-third-world duality. In terms of income inequality, South Africa is next only to Brazil. 54 % of South Africa's water use is in agriculture; and 95 % of its farm lands are owned by a small minority of white commercial farmers. In the Olifants, one of South Africa's most developed basins, 95 % of rural water resources is used by only 0.5 % of the population, white commercial farmers. The Gini coefficient for rural water use is as high as 0.96 (Cullis and Van Koppen 2005).

South Africa's ground-breaking water law (chapter 4 of the Act: section 21) specifies the following uses and brings them within its IWRM mandate: (a) taking water from a water resource; (b) storing water; (c) engaging in a stream-flow reduction activity, such as forestry; (d) control activities. E.g., irrigating with wastewater; (e) discharging of wastewater into a water source through a pipe, canal, etc.

All those using water for the above purposes have to register, pay water use charge and a water resource management charge. South Africa has all of 62,000 authorized, billable water users (or registered primary diverters) that account for 11 billion m^3 of water allocation for commercial agriculture, 5 billion m^3 for industry and municipal uses, and 9 billion m^3 for forestry. The Government of South Africa generates around 2 billion rand/year (USD 0.35 billion/year) as income from water tariffs. Managing these 62,000 users has been far from easy: it is difficult to ascertain actual volumes used; some users did not register and some registered use could be unlawful under existing water law. Many commercial farmers have extended their irrigated areas unlawfully, posing that they are using their water allocation more efficiently. A critical issue for officials is whether to rely on voluntary compliance or evolve a system of policing.

Interestingly, however, the South African IWRM leaves 95 % of its people out of its ambit. All of 2.3 billion m^3—about 10 %—of total water use is allocated to the so called schedule-1 users, mostly rural black South Africans, who include some 18 million primary diverters of water for domestic use, irrigating tiny food plots and small vegetable gardens. Their water use is neither subject to licenses nor billable. If anything, everyone agrees, the crying need is to increase the access to and productive use of water by these users; yet the entire edifice of IWRM practices is unable to meet this need.

It is not that South Africans are not trying; but they have just begun reforms in black South Africa and find the going tough. 18 million rural South Africans, *de facto* still partially ruled by 800 chiefs and 13,000 village headmen with their customary law and traditional institutions constitute a diffuse informal water economy where self or community provision galore. Under the National Water Policy of 1997 and Water Act of 1998, South Africa was to be covered by 19 Catchment Management

Agencies (CMAs). Only two fledgling CMAs have been formed so far with a far more modest role than was originally envisaged. Moreover, for the five poorest Water Management Areas it is increasingly recognized that a CMA will never be financially viable at all, and could become, at best, business units within government. Formation of CMAs, turning over of small-holder irrigation systems to WUAs, promotion of appropriate technologies—central to improving the lives of the vast majority of South Africans—remain major challenges that the country's water reforms are yet to begin to meet. These are also the challenges facing India, Bangladesh, Nepal and numerous poor countries. IWRM is working in European South Africa, but the African South Africa has to begin at the beginning.

The lesson India needs to learn from the experience of all these countries is centrally about the gap between the precept and practice of IWRM. There can be little questioning the basic IWRM premises such as that water should be priced to reflect its scarcity value, that it is best managed at basin level, that reform of property rights will promote its efficient and sustainable use. The question is how to make these stick in water economies that are predominantly informal. All the evidence we have suggests that these work best where:

(a) primary water diverters are large, body corporates and few in number;
(b) most water users are supplied by organized service providers; and
(c) capital accumulation in terms of infrastructure creation is already high.

In contrast, IWRM-style demand management reforms would fail to stick where: (a) most of the country's households are primary water diverters; (b) most self-supply their water requirements directly from a natural source; and (c) capital accumulation in water infrastructure is very low.

All in all, the IWRM paradigm neither responds to the priorities of the poor in poor countries, nor does it resonate with their ground conditions which make implementing water pricing, reform of property rights, allocating water at basin level work. The key factor often ignored is the number of primary diverters of water from nature. In rich countries, these are often just a very small number of body corporates—water companies, utilities, municipalities, co-operatives—who serve the water needs of all users that are no longer primary diverters. In low-income countries with high level of income inequality such as Brazil and South Africa, IWRM works well in the rich, modern, formal segment of the water economy but can actually leave the poor worse off by destroying their traditional institutional arrangements while replacing them by poorly functioning modern ones. In most other low income countries where a majority of users are obliged to self-provide their water because of absent or poorly developed water infrastructure, IWRM deflects attention of policy makers in these countries from what ought to be their key priority—which is to deliver improved and better managed water infrastructure and services.

A core value of IWRM is people's participation in water resources management: its popular slogan 'make water everybody's business' is illustrative. In reality, in countries like India, the fact that diverting water from natural water bodies is everybody's business makes IWRM impossible to implement. A condition necessary and sufficient for effective implementation of IWRM type demand management is that diversion of

water from nature is the business of relatively few, large users and service providers who can be brought within the ambit of public policy with relative ease.

Contrast the informal water economy of a typical Indian district with the highly formalized water economy of a typical European country, such as say Switzerland (Luis-Manso 2005). 70 % of Switzerland's population is urban; the country is facing continuous reduction in industrial workers and farmers. 15–20 % of the Swiss population was linked to public water supply as far back as in the eighteenth century, more than India's is now; today, 98 % of the Swiss population is linked to public water supply networks and 95 % is connected with waste-water treatment facilities. At US$468, per capita water bill the Swiss pay annually is higher than the per capita total income of Bangladesh. All its water users are served by a network of municipal, corporate, co-operative water service providers. It has stringent laws and regulations about water abstraction from any water body which can be done only through formal concessions. However, these concessions are held only by a small number of *formal* service providing public agencies; as a result, their enforcement entails little transaction costs. It is not surprising that IWRM instruments work perfectly in such a highly formalized water economy.

2.5 Economic Development and the Organization of a Water Economy

Water institutions that exist or can be externally catalyzed in a country depend, besides several other factors, on the stage of formalization of its water economy which in turn depends upon the overall economic evolution of that country. Figure 2.1 presents a clutch of empirically verifiable hypotheses—a set of iron laws of economic development[3]—about how the economic organization of a country's water economy metamorphoses in response to economic growth and the transformation of society that comes in its wake. Regardless of its water endowments, as a low-income economy climbs up the economic ladder, the organization of its water economy undergoes a transformation in tandem with the transformation of the society as a whole. The foremost driver of this transformation is urbanization and occupational diversification. As the proportion of rural and agrarian population declines, agricultural water demand eases. With urbanization and economic growth, self-provision of water is increasingly replaced by service providers. In poor economies, implicit costs of water acquisition—in the form of labor spent in fetching water—are high, especially for the poor; with economic growth, labor costs decline but monetary cost of buying water service increases. In affluent countries, scientific and economic resources devoted by the society per km^3 of water diverted are much higher than in poorer countries.

[3] Scott Roselle used this phrase recently to refer to the unexceptionable tendency of agricultural population ratios of countries to fall as their economies grow. But I think this also applies to other responses to economic development as outlined in Fig. 2.1.

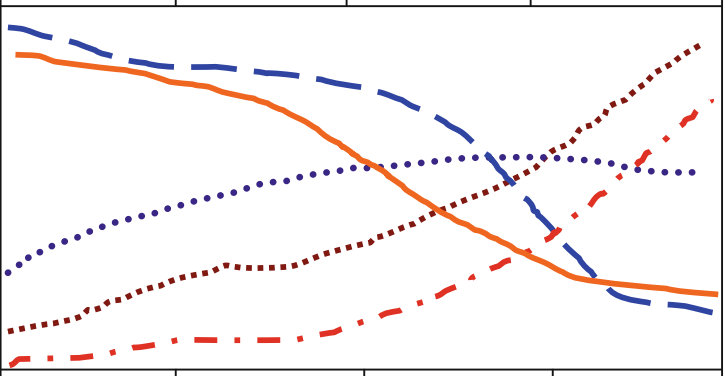
	Stage I: Completely Informal	Stage II: Largely Informal	Stage III: Formalizing	Stage IV: Highly Formal Water Industry
% of water users in the formal sector	<5%	5-35%	35-75%	75-95%
Examples	Sub-Saharan Africa	India, Pakistan, Bangladesh	Mexico, Thailand, Turkey, Eastern China	USA, Canada, Western Europe, Australia
Dominant mode of water service provision	Self-supply and informal mutual-help community institutions	Partial Public Provisioning but self-supply dominates	Private-public provisioning; attempts to improve service and manage the resource	Rise of modern water industry; High Intermediation; self-supply disappears
Human, technical, financial resources used by water sector % of total water use self-supplied Rural population as % of total Monetary Cost of domestic water as % of per caput income Financial Cost of water service provision				
Concerns of the Governments	Infrastructure creation in Welfare Mode	Infrastructure and Water services, especially in Urban areas	Infrastructure and service in towns and villages; Cost recovery; Resource protection	Integrated mgt. of water infrastructure, service and resource; Resource protection
Institutional Arrangements	Self-help; mutual help and feudal institutions dominate	Informal Markets; Mutual help and community management institutions	Organized service providers; self-supply declines; informal institutions decline in significance	Self-supply disappears; all users get served by modern water industry.

Fig. 2.1 Transformation of informal water economies in response to overall economic growth

Along with these changes, water institutions too undergo profound change. In very poor societies, self-provision of water by households is ubiquitous; in much of Africa, we do not find local, informal markets even for pump irrigation service that are widespread in South Asia. Countries at somewhat higher level of economic growth witness limited local specialization in water services provision in an informal manner. As economies grow still further, local specialization—and informal institutions associated with these—disappear as large, professionally run corporates take over the role of procurement, processing and retailing of water. Thus, the informal water institutions we find in India, Pakistan and Bangladesh—such as, say, pump irrigation markets, urban tanker water markets—are unlikely to be found in Australia or Spain because those countries have outlived the need for these by creating specialized water institutions at a higher level that their citizens need and can now afford. Likewise, water institutions that are standard in industrialized countries—high net-worth water companies managing a city's water supply system—would not begin to work until Dhaka as a water service market evolved, at least, to Manila's or Jakarta's level.[4]

[4] If accounts of the travails facing global water companies like Vivendi and Thames Water who are forced to wind up even in these increasingly affluent east- Asian cities is any guide, we must

For much the same reasons, it is difficult to find a country in say Sub-Saharan Africa with a modern water industry of the kind we find in a European country. South Africa may be the exception that proves this rule: white South Africa—inhabiting its towns or operating large, commercial farms in the countryside—is served by what approximates a modern, formalized water sector. However, the former homelands, where half of South Africans live, are served by a water economy even more informal than India's.

We have so far discussed IWRM paradigm's errors of commission. However, its major error of omission is that it offers no guidance on what to do with a plethora of water institutions that developing countries already have. The here-and-now challenge of water governance in low-income countries like India is one of understanding and working with groundswells of spontaneous institutional formations which have emerged and sustained to create value for water users. Informal, decentralized pump irrigation markets today serve 1/3rd of India's gross irrigated areas (Mukherji 2005), as much as the share of all public irrigation projects. There is a booming culture fishery in the making in small common property ponds and tanks throughout India providing livelihoods and improving nutrition of millions of rural households. New technologies and stocking material created the potential for a boom; however, it is the myriad changes that have occurred in the institutional arrangements for leasing of small water bodies that have energized this boom. Where state governments dogmatically adhered to the communitarian ideal, the boom has remained muted; where they have adopted an entrepreneur-friendly approach, the culture fishery economy has boomed. In the famous Sardar Sarovar Project on river Narmada, planners had planned that the government would build lined minors going up to each Village Service Area (VSA) commanding 200–600 ha; a WUA will build subminors and distribution network within each VSA by mobilizing local resources. As it has turned out, planners proposed; and farmers have disposed. Of the 1100 odd VSAs so far covered, not one has a WUA that built the distribution system. However, this has not stopped irrigation in the SSP command; thousands of farmers have invested in diesel pumps and rubber pipes; pump irrigation markets have sprung up everywhere. According to some, this is certainly not the best solution; planners do not like this irrigation anarchy; but then farmers do not like to lose precious farm land and invest own funds for building a distribution system (Talati and Shah 2004). Groundwater depletion is one of the most complex challenges India's people and water policy makers face. However, the responses of the IWRM theoreticians have tended to differ from those of the people who are at the receiving end: the former think primarily in terms of ways to reduce groundwater draft through laws and regulations; people have steered clear of demand restriction but have instead mobilized local resources to increase supply. Rural communities in western India—notably, Saurashtra and eastern Rajasthan—have taken to water harvesting and decentralized groundwater recharge in a big way as a mass movement. In southern states, there is growing tendency to convert irrigation tanks into percolation tanks by sealing the

conclude that South Asian cities have a long way to go before they can afford water supply systems of European or North American quality (see, *The Economist*, August 15–21, 2004).

sluice gates of tanks. In Gujarat, the government has been able to effectively regulate overall groundwater draft for irrigation, not by pricing groundwater and power, or creating tradable water rights or making new groundwater laws, but by intelligent rationing of farm power supply (Shah and Verma 2008; Shah et al. 2008).

Developing countries like India are then confronted with a policy dilemma of whether to pursue an unachievable ideal—such as the IWRM—or to work with what they have. Recent discussions in the field of New Institutional Economics (NIE) help us to explore this dilemma because it addresses the question 'why economies fail to undertake the appropriate activities *if they had a high pay-off*' (North 1990). India's water sector is replete with situations where appropriate activities can potentially generate a high pay-off and yet fail to get undertaken. An institutional change creates a 'structure' of pay-offs with gains varying across different groups of agents, and therefore, inviting different 'intensities' of responses. A small group of agents each threatened with large loss may put up a stiff resistance to a change that is beneficial for the society as a whole, and vice versa. In NIE, transaction costs are seen to include: (a) costs of search and information; (b) costs of negotiation, bargaining and contracting; and (c) costs of policing and enforcement of contracts, property rights, rules and laws. For a policy or institutional intervention, all these three increase *directly* with the number of agents involved as well as the strength of their preference for or against the intervention. All the three costs come into play in determining the 'implementation efficacy' of an institutional intervention because each depends on the number of agents involved in a transaction, which in an informal water economy is large.

A great deal of what policy makers and researchers consider desirable institutional change—such as making and enforcing groundwater regulation, metering farm electricity connections, instituting participatory irrigation management, reforming water rights all of which would be part of the IWRM package—are extremely difficult to implement on the ground because the transaction costs of doing so are high for implementers and pay-offs are low, even negative, for the water users. In contrast, a plethora of institutional arrangements in the informal sector address various priorities of users, offering them high pay-offs and entailing low transaction costs; yet the State is largely oblivious, even suspicious, of them.

2.6 Summary and Conclusion

The trouble with the 'IWRM package', and indeed the global water governance debate as a whole, is its intent to transform, all at once, a predominantly informal water economy into a predominantly formal one—something that would normally be the result of a long process of economic growth and the transformation that comes in its wake. In the IWRM discourse, formalizing informal water economies *is* improving water governance. But evidence across the world suggests that there is no shortcut for a poor society to morph its informal water economy into a formal one; the process by which this happens is organically tied to wider processes of

economic growth. When countries try to force the pace of formalization, as they will no doubt do, interventions come unstuck. Interventions are more likely to work if they aim to improve the working of a water economy while it is informal.

Improving water governance worldwide is a work in progress. Countries like the United States, Spain, Australia, and Mexico struggled with orderly governance of their agricultural groundwater economies for decades before developing countries like India have had to worry about these problems. And their experience is valuable capital from which the latter societies can draw important lessons. The pioneer countries' experience does not offer readily applicable solutions, given developing countries' early stage of economic growth, vast number of small, dispersed water abstractors, and a highly informal, atomistic irrigation economies. The solutions would work in portions of water economies, such as urban areas and industrial sectors, that are already formal or easy to formalize. Here, water pricing and regulation must certainly be the way to go. But in a diffuse, atomistic irrigation economy, more inventive approaches are called for. The lesson that developing countries need to draw from the pioneer countries is the value of actively engaging with the expanding but unregulated atomistic irrigation economy.

Three distinctive aspects set India's water economy apart from the pioneer countries. First is the transaction costs, with millions of dispersed users directly withdrawing water from nature. Using pricing, tradable water rights, or even policing and administrative regulation here is infinitely more difficult in logistical terms than in most other countries.

Second is the agrarian poverty aspect. Over the past three decades, small-holder irrigation based on groundwater revolution has provided more relief—if not a lasting solution—to millions of the region's agrarian poor than most public policies and programs (Shah 2009). Until population pressure on agriculture eases, public policy will involve tightrope walking to balance conflicting objectives. The government will simultaneously persist with the power subsidies responsible for groundwater depletion and implement watershed development intended to recharge aquifers. This apparent incoherence is symptomatic of the dilemma of water governance in India. Efforts to cope with or alleviate depletion through supply-side strategies will tend to be preferred over aggressive demand-side strategies that threaten livelihoods.

Finally, the large numbers of dispersed users over a vast countryside present not only a constraint but also a great opportunity for land and water care that sparsely populated countries do not have. The institutional environment here can often achieve more by joining forces with farming communities and institutional arrangements than by taking a command-and-control position. Rogers and Hall (2003: 10) ask, "can the state steer the society?" In most developing countries "which typically have a strong society and a weak state," the challenge of steering lies in the state's making common cause with the multitudes. The mass-based groundwater recharge movement in Saurashtra is but one example of what the state can do in partnership with people. The trouble with regulatory zeal is that it puts the institutional environment and the people in rivalrous relationships when they should be comrades-in-arms.

Bearing the experiences of the pioneer countries in mind, India needs to look within to find ways of turning Prisoner's Dilemma outcomes in Coase outcomes. In so doing, they can derive useful guidance from the original IWRM philosophy—which emphasized participation and dialectics, enjoined societies to move from a resource development to resource management, highlighted the insight that a natural resource cannot long remain both scarce and free, and encouraged a process for evolving water governance structures tailored to the local context. By so doing, India may not tame the anarchy in its water economy, but it can achieve a better compromise between its conflicting priorities—providing succor to its agrarian poor, and protecting its natural resources and environment.

Finally, the IWRM paradigm must not be allowed to obfuscate India's key priorities for years to come, which is making good, sensible investments in improving water infrastructure and services; and making these investments work. We also need to bear in mind that as the world's largest user of groundwater, India's water economy has a unique dynamic of its own which demands a unique strategic response. Finally, as India urbanizes and gets richer, highly formalized segments must emerge especially in cities; direct demand management of the IWRM variety is the ideal framework for managing these formal segments, and we should vigorously pursue IWRM in these formal segments of our water economy.

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