5 Issues in Reforming Informal Water Economies of Low-income Countries: Examples from India and Elsewhere

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Abstract

The past decade has witnessed a growing sense of urgency in reforming water sectors in developing countries like India faced with acute water scarcity. India, like many other developing countries, is still focused on building water infrastructure and services, and making these sustainable in all senses of the term. The new wave of ideas is asking it to move from this supply-side orientation to proactive *demand management* by reforming water policy, water law and water administration, the so-called 'three pillars' of water institutions and policies. But making this transition is proving difficult in India and elsewhere in the developing world. Here, making water laws is easy – enforcing them is not. Renaming regional water departments as basin organizations is easy – but managing water resources at basin level is not. Declaring water an economic good is simple – but using the price mechanism to direct water to high-value uses is proving complex. This chapter explores why.

It distinguishes between Institutional Environment (IE) of a country's water economy, which comprises the 'three pillars', and the Institutional Arrangements (IAs), which refer to the humanly devised rules-in-use, which drive the working of numerous informal institutions that keep a vibrant economy well lubricated. The relative influence of IE and IAs varies in high- and low-income countries because the water economies of the former are highly *formalized*, while those in the latter are highly informal. In high-income countries' formalized water economies, IE has an all-powerful presence in the water economy; in contrast, in highly informal water economies of low-income countries, IAs have a large role with the IE struggling to influence the working of countless tiny players in informal water institutions. The emerging discussion exhorting governments to adopt demand-side management overestimates the developing-country IE's capacity to shape the working of their informal IAs through direct regulatory means, and underestimates the potential for demand management through indirect instruments.

Demand-management reforms through laws, pricing and rights reforms in informal water economies are ill advised, not because they are not badly needed but because they are unlikely to work. The real challenge of improving the working of poor-country water economies lies in four areas: (i) improving water infrastructure and services through better investment and management; (ii) promoting institutional innovations that reduce transaction costs and rationalize incentive structures; (iii) using indirect instruments to work towards public-policy goals in the informal sectors of the water economy; and (iv) undertaking vigorous *demand management* in formal segments of the water economy such as cities and industrial water users. Facilitating these requires that water resources managers adopt a broader view of policy and institutional interventions they can catalyse to achieve policy goals.

Keywords: informal water economies, water institutions, institutional environment, irrigation management transfer, groundwater markets, groundwater recharge, energy, fishery, fluoride, India, China, Mexico.

 Community-based Water Law and Water Resource Management Reform in Developing Countries (eds B. van Koppen, M. Giordano and J. Butterworth)

Institutions and Policies in Formal and Informal Water Economies

A recent review of institutional changes in the water sector in 11 countries by Saleth and Dinar (2000) deals with water law, water policy and water administration, as the three pillars of institutional analysis in national water economies. This focus on law, policy and organizations as central themes of institutional analysis has been the concern of many analysts and practitioners of water resources management (see, e.g. Bandaragoda and Firdousi, 1992; Merrey, 1996; Frederickson and Vissia, 1998; Holmes, 2000; Saleth, 2004). However, if institutional change is about how societies adapt to new demands, its study needs to go beyond what government bureaucracies, international agencies and legal/regulatory systems do. People, businesses, exchange institutions, civil society institutions, religions and social movements – all these too must be covered in the ambit of institutional analysis (see, e.g. Livingston, 1993; Mestre, 1997 cited in Merrey, 2000, p. 5).

The current chapter takes this broader view in attempting a preliminary analysis of water institutions in India and elsewhere (see Fig. 5.1). In doing so, it draws upon the vast emerging field of New Institutional Economics (NIE) whose goal is to 'explain what institutions are, how they arise, what purposes they serve, how they change and how – if at all – they should be reformed' (Klein, 2000). We begin by borrowing from North (1990) the notion of institutions as 'formal rules, informal constraints (norms of behaviour, conventions, and self-imposed codes of conduct) and the enforcement characteristics of both'; and also the notion that 'if institutions are the rules of the game, organizations are the players'. It is also useful to borrow the important distinction drawn in the NIE between *institutional environment* (IE) and *institutional arrangements* (IAs). IE refers to the background constraints or 'rules of the game' – formal and explicit (constitutions, laws, etc.) and informal and implicit (norms, customs). Thus aspects that Saleth and Dinar (2000) include in their 'institutional analysis' represent, mostly, IE. IAs, in contrast, 'are the structure

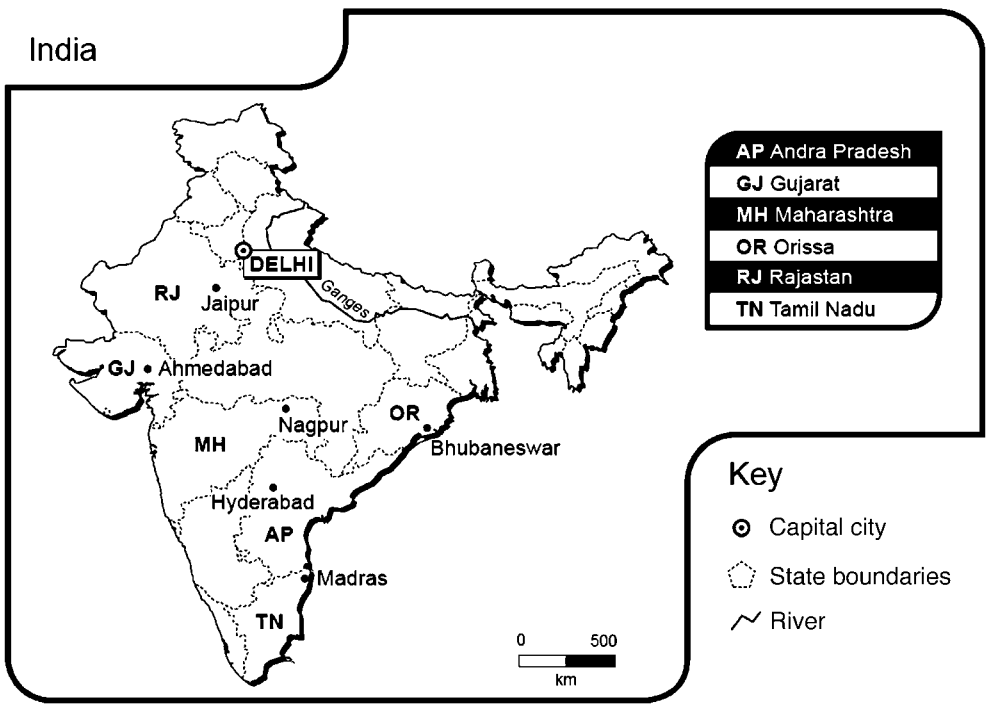

Fig. 5.1. Map of India.

that humans impose on their dealings with each other' (North, 1990).

In the Indian context, then, IE would include various government agencies at different levels that directly or indirectly deal in water, international agencies, governments' water policy and water-related laws and so on. And *institutions* or IAs – what Williamson (1985) calls 'governance structures' – refer to entities like groundwater markets, tube well cooperatives, water user associations (WUAs), Tarun Bharat Sangh's *johad* (small pond) movement in Alwar (Shah and Raju, 2001), groundwater recharge movement in Saurashtra (Shah, 2000), tank fishery contractors in Bundelkhand (Shah, 2002), emergence of defluoridation plants in the cottage sector in North Gujarat's towns (Indu, 2002), private lift irrigation provisioning on a large scale from Narmada canals in Gujarat (Talati and Shah, 2004) and from government reservoirs in the Upper Krishna basin in Maharashtra (Padhiari, 2005), and urban tanker water markets operating throughout cities in India and many other developing countries (Londhe *et al*., 2004) and so on.

We begin with three propositions:

- Water institutions existing in a nation at any given point in time depend critically upon the level of *formalization* of its water economy; by formalization, we mean the proportion of the economy that comes under the ambit of direct regulatory influence of the IE.[1, 2]
- In this sense, water sectors are highly informal in poorly developed economies and become more formalized as national economies grow.
- The *pace* of water sector formalization in response to economic growth varies across countries and is influenced in a limited way by a host of factors but principally by the nature of the 'state'[3] (i.e. how hard or soft it is) (Myrdal, 1968). How much difference these other factors make is unclear; what is clear is that India or Tanzania cannot have Netherlands' level of formalization of its water sector at their present state of economic evolution.

The level of formalization of a country's water sector is best indicated by the low level of interface between its water IAs and its water IE – or by what North (1990) calls the 'transaction sector'[4] of the water economy. Informal water economies, where the writ of 'the three pillars' does not run, are marked by heavy dependence of water users on self-provision (through private wells, streams, ponds), on informal, personalized exchange institutions or on community-managed water sources. In contrast, in highly formalized water economies – as in Europe and North America – self-provision disappears as a mode of securing water service; all or most users are served by service providers – private-corporate, municipal or others – who form the interface between users and the institutional environment. Volumetric supply and economic pricing are commonly used in highly formal water sectors for cost recovery as well as for resource allocation. Here, water emerges as an organized industry easily amenable to a host of policy and management interventions that become infeasible in informal water economies.

Just how informal the water economy of a developing country can be was explored by a large nationwide survey (NSSO, 1999b, p. 46) carried out in India during June–July 1998. Based on interviews with 78,990 rural households in 5110 villages throughout India, its purpose was to understand the extent to which they depended upon common property (and government) land and water resources for their consumptive and productive uses. The survey showed that only 10% of water infrastructural assets used by survey households were owned and managed by either a public or community organization. The rest were mostly owned and managed by private households or owned by the government/community but *not* managed by either.[5]

If receiving domestic water from a 'tap' is an indicator of getting connected to a formal water supply system, the same survey also showed that over 80% of rural households were not connected with *any* public or community water supply system: they self-supplied their domestic water needs. In urban households (sample = 31,323 households), the situation was the reverse: 75% were connected to a public water supply system.

A somewhat different 2002 survey (NSSO, 2003) showed that, of the 4646 villages covered, only 8.8% had a public/community water supply system. People living in the rest of the villages

depended on wells or open water bodies for domestic water supply. A strong imprint of economic growth was evident too. The proportion of villages with a public water supply system increases rapidly as we move from a poor state to a relatively rich one. In Bihar, one of India's poorest states, none of the 364 villages covered had a public/community water supply. In the somewhat richer Haryana state, over half the villages surveyed had a public water supply system and, in still richer Goa, every village surveyed had a public water supply system.

The irrigation economy of India is equally informal. A 1998 survey of 48,419 cultivators around India showed that nearly 65% used irrigation for five major field crops cultivated by them. For nearly half of these, the source of irrigation was informal, fragmented pump irrigation markets (NSSO, 1999b, p. 42), which are totally outside the ambit of *direct* influence of the 'three pillars'. In a 2002 survey of 4646 villages around India (NSSO, 2003), 76% of the villages reported they irrigated some of the lands. However, only 17% had access to a *public* irrigation system: the rest depended primarily on wells and tube wells, tanks and streams.

All these surveys suggest that rural India's water economy – both domestic and irrigation use – is predominantly *informal*, based as it largely is on self-supply and local, informal water institutions. It has little connection with public systems and formal organizations through which the 'three pillars' typically operate in industrialized countries.[6]

Figure 5.2 presents a clutch of empirically verifiable hypotheses – a set of 'iron laws of economic development'[7] – 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. 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 is an exception: white South Africa – inhabiting its towns or operating large, commercial farms in the countryside – is served by what approximates a modern water sector. In the rural areas of the Olifants basin, for example, only 0.5% of this

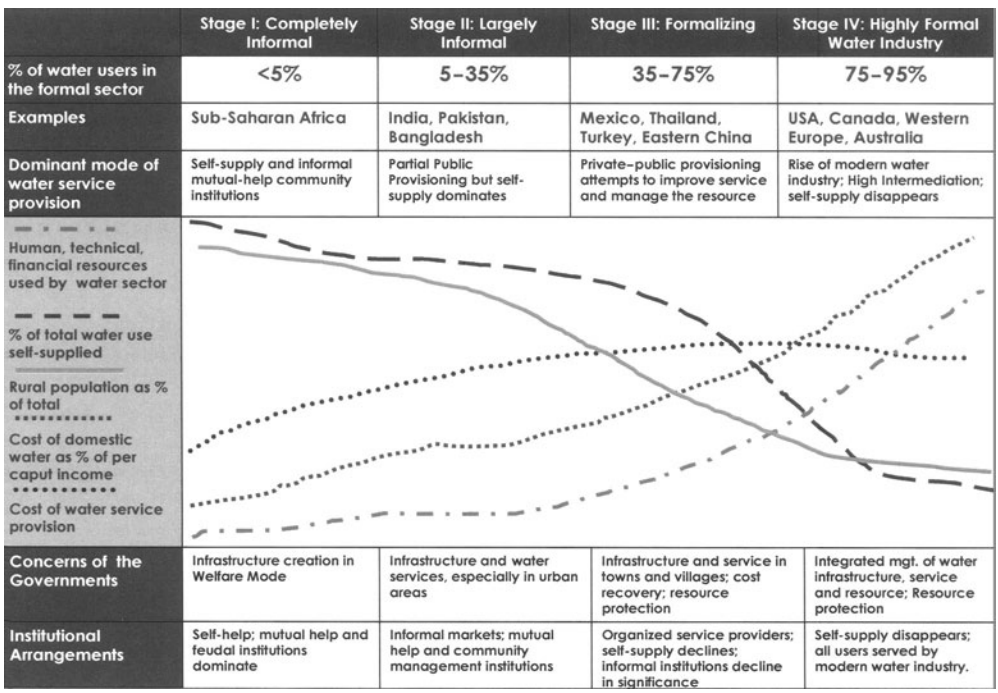

Fig. 5.2. Transformation of informal water economies in response to overall economic growth (from author).

formal sector – some 1600 registered users in a population of 2.5 million – uses 95% of the water resources (Cullis and van Koppen, 2007). The former homelands, where half of South Africans live, are served by a water economy even more informal than India's.

Water institutions that exist in a country or can be expected to be successfully catalysed by external actors depend upon, besides several other factors, the stage of formalization of its water economy which, in turn, depends upon the overall economic evolution of that country as outlined in Fig. 5.2. Water IAs we found in India, Pakistan and Bangladesh – such as, say, pump irrigation markets or urban tanker water markets – are unlikely to be found in Australia or Spain because they would serve nobody's purpose there. Likewise, water IAs that are standard in industrialized countries – multinationals managing a city's water supply system – would not begin to work until Dhaka has a water service market evolved, at least, to the level of Manila or Jakarta.[8]

The Process of Institutional Change

In understanding how societies adapt their institutions to changing demands, Oliver Williamson (1999) suggests the criticality of social analysis at four levels. At the highest level (say L1) of social embeddedness are customs, traditions, mores and religion, which change very slowly because of the spontaneous origin of these practices in which 'deliberative choice of a calculative kind is minimally implicated'. At the second level (L2), evolutionary processes play a big role; but opportunities for design present themselves through formal rules, constitutions, laws and property rights. The challenge here is getting the rules of the game right through better definition and enforcement of property rights and contract laws. Also critical is the understanding of how things actually work – 'warts and all' in some settings, but not in others. However, it is one thing to get the rules of the game (laws, policies, administrative reforms in the IE) right; it is quite another to get the play of the game (enforcement of contracts/property rights) right.

This leads to the third level (L3) of institutional analysis: transaction costs of enforcement of contracts and property rights, and the governance structures through which this is done. Governance – through markets, hybrids (like public–private partnerships), firms and bureaus – is an effort to craft order, thereby mitigating conflict and realizing mutual gains. Good governance structures craft order by reshaping incentives, which leads to the fourth level (L4) of social analysis – getting the incentives right.

L1 and L2 offer possibilities for change only over the long term.[9] Sectoral interventions aiming to achieve at least L2 level changes[10] – property rights on water through a permit system or reorienting the bureaucracy – are not uncommon; but it is virtually impossible to enduringly[11] transform *only* the water bureaucracy while the rest of the bureaucracy stays the same. All things considered, L3 and L4 comprise the most relevant playing field for institutional reform in the short term.

An important question that New Institutional Economics (NIE) helps us explore is: 'Why do economies fail to undertake the appropriate activities *if they had a high pay-off?*' (North, 1990). The response to this question depends largely on L3 and L4 levels of institutional analysis. India's water sector is replete with situations where appropriate activities can potentially generate a high pay-off and yet fail to be undertaken; in contrast, much institutional reform being contemplated or attempted may not work, in the current context, because, among other things, high transaction costs make them inappropriate to undertake.

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. Likewise, different groups of agents in IAs as well as in IE may experience different levels of incidence of transaction costs attendant on a change. In NIE, transaction costs are seen to include: (i) costs of search and information; (ii) costs of negotiation, bargaining and contracting; and (iii) costs of policing and enforcement of contracts, property rights, rules and laws. Our key proposition in this chapter is: for a policy or institutional intervention, all these three increase *directly* with the number of agents involved as well as with the strength of their preference for or against the intervention.

All 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. Just take the case of groundwater regulation in a country like Mexico which, in some parts, faces problems of resource over-exploitation similar to those of India and the North China plains. Mexico's new Law of the Nation's Water provided for the registration of all groundwater diverters and issue of 'concessions' to each, with an entitlement to pump a permitted quota of water per year. Nearly a decade later, the 'implementation efficacy' of this policy regime has varied across different segments of groundwater diverters: municipal and industrial diverters – all large, visible entities in the formal sector – have been promptly and effectively brought within the ambit of the new Law because these large diverters are few in number. Household wells – far too numerous, and each diverting small quantities – were wisely kept out of the ambit of the law; the transaction cost of regulating them was not worth the gains in 'implementation efficacy'.[12]

The real problem was with over 96,000 agricultural tube wells, some of them abstracting up to 1 million m^3 of groundwater each per year. Having registered agricultural tube wells, Mexico's CNA (*Comisión Nacional del Agua*) found it impossible to police and enforce concessions with the staff and resources at its command. To reduce policing and enforcement costs, CNA created COTAS (Comités Técnicos de Aguas Subterráneas), assuming that farmers would police each other better. A slew of recent studies, however, have shown that Mexico's new Law of the Nation's Water, its national water policy as well as institutions like COTAS have had no perceptible impact on groundwater abstraction for agricultural use (Shah *et al.*, 2004b).

If Mexico is serious about groundwater regulation, it will need to either find effective ways to reduce policing and enforcement costs of tube well concessions or else allocate much larger resources to absorb the high costs of policing and enforcement of groundwater concessions on 96,000 tube well owners scattered over the countryside. And if India were to try a similar strategy, it would need to provide for policing and enforcement costs for some 20 million private tube well owners scattered over 600,000 villages.

One core NIE idea – especially, of the Transaction Cost Economics (TCE) branch – is that economizing on transaction costs is a key determinant of the nature of IAs that economic agents evolve. Our proposition is that players in IE of sectoral economies too are sensitive to transaction costs in designing, implementing or abandoning institutional interventions. This implies that the state too indulges in transaction cost-economizing behaviour. This is indicated by the fact that water regulations in most countries exclude small users from their ambit. Mexico's Law of the Nation's Water does not apply to anyone who stores less than 1030 m^3 of water. Australia's water law excludes users who irrigate less than 2 ha (MacDonald and Young, 2001). Water withdrawal permits instituted in South Africa and many African countries in recent years exclude domestic users, homestead gardening and stock watering (Shah and van Koppen, 2005).

One rationale for leaving these out is that these represent lifeline uses of water. But another equally important reason is that the inclusion of these would hugely increase search, information and policing and enforcement costs involved in implementing the new intervention. Under its new water law, China has instituted a system of water withdrawal permits to be obtained by each tube well owner. But, in reality, except in selected provinces such as Beijing, Hebei and Shandong where tube wells are deep and heavy duty, the permits are issued to the village as a whole. Doing this defeats the intent of the law but it reduces transaction costs (Shah *et al.*, 2004a). When transaction costs of implementing an institutional intervention become prohibitive, players in IE relinquish it rather than enforcing it *at any cost.*

Alternatively, IE players discover well-thought out approaches to drastically reduce transaction costs. Provincial and city water bureaus in eastern China have for long tried to regulate pumping of urban groundwater aquifers that are under great stress. An array of regulatory measures – imposition of a water withdrawal fee, increases in water price, sealing of urban tube wells, etc. – failed to control urban groundwater depletion. More recently, many cities have begun sourcing water from

distant reservoirs and supplying it to urban water service providers. Alternative water supply assured, many cities have quickly brought urban groundwater diverters within the regulatory fold (Shah *et al.*, 2004a).

Another example of 'transaction cost economizing' behaviour of IE players is the Mexican government's decision of levying a penal charge for electricity use by tube wells withdrawing groundwater beyond the concessioned volume. Having failed to police and enforce groundwater abstraction concessions through COTAS, the CNA found the second best approach, whose key merit is that it imposed little 'incremental' transaction cost because metered electricity use already provided a good surrogate of volumes of abstraction (Scott and Shah, 2004).

In analysing the Indian institutional experience in the water sector, then, our key propositions are embodied in Fig. 5.3. It suggests that several kinds of institutional reform tried or suggested in the Indian water sector have tended to have entailed either high transaction costs (quadrant 2), low pay-offs (quadrant 4) or both (quadrant 3). In contrast, institutional changes that have quietly occurred because pay-offs are high *and* transaction costs low (quadrant 1) are either ignored or thwarted or, at least, not built upon. In the following sections, we briefly analyse a sample of situations in each of these four quarters in Fig. 5.3 before drawing some general implications arising from this analysis.

Interventions with Poor Implementation Efficacy (Quadrants 3 and 4)

When policing and enforcement costs of an intervention are high, the tendency often is to design frivolous interventions without serious intention to implement them or to abandon an intervention even if designed with serious intent. International pressure has often led to a persistent demand for a modern legislative and policy framework for orderly and effective management of the water economy and sustainable husbanding of the resource. Conditionalities imposed by donors sometimes oblige developing-country governments to agree to interventions without a local buy-in. One possible reason they submit to such pressures is their dependence on them for financial

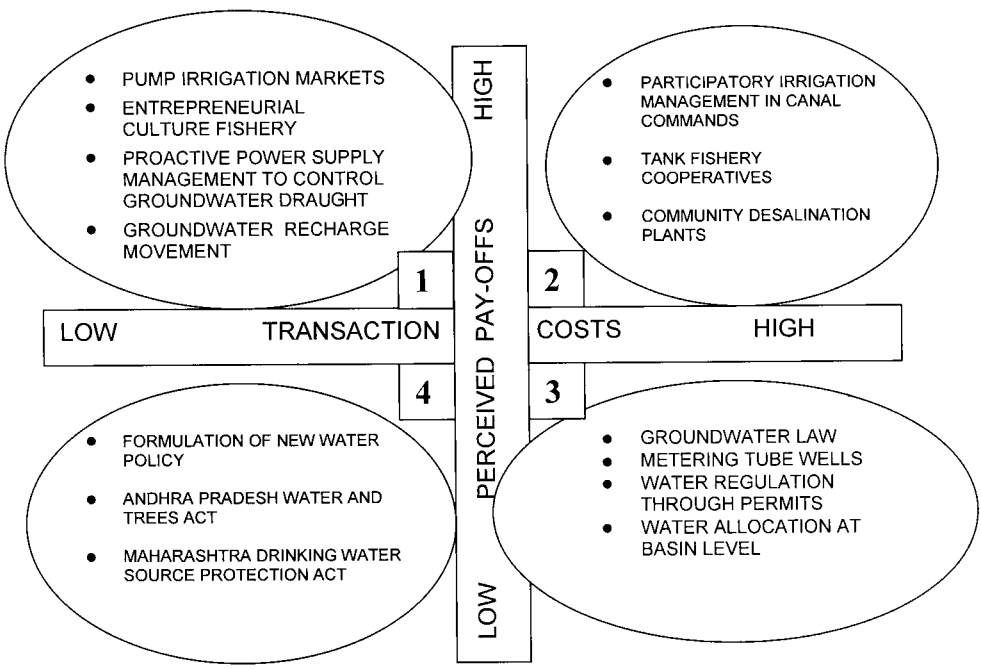

Fig. 5.3. Expected pay-offs versus transaction costs.

resources; however, it may also be that donors can pressurize governments to make laws but not to enforce them. Even if governments had a genuine intent to enforce, in a predominantly informal water economy such as India's, the transaction costs of enforcing a 'strong' water law effectively are so high that these attempts often remain cosmetic, essentially setting 'targets without teeth'. Indeed, laws and policies are often written to minimize transaction costs by progressively removing clauses that bite and are likely to be extensively violated, thereby reducing the *effective* regulatory powers of a law. When this is not done, decision makers responsible for enforcement shy away.

The Model Groundwater Law developed by the Government of India circa 1970 is a case in point; it has been tossed around for 35 years across state capitals but it has found no takers, not only because of the virtual impossibility of reasonable enforcement but also because of the invidious political economy of rent-seeking that it may create at the local levels. The Gujarat assembly passed the law but the Chief Minister decided, wisely, not to gazette the act in view of high transaction costs of enforcing it.[13]

The chief ministers of some other Indian states were, however, less transaction cost-savvy. So in 1993, Maharashtra made a law with a limited ambition of disabling irrigation wells within 500 m of a Public Water Source during droughts, with a view to protecting drinking water wells. Ten years after its enactment, the International Water Management Institute (IWMI) commissioned a study of the enforcement of this law (Phansalkar and Kher, 2003). The law provides for stern action against violation but has a 'naughty' clause requiring that the law be invoked only when a '*gram panchayat* (village council) files a written complaint' (which, at one stroke, reduces to a fraction the transaction costs as well as the potency of the law).

The study found numerous cases of violations of the 500 m norm, yet not a single case of legal action has resulted because gram panchayats have failed to file a written complaint. It concluded that: 'There is a near complete absence of social support for the legislation. The rural lay public as well as the office bearers of gram panchayats appear inhibited and reluctant to seem to be "revengeful" towards those who are doing no worse than trying to earn incomes by using water for raising oranges.'

Instead of invoking the law, supply-side solutions in the form of upgraded drinking water facilities and water tankers during droughts are preferred by people, gram panchayats as well as *zilla parishads* (district councils). IWMI also did a quick assessment of the Andhra Pradesh Water and Trees Act (Narayana and Scott 2004),[14] and concluded on a similar pessimistic note. A similar exercise has been the formulation of the official Government of India Water Policy of 1987 and 2002. Both these pieces are an excellent example of bland, almost tongue-in-cheek, enunciations that are *not* designed to change anything in any manner.[15] As a result, they have low transaction costs, but also no pay-off.

Other widely espoused proposals entail high transaction costs and promise doubtful benefits – at least in the prevailing circumstances. A good example in India is the effort to introduce volumetric pricing of electricity supply to groundwater irrigators after having given up on it decades previously. It was the high transaction costs of metering over a million irrigation pump-sets – which involved installing and maintaining meters, reading them every month, billing based on metered consumption of power but, more importantly, controlling pilferage, tampering with meters with or without collusion with meter readers, etc. – that obliged State Electricity Boards (SEBs) to switch to a flat tariff during the 1970s (Shah, 1993).

A flat tariff, collected based on the size of the pump horsepower rather than on the metered consumption of electricity for pumping, succeeded in reducing transaction costs of serving a market where derived demand for electricity was confined to periods of peak irrigation requirements. It would have been a viable system if SEBs had learnt to ration power supply to agriculture and gradually raise the flat tariffs to break-even levels. However, neither happened; farmer lobbies have managed all along to prevent upward revision in the flat tariff while compelling the SEBs to maintain electricity supply to the farm sector. The invidious nexus between energy and irrigation – which has contributed to the bankruptcy of the

Indian power sector and rampant over-exploitation of groundwater – has been discussed by Shah *et al.* (2004c). We simply summarize its conclusion here.

In the thinking of SEBs and multilateral donors about ways out of this imbroglio, a return to metering power is critical, even if it means taking on farmer lobbies. Several chief ministers have tried to bite the bullet in the past few years. But farmers' opposition has been so strong, swift and strident that they have been either felled or obliged to retract. Some, as in Punjab and Tamilnadu, have done away with farm power tariff altogether. Recommending metering farm electricity in today's setting is asking politicians to do hara-kiri.

But even if a politician were to succeed in metering farm power supply, it would probably change little because, if anything, transaction costs of metered power supply are much higher today than they were in the 1970s. Most states have at least eight to ten times more irrigation tube wells today than they had during the 1970s; and farming livelihoods depend far more critically on electricity today than 30 years ago. If metering must work in the India of today, we must learn from the Chinese experiments, which always stuck with metering, and then focus on modifying the incentive structures to address many of the problems metering faces in India (see Shah *et al.*, 2004a).

Surprisingly, the electricity–irrigation nexus is not a subject of discussion in China at all. The Chinese electricity supply industry operates on two principles: (i) total cost recovery in generation, transmission and distribution at each level, with some minor cross-subsidization across user groups and areas; and (ii) each user pays in proportion to their metered use. Unlike in much of South Asia, rural electricity throughout China was charged at a higher rate than urban; and agriculture paid more than domestic and industrial use until a few years ago (Wang *et al.*, 2004).

Until 1997, the responsibility for operation and maintenance of the village electricity infrastructure and user charge recovery lay with the village committee. The standard arrangement in use was for the village committee and the township electricity bureau to appoint and train one or more local farmers as part-time village electricians with dual responsibility for: (i) maintaining the power supply infrastructure in the village; and (ii) collecting user charges for a transformer assigned to him/her based on metered individual consumption from all categories of users. The sum of power use recorded in the meters attached to all irrigation pumps had to tally with the power supply recorded at the transformer for any given period. The electrician was required to pay the township electricity bureau for power use recorded at the transformer level.

This arrangement did not always work easily. Where power supply infrastructure was old and worn out, line losses below the transformer made this difficult. To allow for normal line losses, a 10% allowance was given by the township electricity bureau to the electrician. However, even this must have made it difficult for the latter to tally the two; as a result, an electricity network reform programme was undertaken by the national government to modernize and rehabilitate rural power infrastructure.[16] Where this was done, line losses fell sharply,[17] and among a sample of ten villages I visited in 2003, none had a problem tallying power consumption recorded at the transformer level with the sum of consumption recorded by individual users, especially with the line loss allowance of 10%.

It is interesting that the village electrician in Henan and Hebei provinces in North China is able to deliver on a fairly modest reward of US$24–30/month plus an incentive bonus of around $24/month (Zhang, 2004), which is equivalent to the value of wheat produced on 1 mu (or 0.67 ha) of land. For this rather modest wage, China's village electrician undertakes to make good to the township electricity station the full amount on line and commercial losses in excess of 10% of the power consumption recorded on the transformers; if he can manage to keep losses to less than 10%, he can keep 40% of the value of power saved. This generates a powerful incentive for him to reduce line losses.

In the way that the Chinese collect metered electricity charges, it is well nigh impossible to make financial losses since these are firmly passed on downstream from one level to the next. Take, for example, the malpractice common in South Asia of end-users tampering with meters or bribing the meter reader to

under-report actual consumption. In the Chinese system, it is very unlikely that such malpractices could occur on a large scale, since the village electrician is faced with serious personal loss if he fails to collect from the farmers electricity charges for at least 90% of power consumed as reported at the transformer meter. And since malpractice by a farmer directly hits other farmers in the village, there is likely to exist strong peer control over such practices.

In making metered power pricing work, China's unique advantage is its strong village-level authority structure. The village committee, and especially, the village party leader, is respected and feared. These factors ensure that the electrician is able to do his or her job. In comparison to China's village committees, India's village Panchayats are utterly devoid of power, as well as authority, as institutions for local governance.

In India a similar experiment was tried out in Orissa, where private companies in charge of distribution first experimented with village *vidyut sangha*s (electricity cooperatives) by forming 5500 of them but are now veering around to private entrepreneurs as electricity retailers. Mishra (2004), who carried out an assessment of Orissa reforms for the IWMI-Tata programme, visited a number of these sanghas during 2003 and noted that: 'None of the village committees were operational.' These worked as long as the support organization hired to catalyse them propped them up with constant visits and organizational work; as soon as the support organization was withdrawn, the village vidyut sanghas became defunct. Mishra (2004) wrote: 'The situation today is quite similar to that [which] existed earlier before the interventions were made through the Committee.' Sanghas having failed, power distribution companies appointed three private entrepreneurs as franchisees on terms similar to those facing China's village electricians. These have resulted in sustained and significant improvements in billing and collection of electricity dues.

The Orissa experiment and the Chinese experience suggest that, in principle, it is possible to make volumetric pricing and collection of electricity charges work if private entrepreneurs are given appropriate incentives. However, in Orissa, the electricity use in agriculture is less than 5%. If the same arrangement were to work in Punjab, Haryana or Gujarat or several other states where electricity use in the farm sector is 30% or more, farmer resistance would be greater and commensurate with the effectiveness of the volumetric pricing. And one thing that private power retailers in Indian villages would have to do without is the authority of the village party leader that helps China's village electricians to firmly pass on all costs to farmers. In the absence of such authority structures, private entrepreneurs would expect very high margins to assume the role of retailing power on a volumetric basis. This – as well as farmer propensity to frustrate metering – would raise transaction costs of metering to very high levels. If the ultimate purpose of volumetric pricing is to improve the finances of electricity utilities, I doubt this purpose would be achieved.

In a recent paper (Shah *et al.*, 2004c), we have argued that, in making an impossibly bad situation better, a more practical course available to SEBs and state governments is to stay with flat tariffs but to rationalize them through intelligent management of power supply. Farmers' needs for power are different from those of households or industries: they need plentiful power on 30–40 days of the year when crops face acute moisture stress. However, in most states, they receive a constant 8–10 h/day of poor-quality power supply throughout the year. If SEBs were to invest in understanding that their farmers are customers, it should be possible for them to supply 20 h/day of good-quality power to farmers on 30–40 days of peak irrigation need while maintaining 3–4 h/day supply on other days. In order for such an approach to work, the nature and capabilities of the power utilities have to change; so also does the thinking of donors and governments.

In sum, in improving the working of India's water economy, many policy and institutional interventions – already tried and watered down, or on the discussion table – are of little value because its predominantly informal nature makes its policing and enforcement costs prohibitive. India is not alone in devoting energies and resources to these.

In Africa several countries have, during recent years, experimented with demand management ideas such as pricing of water, instituting water

withdrawal permits and restructuring regional water departments as river basin organizations. Although it may be too early to write a report on these, countries like Ghana are already having second thoughts. The concerns are of five kinds: (i) most reforms have remained largely unimplemented, especially in the informal segments of the water economy that encompass most of the users and uses; (ii) nowhere have the reforms produced evidence of improved performance of the water economy, except in countries with a large formal water economy; (iii) implementation of reforms has disrupted customary arrangements for water management that was robust enough to, at least, survive the test of time; (iv) when zealously implemented, reforms – especially water permits and water taxes – hit poor people in remote rural areas hard; and (v) 'demand management reforms' deflected national IE players from pursuing water sector priorities important to them, namely improving water infrastructure and services to their people (Shah and van Koppen, 2005).

Areas in Need of Institutional Innovation (Quadrant 2)

Rather than evolving organically from the unfolding situation on the ground – and therefore being demanded by stakeholders – many of the reforms currently being pursued in India, such as Irrigation Management Transfer (IMT), River Basin Management and metering of electricity are actually promoted aggressively by both researchers and funding agencies,[18] and are sometimes out of sync with the prevailing Indian context. By far the most frequent are situations where institutional interventions proposed would yield high productivity pay-offs if successful; but they rarely succeed because of high transaction costs.

In independent India's history, the 'communitarian ideal' – the notion that villagers will instantly come together to take over the responsibility of participatory, democratic management of virtually anything (land, water, watersheds, forests, irrigation systems, river basins) – has been behind innumerable abortive institutional interventions. What has helped fuel this enthusiasm for participatory irrigation management (PIM) by farmers are occasional examples of such models having worked reasonably well either in the industrialized countries or in India itself, but under the tutelage of an inspired local leader or an industrious NGO. Its having worked in a few situations in exceptional conditions becomes the basis for designs of major programmes of institutional interventions, commonly bankrolled by a supportive donor.

One classic example of ideas in this genre is PIM (or its cousin IMT) which has been, for the past four decades, the ruling *mantra* for improving the productivity of irrigation systems in India. What is extraordinary about this preoccupation with PIM (or IMT) is the sway it has continued to hold on players in water IE, despite virtually no evidence of it having succeeded anywhere else except on an experimental scale, that too with facilitation of non-replicable quality and scale.[19]

The idea of farmers managing irrigation canals is not new; the British tried hard in the late 19th century to get farmers from the Indus and Ganges areas to participate in irrigation management but without much success, except in enforcing *warabandi* (rotational methods for equitable allocation of available water) in the Indus canals (Whitcombe, 1984). More recently, since 1960, WUAs (Water Users' Associations) have been tried out on small irrigation systems. Uttar Pradesh tried *sinchai samitis* (irrigation committees) way back in the early 1960s on irrigation tanks and reservoirs; following that, Madhya Pradesh too tried it on thousands of its minor irrigation tanks.

Other states have been trying to make *pani panchayats* (water councils) work. But sinchai samitis of Madhya Pradesh and Uttar Pradesh have disappeared without trace; and so have pani panchayats in Gujarat and elsewhere. Yet, Orissa recently made a law that transferred all its minor irrigation systems to instantly created pani panchayats. Gujarat introduced joint irrigation management programmes as far back as in 1983, but the 17 irrigation cooperatives lost money and became defunct. In 1991 it made another attempt, this time around with assistance from NGOs; 144 irrigation cooperatives were formed to cover 45,000 ha of irrigated area (Shukla, 2004); however, it is difficult to see precisely in what way these areas are better off than other command areas.

Indeed, a core idea of Command Area Development Agencies (CADAs) in the early 1980s was to involve farmer organizations in the management of irrigation projects. But we see no trace of CADAs or their beneficiary farmers' associations (BFAs), even in Kerala where thousands of these were formed under a 'big bang' approach in 1986. An assessment by Joseph (2001) in the late 1990s suggested that, even in this land of strong traditions of local governance, good education and high levels of public participation, BFAs were a damp squib.[20]

As in Kerala, Andhra Pradesh overnight transferred the management of all its irrigation systems to over 10,000 WUAs created by the automobile company Fiat and a World Bank loan; this 'big bang' approach to PIM has attracted all-round interest; however, now that the World Bank funds retailed to WUAs for maintenance are over, field observers are beginning to wonder precisely what the WUAs are doing better (Jairath, 2001).[21]

The central assumption underlying PIM/IMT is that, once irrigation management is transferred from remote bureaucracies to WUAs, the financial viability of the systems would improve and so would the quality and reliability of irrigation. Physical and value productivity of water and land would increase. As a result, irrigation systems would better achieve their potential for food and livelihood security for farmers in their command. PIM/IMT programmes have belied many of these expectations, even in countries like Turkey, Mexico and Philippines where they are known to have succeeded. As a result, early expectations from PIM/IMT have been increasingly moderated and IMT is now considered successful even if it just 'saves the government money, improves cost effectiveness of operation and maintenance while improving, or at least not weakening, the productivity of irrigated agriculture' (Vermillion, 1996, p. 153). The drift of the IMT discussion then, in recent times, has been more towards getting irrigation off the back of the governments than towards improving the lot of the farmers and the poor, the original goal at which much public irrigation investment has been directed over the past 50 years.

Some over-arching patterns emerge from a reading of the international experience. IMT has tended to be smooth, relatively effortless and successful where:

- The irrigation system is central to a dynamic, high-performing agriculture.
- The average farm size is large enough for a typical or a significant proportion of the command area farmers to operate like agro-businessmen.
- The farm producers are linked with global input and output markets.
- The costs of self-managed irrigation are an insignificant part of the gross value of product of farming.

These are the conditions – all of which enhance the pay-offs, reduce transaction costs or both – obtained in Mexico, the USA and New Zealand, from where emerge the resounding success stories we hear about IMT[22] (Shah *et al.*, 2002). In South Africa the commercial farming sector, which satisfies all these conditions, took naturally to PIM through its irrigation boards; but the same logic when applied to irrigation systems serving smallholders in former homelands met with resounding failure because these met none of the conditions that irrigation boards satisfied (Shah *et al.*, 2002).

Even where all conditions are satisfied and PIM/IMT declared 'successful', researchers have presented a mixed picture of resultant impacts. For example, an exhaustive global review carried out for IWMI of IMT impacts by Douglas Vermillion, a pioneer in IMT research, showed that impacts are significant and unambiguously beneficial in terms of cost recovery in Turkey, Mexico, the USA and New Zealand. Fee collection has improved; agency staff strength has declined. But the impact of management transfer on agricultural productivity and farm incomes is far less unequivocal even in these countries (Vermillion, 1996, p. 153). In Philippines, the Mecca of IMT and PIM, recent studies show that productivity gains from PIM have not been sustained (Panella, 1999).

None of the conditions outlined above are obtained in a typical Indian surface irrigation system. Most farmers in the command have small-holdings, subdivided further into smaller parcels. A typical major system has hundreds of thousands of smallholders, making it well nigh impossible to bring them all together to negotiate. Over 90% of the surface water irrigated area in India is under field crops yielding Rs 15,000–18,000 (US$325–400)/ha of gross

value of output, compared with US$3000–7500/ha in high-value farming in industrialized countries. Irrigation systems are at the heart of the farming economy of command areas. However, the mushrooming of wells and tube wells, and booming pump irrigation markets in command areas and in the neighbourhood of irrigation tanks have reduced farmers' stakes in managing surface irrigation systems. Head-reach and tail-end farmers almost always have opposing motivations when it comes to management reform, with the former interested in preserving the status quo and the latter interested in change.

All these, together, raise the transaction costs of implementing management reform through PIM/IMT-type interventions. The prospects become worse because, almost everywhere, the agency's purpose in promoting PIM is to get WUAs to assume arduous responsibilities – maintenance, fee collection, mobilization of voluntary labour for repair and maintenance works, etc. Moreover, farmers are generally quick to figure out that PIM often means increased water fees without corresponding improvement in service quality. These reduce the perceived pay-offs from reform.

All in all, decades invested in the hope that PIM or IMT would spearhead productivity improvements in public irrigation are decades wasted. PIM has not achieved any significant success on a meaningful scale anywhere in India, and it will indeed be a great surprise if it does in the existing IE marked by hopelessly low irrigation fees, extremely poor collection and poor main system management.

There are similar institutional misadventures in other spheres. In growing regions where fluoride contamination of groundwater is endemic, governments and donors have tried setting up village-based reverse osmosis-type plants or Nalgonda-type defluoridation plants to control the growing menace of dental and skeletal fluorosis. Again, the management model chosen is communitarian, and these have invariably failed. In Gujarat, out of dozens of such plants set up during the 1980s and 1990s, not one has operated for more than a few months.

An older experiment with a communitarian model has been with inland fishery cooperatives. Numerous local water bodies controlled by irrigation departments, zilla panchayats, *taluka panchayats* (sub-district councils) and gram panchayats can potentially sustain a vibrant inland fishing enterprise and livelihood system. However, government policy has always been to give away monopoly lease rights to registered fisher-people's cooperatives. Thousands of such cooperatives are registered; but probably a very small fraction – in my surmise, less than 1 or 2% – operate as dynamic producer cooperatives as, for instance, the dairy cooperatives do in Gujarat.

In South India, which has over 300,000 irrigation tanks, a decades-old concern has been about the breakdown of traditions of maintenance of bunds and supply channels, orderly distribution of water and protection from encroachment. Several donor-supported projects first aimed at 'engineering rehabilitation' and restored tank infrastructure to their original – or even a better – condition. However, when rehabilitation of tanks again declined and needed another round of rehabilitation, planners found something amiss in their earlier approach. Therefore, in new tank rehabilitation programmes – such as the new World Bank project in Karnataka – an institutional component is added to the engineering component. But the institutional component invariably consists of registering a WUA of command area farmers. Except where such WUAs have been constantly animated and propped up by support NGOs – as in the case of the Dhan Foundation in Madurai, Tamilnadu – it is difficult to find evidence of productivity improvements in tanks because of WUAs on any significant scale (Shah *et al*., 1998).

Besides the problem of high transaction costs of co-coordinating, negotiating, rule making and, above all, rule enforcement and improving the management of tanks – more in North India than in South India – face some special problems. One of them is of aligning conflicting interests of multiple stakeholders. Command area farmers have a direct conflict of interest with tank-bed farmers; and well owners in the neighbourhood of tanks are a potential threat to all other users because they can virtually steal tank water by pumping from their wells. Then, there are fishing contractors whose interests also clash with those of irrigators, especially during the dry season (Shah and Raju, 2001). Registering a WUA of command area farmers and hoping that this 'institutional intervention' would increase productivity of tanks is

extremely naive. Improved management of public irrigation systems, tanks and fishery represents opportunities for high pay-off but has failed to be realized because the institutional models promoted have high transaction costs.

Vibrant Institutional Arrangements Ignored (Quadrant 1)

The core of New Institutional Economics is the notion that productivity of resources in an economy is determined by technology employed and institutions. And if 'institutions affect economic performance by determining transaction and transformation (production) costs', then the Indian water sector is brimming with institutional changes occurring on the margins that are doing this all the time, and yet are either glossed over (or even frowned upon) by the players in the IE. Most such institutions we explore in this section are invariably *swayambhoo*[23] (self-creating and spontaneous); they have come up on a significant enough scale to permit generic lessons. These invariably involve *entrepreneurial* effort to reduce transaction costs; they serve an important economic purpose, improve welfare and raise productivity; they are commonly faced with an adverse or unhelpful IE. Crucially, these constitute the *instrumentality* of the players of the game, and sustain as long as they serve their purpose.

The emergence of tube well technology has been the biggest contributor to growth in irrigation in post-independent India; and the spontaneous rise of groundwater (or, more appropriately, pump irrigation service) markets has done much to multiply the productivity and welfare impact of tube well irrigation. The Indian irrigation establishment is probably out of touch with the changing face of its playing field: it still believes that only 38% of the gross cropped area is irrigated, 55% of it by groundwater wells. But concerning the reality of Indian irrigation at the dawn of the millennium, the tail has begun wagging the dog.[24] IE in the Indian water sector has little or no interface with either the 75% of Indian irrigation occurring through tube wells or with the institution of water markets.

The working of groundwater markets has now been extensively studied (see Shah, 1993; Janakarajan, 1994; Saleth, 1998; Singh and Singh, 2003; Mukherji, 2004 for a good survey of the literature). These studies analyse myriad ways in which their working differs across space and time.

But common elements of groundwater markets everywhere in the Indian subcontinent are the features we listed at the start of this section: (i) they are swayambhoo; (ii) they operate on such a large scale as to account for over one-quarter of the Indian irrigated areas; (iii) water sellers everywhere constantly innovate to reduce transaction costs and create value; (iv) water markets are the *instrumentality* of buyers and sellers of pump irrigation service, and not of society at large or the IE; (v) as a result, water markets are unrepentant when their operation produces externalities such as groundwater depletion or drying up of wetlands; and, finally, (vi) despite their scale and significance, the IE has been blind towards the potential of water markets to achieve larger policy ends. When they take notice of their existence and role – which is seldom – water policy makers are often unable to decide whether they deserve promotion or regulation.

Much the same is the case with many other water institutions. In the previous section, I mentioned tens of thousands of fishermen's cooperatives that are lying defunct. However, pond fishery entrepreneurs have sprung up everywhere who use 'paper' cooperatives as a front for operating profitable culture fisheries. Why don't fisher cooperatives exploit the economic opportunities that these contractors are able to? The most important reason is the transaction costs of protecting their crop. Culture fishery is capital intensive but affords a high yield. In common property village or irrigation tanks with multiple stakeholders, in order to remain viable the fishermen should be able to meet many conditions. They should effectively defend their rights against poachers, and against irrigators who may want to pump tank water below the sill level during dry periods to irrigate crops, or against tank-bed cultivators who want to empty the tank so they can begin sowing.

In South Asia, fisher communities are commonly from the lowest rung of the village society. They would not only have difficulty in

mobilizing capital to buy seedlings and manure but also in protecting the crop from poaching from outsiders, from the local bigwigs as well as from their own members. Fisher cooperatives, as a result, always underinvest. Reserving fishing contracts for fisher cooperatives is therefore the best formula for sustained low productivity of the inland fishery economy.

We discovered just how high the transaction cost of protecting a fish crop was when we studied who precisely the fishing contractors were in two separate studies in central Gujarat and Bundelkhand. We found that, in both the regions, the key characteristic of people who emerged as successful fishing contractors was a painstakingly cultivated image of a toughie, or a ruffian capable of enforcing his rights even by using violence. In Bundelkhand, 'Everywhere the fishing contractors involved stopped farmers from lifting water from the tank once the last five feet of water was left. They had invested in fish production and now were making sure they get their money's worth' (Shah, 2002, p. 3).

In central Gujarat, fishing contractors often have to resort to violence and even undergo a jail term to establish that they meant business when it came to defending their property right.[25] Despite this unsavoury aspect, I would not be much off the mark in suggesting that the explosive increase in inland fishery in India during the past 40 years is the result of two factors: (i) introduction of new technologies of culture fishery along with its paraphernalia; and (ii) gradual emasculation by the fishing contractors of the idealized fisher cooperatives as monopoly lease holders on water bodies. Had the cooperative ideal been enforced vigorously, India's inland fishery would not have emerged as the growth industry it is today.

How changing IE policy unleashes productive forces in an economy is best illustrated by the evolution of Gujarat's inland fishery policy over the past 30 years (Pandya, 2004). Following early attempts to intensify inland fisheries during the 1940s, Gujarat Government's Fisheries Department began supporting village panchayats to undertake intensive culture fishery in village tanks during early 1960. However, the programme failed to make headway, partly because of popular resistance to fish culture in this traditionally vegetarian state and partly because of rampant poaching from local fisherfolk that village panchayats, as managers, could not control. In a modified programme, the Fisheries Department took over the management of tanks from the panchayats to raise fishery to a produce-sharing basis; but the Department was less effective than the panchayats in checking poaching. In 1973, a special notification of the Government of Gujarat transferred inland fishing rights on all water bodies, including village tanks, to the Fisheries Department, which now set about forming fishermen's cooperatives in a campaign mode. The idea was to entrust the management to the community of poachers themselves.

In the Kheda district of Gujarat, for example, 27 such cooperatives were formed to undertake intensive culture fishing. However, these were none the better when it came to controlling poaching – including that by their own members; and the gross revenues could not even meet the bank loans. Members lost heart and cooperatives became defunct, a story that has been endlessly repeated in various fields in India's history of the cooperative movement. While all manner of government subsidies were on offer, what made culture fishery unviable were three factors: (i) a lease offered for only 3 years, a period considered too short to recoup the investment made; (ii) only registered cooperatives could be given a lease and the process of registration was transaction-costly; and (iii) rampant poaching and the high cost of policing and preventing it.

All this time, culture fishery productivity was steadily rising. Although fisher cooperatives were not doing well, culture fishery was, as entrepreneurs began using cooperatives as a front to win leases on common property water bodies. Doing this entailed significant transaction costs; office bearers of cooperatives had to be paid off, and gram panchayat leaders kept in good humour so that the lease would be renewed. Even then, whenever a gram panchayat leadership changed, the new order would terminate the contract to favour a new contractor. This dampened the contractors' interest in investing in high productivity.

In 1976, the government began setting up fish farmers' development agencies in each district to implement a new Intensive Fish Culture Programme. Terms of lease began to

undergo change: private entrepreneurs were, in principle, considered for giving away leases but there was a pecking order of priority where first priority was for a Below Poverty Line (BPL) family, followed by a local poor fisherman, then a local cooperative and, if none of these were available, to any entrepreneur who bid in an open auction.

Earlier, the government had paid a puny rental to the gram panchayats for using their tanks for fish culture. Now that entrepreneurs were allowed, gram panchayats began quoting an 'upset price' derived as an estimate of the 'fishing value' of the tank, which was often 20 to 30 times the rental panchayats received earlier from the Department. Even so, as soon as leases were open to entrepreneurs, many came forward. A later change in policy gave cooperatives some discount in the 'upset price' and other benefits. In general, the IE's outlook constantly remained favourable to cooperatives and suspicious of entrepreneurs. In 2003, a series of new changes in the policy framework gave a further fillip to productivity growth: the lease period was extended from 3 to 10 years, which reduced the contractors' vulnerability to changes in panchayat leadership. It also made investment in productivity enhancement attractive. The new policy also removed the last vestiges of special treatment to cooperatives, and provided for a public auction of the lease after open advertisement.

During 1971–1998, the inland fishery output of Gujarat increased sixfold from 14,000 mt (metric tons) in 1971 to over 80,000 mt in 1998–1999 (Government of Gujarat, 2004). Considering that Gujarat had hardly any culture fishery before 1950, it must be said that the credit for this growth rightly belongs to the government's efforts. The government invested in subsidies, organizing inputs, bringing in new technology, extension and training and much else. All these played a role in expanding the fisheries economy. However, perhaps, the most important impact has been produced by two factors: (i) the changes made at the margins in the leasing policies of water bodies that have shaped the transaction costs of setting up and operating a profitable culture fishery business; and (ii) the high costs of controlling poaching, which has ensured that, besides several entrepreneurial qualities, successful fishing contractors also have to acquire and deploy muscle power.

Several less sensational examples can be offered of spontaneous institutions that operate on a large scale to serve purposes for which water establishments often promote copybook institutions such as WUAs. I briefly mentioned earlier how hundreds of defunct community reverse osmosis (RO) or defluoridation plants set up by governments and donors to supply fluoride-free drinking water to village communities have failed under community management. However, in North Gujarat, as a demand curve has emerged for fluoride-free drinking water, some 300 plants selling packed desalinated water have mushroomed in the cottage sector. Over half of these have been set up since 2001, mostly in *mofussil* (small towns) to serve permanent customers, as well as to retail water in polythene pouches.[26]

The RO cottage industry of Gujarat was quietly serving a growing demand when the 'IE' caught up with it. In 2001, the Bureau of Indian Standards (BIS) made it compulsory for cottage RO plants to achieve the ISI mark.[27] This entailed that each plant had to invest Rs 0.3–0.4 million ($6500–8670) in an in-house laboratory and pay an annual certification fee of Rs 84,000 ($1870) to the ISI. This single move immobilized the emerging RO water cottage industry; 200 operators had to close their businesses because the new announcement doubled their cost of production. Yet, setting up an in-house laboratory and paying an annual certification fee implied no guarantee of quality assurance because BIS inspectors hardly visit plants, if ever. Many customers (Indu, 2002) interviewed wondered if the ISI mark – like the AGMARK (standardized certification for agricultural food products) ghee and honey – can by itself guarantee quality unless BIS itself put its act together in the first place.

Likewise, many state governments are struggling, in vain, to cut their losses from operating mostly World Bank-funded public tube well programmes by trying to transfer these to *idealized* cooperatives registered under the Cooperative Act. If the purpose of a cooperative tube well is to enable a group of farmers to mobilize capital, to install and operate a tube well for the mutual benefit of members, such tube well groups have existed for decades in

North Gujarat. The difference is that, having been created to serve the purpose of their members, their ownership structure and operating rules are designed to minimize the transaction costs of cooperating on a sustained basis (Shah and Bhattacharya, 1993). The Government of Gujarat tried hard to transfer its public tube wells to idealized cooperatives but, thanks to the very high transaction costs relative to the pay-off facing potential entrepreneurs, the programme made no headway until 1998 when the terms of turnover were rewritten.[28]

Basically, the requirement that a cooperative be registered under the Cooperative Act was dropped; the lease period was extended from 1 to 5 years; and changes were introduced that made it possible for one or few major stakeholders to assume the role of tube well manager and residual claimant. These minor changes suddenly gave a fillip to the turnover programme and, over a 3-year period, over half of Gujarat's public tube wells, some 3500 in all, were transferred to farmer groups. An IWMI-Tata study of turned-over public tube wells (Mukherji and Kishore, 2003) showed that, within 1 year of the turnover, the performance of turned-over tube wells, in terms of area irrigated, hours of operation, quality of service, O&M and financial results improved. Two years after the turnover, it improved dramatically.

In opening this section, I talked about the significance of groundwater markets in India's irrigation. However, private provision of water services is also an important part of India's urban reality. In an IWMI-Tata study of six cities – Indore, Jaipur, Nagpur, Ahmedabad, Bangalore and Chennai – Londhe *et al*. (2004) found that municipal agencies supplied only 51% of the demand calculated at 80 l per capita per day.

In Chennai and Ahmedabad, formal organizations served only 10 and 26%, respectively, of the 'normative' demand, the balance being either self-supplied or served by informal sector players. 'Tanker markets' supply 21, 12 and 10% of the demand in Chennai, Indore and Jaipur, respectively. In Chennai, tanker operators have year-round operations and even have an association. In other cities, tanker markets emerge during the summer and quietly disappear as the monsoon arrives. Londhe *et al.* (2004) estimate that some 3000 tankers in the six cities operate a water trade worth Rs 203 crore (US$45 million)/year. Despite being key players in urban water sectors: 'There is no record with any government department about its size, scale and modus operandi. There is an absence of any government regulation on groundwater withdrawals. Except in Chennai, municipal authorities refuse to even acknowledge the existence of such markets' (Londhe *et al*., 2004).

Tanker markets operate much like any other market, and serve those who can pay for their services. The IWMI-Tata study estimated that 51% of consumers in the six cities are from high-income groups, 43% from middle-income groups and only 6% from low-income groups. Contrary to belief that the poorest pay the most for water, the IWMI-Tata study showed that the poorest pay the least, even when transaction costs and imputed cost of labour and time in fetching water are factored in (Londhe *et al*., 2004).

One more case of institutions that 'planners propose and people dispose' that I want to discuss briefly concerns the world-famous Sardar Sarovar Project (SSP) on the Narmada river. SSP must be one of the world's most-planned projects. One of SSP's key planning premises was that the Project would construct lined canals with gated structures going right up to the village service area (VSA), comprising some 400 ha of command. A WUA would be organized in each VSA that would simultaneously construct the sub-minor and field channels to convey water from the *pucca* (lined minor) to the fields. When SSP water was first released to some 80,000 ha of the command just below the dam in 2001, the Project managers registered, on a war footing, WUAs as cooperatives in some 1100 VSAs. When the water was finally released, however, the village-level distribution structure was not ready in a single village.

And it will never be, as we learnt in the course of a quick assessment of farmer preparedness to receive Narmada irrigation (Talati and Shah, 2004). The perceived sum of the transaction and transformation cost[29] of constructing village distribution systems seemed by far to outweigh the benefits people expected of SSP. There was, however, a flurry of activity as SSP water began flowing into minors.

According to our quick estimates, several thousand diesel pumps and several million metres of rubber pipes were purchased by water entrepreneurs to take water to their own fields and to provide irrigation services to others.

The trend for new investments in diesel pumps and rubber pipes gathered further momentum in 2002 and 2003; and we found that village communities were none the worse for having violated the SSP planning assumption. The Government of Gujarat is, however, adamant on constructing a 'proper' village distribution system in the SSP command – never mind whether it will take 50 years to complete the canal network.[30]

The swayambhoo institutions I have discussed in this section are all driven by opportunism. However, large-scale swayambhoo institutions are often driven by more complex motives including long-term, collective self-interest. The decentralized mass movement for rainwater harvesting and groundwater recharge that the Saurashtra region of Gujarat saw from 1987 until 1998, when it became co-opted by the state government, is a good example of such an institutional development (Shah, 2000).

The movement was catalysed first by stray experiments of 'barefoot hydrologists' in modifying open wells to collect monsoonal flood waters. Early successes fired the imagination of a people disillusioned with ineffective government programmes. Soon, well recharge was joined by other water-capture structures such as check dams and percolation tanks. With all manner of experimentation going on, a kind of subaltern hydrology of groundwater recharge developed and became energetically disseminated. Religious leaders of sects like *Swadhyaya Pariwar* and *Swaminarayana Sampradaya* ennobled this work in their public discourses by imbuing it with a larger social purpose. The gathering movement generated enormous local goodwill and released philanthropic energies on an unprecedented scale, with diamond merchants – originally from Saurashtra but now settled in Surat and Belgium – offering cash, cement companies offering cement at discounted prices and communities offering millions of days of voluntary labour.

In neighbouring Rajasthan, Alwar was also undergoing similar mass action; but it was far more limited in scale, and was orchestrated by Rajendra Singh's Tarun Bharat Sangh, a grass-roots organization. Saurashtra's recharge movement was truly multicentric, unruly, spontaneous and wholly internally funded with no support from government, international donors or the scientific community – until 1998, when the Government of Gujarat became involved and proceeded to rid the movement of its quintessentially swayambhoo and voluntary character by announcing a subsidy programme (Shah, 2000; Shah and Desai, 2002).

It is difficult to assess the social value of this movement, partly because 'formal hydrology' and 'popular hydrology' have failed to find a meeting ground. Scientists want check dams sited near recharge zones; villagers want them close to their wells. Scientists recommend recharge tube wells to counter the silt layer impeding recharge; farmers just direct flood water into their wells after filtering. Scientists worry about upstream–downstream externalities; farmers say everyone lives downstream. Scientists say the hard-rock aquifers have too little storage to justify the prolific growth in recharge structures; people say a check dam is worthwhile if their wells provide even 1000 m^3 of life-saving irrigation/ha in times of delayed rain. Hydrologists keep writing the obituary of the recharge movement; but the movement has spread from eastern Rajasthan to Gujarat, thence to Madhya Pradesh and Andhra Pradesh. Protagonists think that, with better planning and larger coverage, the decentralized recharge movement can be a major response to India's groundwater depletion problem because it can ensure that water tables in pockets of intensive use rebound to pre-development levels at the end of the monsoonal season every year they have a good monsoon.

Table 5.1 offers a comparative view of a sample of six 'high pay-off–low transaction-cost' institutions that have emerged in India's water sector in recent years. If we judge institutions by their contribution to increasing productivity and welfare, all six can be considered successful. Each can be found to operate on a significant scale, thus permitting generic lessons. One notable aspect is that each institution has arisen spontaneously and flourished as an instrumentality of its players, serving a purpose important to them though not necessarily of the IE players. Each has devised

Table 5.1. Characteristics of swayambhoo water institutions.

	Fishing contractors using cooperatives as fronts	Reverse osmosis (RO) plants in North Gujarat's cottage industry	Tube well companies of North Gujarat and Gujarat's Public Tube Well Transfer Programme	Urban tanker water markets	Irrigation institutions unfolding in the Narmada command and Upper Krishna basin	Decentralized groundwater recharge movement of Saurashtra
Spread of the institution	Tens of thousands of small and large tank fisheries in India	Around 300 plants in Gujarat	Some 8,000–10,000 companies in North Gujarat	Most Indian cities	Several thousand new pumps installed/year	300,000 wells modified for recharge; 50,000 check dams
Economic contribution	Contributed to achieving seven- to tenfold increase in inland fishery productivity 1960–2000	Add and operate water treatment capacity to serve demand for clean water	Create irrigation potential which individual farmers would not be able to do	Fill the gap between demand and supply	Private investment in water distribution infrastructure; expansion of Narmada irrigation	Improved greatly security of kharif crops, and possibility of a rabi crop
Raison d'être	Can protect fish better and therefore can invest in intensive culture fishery, which cooperatives cannot	To profit from serving emerging demand for fluoride-free water by investing in and maintaining RO plant	To pool capital and share risks of tube well failure in creating and operating an irrigation source in an over-exploited aquifer	To profit from supply of water in cities where public institutions cannot cope with the economic demand	To profit by distributing Narmada water by lifting water from canals and transporting it by rubber pipe to user fields	Improve water availability in wells for life-saving irrigation when monsoon makes early withdrawal
Mode of emergence	*Swayambhoo*	*Swayambhoo*	*Swayambhoo*	*Swayambhoo*	*Swayambhoo*	Catalysed by religious organizations
Strategy of reducing transaction and transformation cost	Instilling fear amongst poachers	Cultivating annual customers	Vesting management roles in members with largest share in command area	Meet the demand as it occurs in a flexible manner	Avoidance of making of sub-minors and field channels, reducing seepage, overcoming topography	Religious leaders have reduced transaction costs of cooperative action
Incentive structure	Pay-off concentration	Pay-off concentration	Pay-off concentration	Pay-off concentration	Pay-off concentration	Self-interest was skillfully blended with missionary zeal
Outlook of the 'establishment'	Negative, but changing in states like Gujarat	Negative	Negative	Neutral/negative	Negative/neutral	Sceptical, but piggybacked and lessened its swayambhoo character
Preferred alternative by institutional environment	Registered fishermen's cooperatives	Community RO plants	Idealized WUAs	Municipal water supply improved	Idealized WUAs	Narmada project; scientific recharge works

its own methods of reducing transaction costs and managing incentive structures.

Finally, each is widely viewed in the IE – by government officials, NGOs, researchers, international experts and even local opinion leaders – as a *subaltern* or inferior alternative to the mainstream notion of an institution considered ideal but that has not worked on a desired scale or in a desired manner. As a result, far from recognizing the potential of these subaltern institutions to further larger social goals, the outlook has been to ignore their existence and social value, or even to emasculate them.

Analysis and Discussion

The repertoire of institutional arrangements that operate on a large scale includes numerous 'successes' of varied types and scales produced by exceptional local leaders and industrious NGOs. By virtue of exceptional and highly scarce resources at their command – such as reputation, social status, allegiance of people, funds, goodwill, influence in the IE, skilled manpower – local leaders and NGOs are often able to drastically reduce transaction costs of fostering institutional change of a certain kind in a limited setting for a limited period. Out of hundreds of thousands of irrigation tanks in India that can produce large pay-offs from improved management, there are but a few hundred in which exceptional local leaders have established and sustained novel institutions for upkeep, maintenance, management and use of tanks to improve the welfare of the community. The IWMI-Tata Programme studied some 50 of these during 2002–2003 (Sakthivadivel *et al.*, 2004) and found that, while the architecture of institutions (as rules-in-use) varied from case to case, the common aspect of all successful tank institutions was a leader or a leadership compact which, by virtue of the sway they/it has over the community, is able to drastically reduce the transaction costs of enforcing an institutional arrangement that would neither work in their absence nor survive them.

Successful NGOs similarly create islands of excellence by reducing transaction costs *artificially* and *temporarily*. The *Sukhomajri* experiment with watershed institutions in Haryana in the mid-1980s – Vilas Rao Salunke's pani panchayats in Maharashtra, Aga Khan Rural Support Programme's irrigators' association in Raj Samadhiala, Dhan Foundation's Tank User Federations, Development Support Centre's WUAs in Dharoi command in North Gujarat, community-managed tube wells that came up in Vaishali and Deoria in Eastern UP, Anna Hazare's Ralegaon Shiddi, Rajendra Singh's profusion of *johads* in Thanagazi, Alwar district, Chaitanya's conversion of irrigation tanks into percolation tanks in Rayalaseema – all these are examples. That the transaction cost reduction in all these was *artificial* is indicated by the absence of spontaneous lateral expansion/replication of these experiments despite the high pay-offs they are seen to have produced. That it was *temporary* is evident in that many of these institutions disappeared, stagnated or declined once the 'transaction cost reducer' was removed from the scene, as in Sukhomajri, Salunke's pani panchayats and others.

A more important source of ideas – than the NGO-inspired islands of excellence – about what institutional change should occur and *can sustain* are the swayambhoo institutions that have already emerged and are thriving, as we explored earlier in the section under Vibrant Institutional Arrangements Ignored (Quadrant 1). These have found ways of reducing transaction costs in ways that are more *natural*, *enduring and upscalable.* This is evident in that these institutions multiply on their own, and are able to sustain and grow as long as they serve purposes important to the participants in the transactions. In my understanding, these offer six useful lessons (given under the following six headings) about how to make institutional change work in the Indian water sector.

Instrumentality

The first, and most obvious, is that institutional change which multiplies and sustains is invariably an instrument of the exchange of participants, and not of the players in the IE who often design institutional interventions. 'Opportunism with guile' is the driving force, even when high ideals and social goals are laboriously espoused as *raison d'être.* Trite as it may sound, design of incentive structures is

amongst the most commonly ignored aspects in most institutional development programmes. Ideas like community-based groundwater demand management propose organizing cooperatives whose sole task would be to persuade their members to reduce their farming and incomes. Similarly, programmes to revive traditional community management of tanks commonly overlook the performance-based rewards offered to *neerkattis* (tank water distributors appointed by command area farmers) and focus primarily on generating voluntary contributions of time and effort for the greater good of the community. For institutional change to work it must serve a private purpose important to agents involved; otherwise, they will withhold participation or even work to defeat it.

Incentive diffusion or perversion

Institutions fail to emerge to take advantage of high-pay-off situations often because incentives are diffuse or even perverse, but the transaction costs of implementing change are concentrated in one or a few persons. In fishermen's cooperatives I discussed earlier, members faced perverse incentives: the cooperative stocked the pond but members stole the catch. The secretary had no incentive to make enemies by stopping poachers. When incentives became concentrated in the contractor as the residual claimant, he was willing to control poaching and invest in higher productivity. Gujarat's public tube wells had no takers until the opportunity arose for incentive concentration. That only a fraction of the surplus created by management improvement needs to be concentrated in the manager as a reward was shown 40 years ago by Amartya Sen (1966). In traditional tank institutions in South India, only a portion of the surplus output was offered to the neerkatti, who absorbed the bulk of the transaction cost of orderly distribution of tank water.

This principle is at the heart of irrigation reforms in China. Except where traditional PIM/IMT is supported by a donor loan, China's strategy of making canal irrigation productive and viable consists of changing the incentive structure facing the 'ditch manager' (Shah *et al.*, 2004a; Wang *et al.*, 2005). A pre-specified volume of water is released into a reservoir and is charged for at a certain volumetric rate. The reservoir manager's remuneration includes a fixed component and a variable component, the latter increasing with the area irrigated from the same total volume of water. Like the Chinese village electrician who is able to perform a high transaction-cost role for a fairly modest reward, the ditch manager too is able to improve water productivity for a modest bonus, if recent studies are any guide (Shah *et al.*, 2004a).

High costs of self-enforcement

Experimenting with the Indian equivalents of Chinese village electricians and ditch managers would be an interesting study. From the transaction cost viewpoint, however, there are two key differences between the Chinese and South Asian villages: first, the Chinese in general, thanks perhaps to the Confucian ethics, are more respectful to State authority compared with South Asians. Secondly, and more importantly, the village committees and the village party leader in a Chinese village enjoy far greater power and authority in the village society compared with India's gram panchayats and *sarpanch*. This has great implications for transaction costs. North (1990) suggests that: ' … institutional setting depends on the effectiveness of enforcement. Enforcement is carried out by first party (self-imposed codes of conduct), by second party (retaliation), and/or by a third party (societal sanctions or coercive enforcement by state).' Transaction costs facing an institutional change are determined by the ease of enforcement. A Chinese village electrician or ditch manager backed by the village committee and party leader can enforce the new rules by both retaliation and recourse to coercion through the party leader.

In India, by contrast, Orissa's model of franchisees for rural billing and collection of electricity bills has attracted many entrepreneurs whose core competence is represented by their muscle power (Panda, 2002), because they have no effective local authority to either discipline them or to which they can turn to in order to defend their rights. For the same reasons, a

typical culture fishery contractor has recourse only to retaliation to enforce his property right against a poacher. The high transaction cost of second-party enforcement of rules is perhaps the prime reason why entrepreneurs fail to come forward to make a business out of operating a canal or tank irrigation system.

Structures of incentives and sanction

Catalysing effective local IAs is then a matter not only of designing appropriate incentive structures that entice entrepreneurs to undertake activities with a high pay-off but also of putting into place community sanction or authority structures that: (i) enforce his/her right to do so; and (ii) establish the boundaries within which he or she operates. Here is where a community organization has a role in providing legitimacy or sanction and boundary to a service provider, thereby reducing his/her transaction cost of self-enforcement of rules. It is difficult to overemphasize this point, which is commonly overlooked in programmes of creating participatory institutions. In the much-acclaimed traditional tank management institutions, all tank management was carried out not by the community but by the neerkatti, who had the sanction and legitimacy given by the community and a reward for services that was linked to the benefits they produced for the community. A self-appointed neerkatti would find it impossible to enforce rules of water distribution amongst *ayacut* (command area) farmers.

A recent study of neerkattis by the Dhan Foundation shows that, for various reasons, many tank communities have begun withholding their sanction and questioning the legitimacy of the role neerkattis have played for centuries; as a result, the institution of neerkattis has begun to decline (Seenivasan, 2003). However, in those few tanks where we find traditional community management still working, it becomes evident that it worked through a clear specification of the 'governance' role of the community organization and the community-sanctioned, well-defined 'management' role of the neerkatti, a service provider whose rewards were linked to his performance.[31]

The value of this lesson for improving the quality of 'social engineering' is evident in the Gujarat government's public tube well transfer programme; after getting nowhere for a decade, it suddenly took off the moment entrepreneurial service providers were offered concentrated incentives coupled with some legitimacy and sanction for undertaking service provision. On these counts, I predict that such service providers have failed to come forward to provide improved water distribution in surface irrigation projects because neither concentrated incentives nor legitimacy and sanction are on offer for local entrepreneurs who would contemplate taking up such roles. Equally, the entrepreneurial service provider model too – such as the culture fishery contractor – operating without the sanction, legitimacy and boundary provided by a community organization is bound to be fragile.

Institutional environment

Finally, the IE can have a profound impact on what kind of IAs are promoted or discouraged, and what welfare and productivity impacts these produce (Mansuri and Rao, 2004); however, they *do not* have such impact because often they neither understand their working nor how to influence it. Informal pump irrigation markets, the fishing contractor and a decentralized groundwater recharge movement[32] are spontaneous and seemingly autonomous; but each of these is amenable to strong positive or negative influence from the IE.

Gujarat's cottage RO industry fell in a single swoop of the Bureau of Indian Standards; and the working of pump irrigation markets can change overnight if policies related to electricity pricing and supply to the farm sector were to change (Shah *et al.*, 2004c). Gujarat's Public Tube Well Transfer programme ploughed along without success for a decade and then suddenly took off because an actor in the IE changed the key rules of the game. And the culture fishery contractor faced drastic reduction in his transaction costs of doing business when the leasing policy for water bodies was changed at the instance of some actor in the IE. How well actors in the IE understand extant and potential institutions, their net welfare and productivity impacts and their backward and forward linkages determines how much they can influence or manage them.

Path-dependence

According to North (1990), institutional change is inherently incremental and path-dependent. It invariably grows out of its context; transposing institutional models that have worked in other, different contexts therefore seldom works in catalysing institutional change. India's state governments would probably have found it easier to manage metered electricity supply to farmers had they stayed engaged with the problems of metering rather than abandoning it the 1970s. Now that they face a huge groundwater economy based on the 'path' of flat tariff, their here-and-now options for change are tied to this path. The notion of 'path-dependence' has particular relevance to popular institutional notions, such as the Integrated River Basin Management, which have worked in highly formalized water economies in recent years. It is doubtful whether such models would work in the same way in the Indian situation, simply because by far the bulk of the Indian water economy is informal and outside the direct ambit of the IE.

Conclusion

A reader who comes to this stage of this chapter will surely remark, as did John Briscoe, World Bank's Asia Water Advisor: 'But I find very little in the chapter that would help me if I am a Secretary for Water in Gujarat, or in the Government of India, for that matter …' This response is entirely understandable; however, on the contrary, this analysis does offer useful advice for action that should always focus on the 'art of the possible'. Allan (2001) has wisely suggested that: 'The mark of effective research, advice and policy making is the capacity of those involved to know the difference between what "should" be done, and what "can" be done. This can be expressed in another way as awareness of "when" what "should" be done, "will be able" to be done'.

The upshot of this chapter is that all the things that a Secretary of Water Resources at the state or federal level is enjoined to do by the current discourse to promote improved demand management – imposing price on water resources (rather than water service), enforcing a groundwater law, making water the property of the state and stopping unlawful diversion from nature, instituting water withdrawal permits and assigning water entitlements, managing water at river basin level – would be well nigh impossible to implement on any meaningful scale in a predominantly informal water economy such as that of India. Instead, governments of low-income countries should focus their effort on areas where they *can* produce significant impacts, which in my view are four (given under the following four headings):

Improving water infrastructure and services

This already is a high priority and will remain so for a long time, even as opinion in the rich world is turning against investments in certain kinds of water infrastructure such as irrigation projects. There are several issues to be addressed such as mobilizing capital, improving the coverage of user households – especially from poorer classes, cost recovery, and so on. The point of attack, however, is the performance of public systems, which has tended to be abysmally low, be it irrigation systems or water supply and sanitation systems.

Institutional reforms focused on incentive concentration and transaction cost reduction

Public systems' performance often responds strongly to demand for better performance not from users but from administrative or political leadership; however, such performance gains are transient, and become dissipated when demand slackens. To achieve sustainable performance improvements, institutional innovations are needed that restructure incentives and reduce transaction costs.

Honing and using indirect instruments and strategies for achieving public policy objectives

In its enthusiasm for *direct* management of water demand – through pricing, rights and

entitlements, laws and regulations – the current discourse is overlooking numerous opportunities to achieve comparable aims using *indirect* instruments. True, the Secretary of Water can do little to manage water demand directly. However, in the particular situation of India, the Secretary of Energy controlling the State Electricity Board can do a great deal for groundwater demand management, through pricing and rationing of electricity to tube wells.

Undertaking vigorous demand management in formal or formalizing segments

Finally, pricing and full cost recovery, tight water law and regulations, and water rights and entitlements are definitely indicated in the predominantly formal segments of the water economy. These are to be found in cities, excluding the slums and shanty towns; and in the industrial sector where users are large and easily identifiable. It will probably take Delhi and Mumbai years before they can establish a water supply and sanitation system that can match those of Abidjan or Tunis. However, given increasing political support for management reforms, India's cities – especially, high net-worth cities like Delhi, Mumbai and Bangalore – offer by far the most fertile ground for water IE and urban governance systems for the introduction of global best practices in urban water supply and sanitation systems.

In summary, then, how formal a country's water economy is determines what kind of policy and institutional interventions are appropriate to it. In a predominantly informal water economy, where self-supply is the rule and water diversion from nature is everybody's business, regulating the actions of all water diverters is extremely costly in terms of search, information, policing and enforcement costs. As a water economy formalizes, self-supply declines and a few, visible, formal entities specialize in diverting, processing and distributing water to users; in such an economy, the range of things public policy makers can do to improve water demand management becomes much larger. The pace of formalization of a water economy is a natural response to overall economic growth and transformation of a society. This pace can be forced to a limited degree by an authoritarian state or by investment in water infrastructure and services management. However, unless this process keeps pace with what the market can bear, it will face sustainability problems.

The current global water policy discourse focusing on *direct demand management* is misleading in two ways for developing countries like India with a highly informal water economy: (i) it is enjoining it to institute policy and institutional reforms that are good in principle but present insurmountable implementation difficulties; and (ii) in contrast, it is deflecting attention away from things that need and can be done with a better understanding of the working of the water economy, warts and all.

Endnotes

[1] Formal and informal economies are a matter of elaborate study in institutional economics. Fiege (1990) summarizes a variety of notions of informality deployed by different researchers. According to Weeks (1975), cited in Fiege (1990, footnote 6): 'The distinction between a formal and informal sector is based on the organizational characteristics of exchange relationships and the position of economic activity vis-à-vis the State. Basically, the formal sector includes government activity itself and those enterprises in the private sector which are officially recognized, fostered, nurtured and regulated by the State. Operations in the informal sector are characterized by the absence of such benefits.' According to Portes *et al.* (1987, cited in Fiege, 1990, footnote 6): 'The informal sector can be defined as the sum total of income-generating activities outside the modern contractual relationships of production.' According to Portes and Saassen-Koo (1987, cited in Fiege, 1990, footnote 6), in the formal sector activities are 'not intrinsically illegal but in which production and exchange escape legal regulation'. To most researchers, an informal economy is marked by the 'absence of official regulation' or 'official status'.

[2] In most countries, the proportion of water use in the informal sector would move in tandem with the proportion of water users. However, in countries marked by high levels of income inequality – such as South Africa or Brazil – this would not be the case. In South Africa, for instance, 95% of the water diversion and use are in the formal sector but over 99% of the users are in the informal sector.

[3] The nature of the State is a crucial determinant of the level of formalization. Colonial state in British India – which lived off the land – had a huge and elaborate apparatus for land revenue administration reaching down to the village level. And since the colonial state invested in irrigation for commercial reasons, its IE evolved and maintained a firm grip over irrigated agriculture. Even today, China has a similar firm grip over its natural resources economy, thanks to the authority structure of the Communist Party and an elaborate structure of farm taxes and levies that sustain the lower rungs of its IE. However, upon independence, India all but abolished land revenue alongside the apparatus for its assessment and collection, thereby informalizing its agrarian and water economy. China is now on course to do just that. In Tanzania, during the Cold War years, Julius Nyerere had created *Mgambo*, an institution for civil defence from village youth trained in martial techniques. The Cold War over, the Tanzanian state has transformed Mgambo into a tax collection machinery. Van Koppen *et al.* (2005, unpublished report) describe how Mgambo was incentivized to undertake the recovery of a water resource fee as a kind of poll tax from rural people.

[4] North (1990) defines the transaction sector as: 'that part of transactions that goes through the market and therefore can be measured' and, according to him, rapid growth in the transaction sector is at the heart of the transformation of a traditional economy into a modern one.

[5] The survey estimated that approximately 36% of all rural households (which include farmers, farm labourers and households dependent on off-farm livelihoods) used some means of irrigation. Of these, 13.3% (i.e. 37% of irrigators) used their own source (well/tube well), 15.3% (i.e. 42.5% of irrigators) used shared tube wells or purchased water and 12.1% (36% of irrigators) used government-owned tube wells, canals or a river. Fewer than 2% used a locally managed irrigation source; 6.6% used more than one source, which is why the percentages fail to add up to 100. The survey also found that, of the 78,990 households interviewed, 48% reported 'no availability of community and government water resources in villages of their residence'; another 42% reported the presence of community or government sources but 'without local management'. Only 10% of households reported living in villages with access to community or government water sources 'with local management' by community or government or both (p. 44). Only 23% of all households interviewed reported depending for irrigation on a source 'other than self-owned'; 30% using water for livestock rearing reported dependence on a source 'other than self-owned'.

[6] Contrast this picture with a recent account by Luis-Manso (2005) of the highly formalized water economy of Switzerland: 70% of its population is urban, and the country is facing continuous reduction in industrial workers and farmers. Probably 15–20% of the Swiss population was linked to public water supply as far back as the 18th century; today, 98% of the Swiss population is linked to public water supply networks and 95% is connected with waste-water treatment facilities. Switzerland spends 0.5% of its GNP annually in maintaining and improving its water supply infrastructure, and its citizens pay an average of CHF 1.6 per 1000 l of water (CHF = US$0.786). The per capita water bill that Swiss citizens pay annually is around CHF 585, which is higher than the per capita total income of Bangladesh. All its water users are served by a network of municipal, corporate, cooperative water service providers; it has stringent laws and regulations about water abstraction from any water body, which can be carried out only through formal concessions. However, these concessions are held only by *formal* service-providing public agencies; as a result, their enforcement entails few transaction costs.

[7] Scott Rozelle used this phrase recently in referring 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. 5.2.

[8] One commentator on an earlier draft of this chapter cited Abidjan, where a First World water supply system has operated for decades. Abidjan, however, seems to be the exception to the rule that a city's water system would rise to what its median earner is willing to pay for. If recent accounts of the travails facing global water companies like Vivendi and Thames Water – who were forced to cease trading – even in these increasingly affluent east Asian cities is any guide, we must 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*, 2004).

[9] Societies often experience wide-ranging ideological or cultural upheavals during which customs, traditions, mores and values undergo massive change. India's Independence Movement – and the rise of the Gandhian ethos – marked one such phase in India's history. On a smaller scale, the water harvesting movement in Saurashtra under the inspiration of religious formations such as *Swadhyaya Pariwar* and *Swaminarayan*

Sampradaya too represent an L1 level change. Both these, however, have proved largely transient; besides occasional lip service paid, Gandhian ethos and ideals no longer dominate Indian psyche quite like they did during the 1940s; and Saurashtra's water harvesting movement too is now energized by the Gujarat Government's 60:40 scheme of government versus community contribution rather than the ideal of self-help the religious leaders had inspired. However, both L1 and L2 may experience rapid change in the face of rapid economic growth and transformation of a society. Since India is in the throes of such economic transformation, the pace of change at L1 and L2 levels should, in my surmise, be quicker than that suggested by Williamson.

[10] A good example is Francis Corten's work during the 1980s on reorienting the irrigation bureaucracy.

[11] A charismatic and energetic political or bureaucratic leader does often produce significant attitude and behaviour changes; however, these generally fail to last for long after the leader has been removed from the scene. In this sense, such change is not enduring.

[12] Because the law did not apply to anyone who diverted less than 1030 m^3 of water/year.

[13] Anil Shah, an illustrious former bureaucrat of the Government of Gujarat, fondly tells the story about Gujarat's groundwater bill, which was passed by the assembly in 1973. When the Chief Minister was required to sign it into the government gazette, he refused to do so because it required that every irrigation well be registered. His curt response to Mr Shah was: 'Can you imagine that as soon as this bill becomes a law, every talati (village-level revenue official) will have one more means at his disposal to extract bribes from farmers?' This is the reason there are no takers for the draft Groundwater Bill that the Ministry of Water Resources of Government of India has been tossing around to states since 1970.

[14] The Andhra Pradesh law tried harder to come to grips with rampant groundwater over-exploitation in Andhra Pradesh by emphasizing the registration of wells and drilling agencies and stipulating punitive measures for non-compliance.

[15] The 1987 Water Policy to Saleth (2004, p. 29) is '… such a simple non-binding policy statement'.

[16] Although the Network Reform Programme is a National Government programme, the government contributes only a part of the resources, the balance being contributed by the village committee. Just to give an example, Guantun village in Yanjin County of Henan got a grant of Y60,000 (US$1.00 = Y8.33) under this project for infrastructural rehabilitation. To match this, the village also contributed Y60,000; of this, 60% came from the funds from the village collective, while the remaining 40% was raised as farmer contributions by charging Y80 per person. All the power lines and other infrastructure were rehabilitated during recent years under this national programme. New meters were purchased by the township in bulk and installed in users' homes on a cost-recovery basis. A system of monitoring meters was installed too.

[17] The village electrician's reward system encourages him/her to exert pressures to achieve greater efficiency by cutting line losses. In Dong Wang Nnu village in Ci County, Hebei Province, the village committee's single large transformer that served both domestic and agricultural connections caused heavy line losses, at 22–25%. Once the Network Reform Programme began, he pressurized the village committee to sell the old transformer to the county electricity bureau and raise Y10,000 (partly by collecting a levy of Y25 per family and partly by a contribution from the village development fund) to acquire two new transformers, one for domestic connections and the other for pumps. Since then, power losses here have fallen to the permissible 12%.

[18] Saleth (2004, p. 30) asserts: ' … most of the organizational reforms, including the promotion of basin-based organizations observed in states such as Andhra Pradesh, Tamil Nadu, Orissa, and Uttar Pradesh were introduced under different World Bank-funded projects.' It is equally clear that Andhra Pradesh's irrigation reforms proceeded at a hectic pace because a World Bank loan was able to kindle interest at all levels in new resources available for maintenance work.

[19] And that too only when a mid-sized NGO invests years of effort and resources in organizing WUAs and using means to reduce transaction costs that farmers on their own would not normally possess. Some of the best-known examples of successful PIM/IMT are the Ozar on Waghad project in Nashik, Maharashtra, Dharoi in North Gujarat, Pingot and a few more medium-sized schemes in the Bharuch district. The success of farmer management in all these – and its beneficial impact – is undisputed. In each of these, however, there was a level of investment of motivation, skill, time, effort and money that is unlikely to be replicated on a large scale. In catalysing Ozar cooperatives, Bapu Upadhye and Bharat Kawale and their Samaj Pragati Kendra, and senior researchers of SOPPECOM, invested years of effort to make PIM work (Paranjapye and Joy, 2003). In Gujarat, between the Aga Khan Rural Support Programme and the Development Support Centre, Anil Shah and Apoorva Oza have

invested at least 30 years' professional staff time to organize, say, 20,000–30,000 flow irrigators into functional WUAs. My intent is not to undermine this exceptional work but to suggest that no government agency had the quality and scale of resources needed to implement an institutional intervention that could sustainably raise the productivity of the 28–30 million ha of flow-irrigated area in India over, say, 15 years.

[20] Here are some random excerpts from Joseph (2001), based on his study of the Malampuzha Project: 'It is the CADA officials who took the initiative in their formation and not the farmer groups. In most cases, membership fee of Rs5 was not paid by the farmers concerned; payment was made on their behalf by prospective office bearers, or the potential contractors of field channel lining or the large farmers in the ayacut. 86% of the Beneficiary Farmers' Associations (BFAs) were formed in these 2 years (1986 and 1987) … for making possible the utilization of funds … Only 57 Canal Committee meetings were held by the 8 Canal Committees during a span of 10 years … 43 of them were held without quorums and 35 with zero attendance of non-official members … The level of knowledge … about CCs … And their structure and functions is very low.'

[21] In a recent paper, Mansuri and Rao (2004) have reviewed a much larger body of evidence from several sectors to assess the extent to which community-based and community-driven development projects for poverty alleviation were effective, and have concluded that: (i) these have not been particularly successful in targeting the poor; (ii) there is no evidence to suggest that participatory elements and processes lead to improved project outcomes and qualities; (iii) community-based development is not necessarily empowering in practice; and (iv) 'There is virtually no reliable evidence on community participation projects actually increasing a community's capacity for collective action' (p. 31).

[22] Even in middle-income countries, huge inequalities in landholdings seem to have helped IMT. In the Andean region of Colombia where IMT has succeeded, according to Ramirez and Vargas (1999), farmers 'mostly grow crops oriented to the external markets, mainly banana and oil palm'; and while 66% of the farms have 5 ha or less, 40.3% of the land is owned by 2.8% of large farmers owning 50 ha or more. In South Africa, numerous Irrigation Boards – WUAs par excellence – have managed irrigation systems successfully for a long time; but their members are all large, white commercial farmers operating highly successful citrus and wine orchards. In Turkey, 40% of the irrigated area was in 5–20 ha holdings with a strong focus on high-value commercial crops for export to Europe. Here in Turkey, it can be argued, IMT has succeeded because, as with South African irrigation boards, in many respects there was already a 40-year old tradition of farmer participation in the maintenance of the canal system through an informal, village-level organization. Equally, irrigation fees under self-management in Turkey were 2% or less of the value of production per ha, 3.5% or less of total variable cost of cultivation and less than 6% of gross margin (Svendsen and Nott, 1997).

[23] Sanskrit for self-creating or spontaneous.

[24] A large survey, covering over 48,000 farming households throughout India during January–June 1998, suggested that over 66% of India's Gross Cropped Area under the five most important field crops (which account for over 90% of the Gross Cropped Area) is irrigated; only one-quarter of irrigated area is served by government canals. Amongst other interesting things it suggests that every fourth Indian farming household probably owns a diesel or electric pump; and the area irrigated through groundwater markets is as large as the area irrigated by all government canals (NSSO, 1999b).

[25] As North (1990) aptly notes: 'If the highest rates of return in a society are to piracy, the organizations will invest in knowledge and skills that will make them better pirates; if the pay offs are … to increase productivity, they will invest in skills and knowledge to achieve that objective.'

[26] An IWMI-Tata study (Indu, 2002, unpublished report) surveyed a sample of 14 such plants that served 4890 households. Reverse osmosis (RO) water in 10 and 20 l cans is delivered daily at the customer's door step; charges are levied on an annual basis (Rs 1500 (US$33) for a 10 l can daily; Rs 2500 (US$55) for a 20 l can). Plant capacities vary from 500 to 2000 l/h. In addition, most plants also retail RO water in pouches at bus stops, railway stations and crossings and market places. Consumers of pouches are typically low-income buyers; retailers are also poor youth working on commission. In sum, this institution serves a demand by transforming 800–2000 ppm TDS water into 150–300 ppm TDS water, and fluoride levels reduced to 0.25–0.50 mg/l. People had no way of ascertaining the quality, but 60 customers surveyed by Indu (2004, unpublished report) asserted that the taste of RO water was distinct. Many also claimed relief from the pain of skeletal fluorosis after adopting RO water.

[27] The seal of the Indian Standards Institution (ISI), the national agency for quality control in all manufactured products.

[28] Registering a cooperative itself meant a great hassle and cost in time and money. The policy also required that two-thirds of the command area farmers submit a written no-objection declaration for the transfer; past defaulters on water fees must first pay up their dues. In addition, several conditions specified that the violation of any of those would qualify the government to reclaim the tube well.

[29] Transformation cost would include the cost of labour and material in creating a lined sub-minor and field channels plus the cost of acquiring land. Transaction cost would basically involve persuading farmers to give up their land for making channels and to give right of way to carrying water to downstream farmers.

[30] In the North Krishna basin in western Maharashtra, a similar groundswell of numerous private irrigation service providers has created an institutional dynamic that challenges orthodox notions of how irrigation systems should be designed. The Bachawat tribunal's decision on the division of Krishna water between Maharashtra and Karnataka made Maharashtra's share contingent upon the amount of water it could develop and use by 2006. To maximize its share, the Government of Maharashtra went on a reservoir-building spree. Strapped of funds, it chose not to build canal systems; instead, it encouraged private entrepreneurs to set up numerous lift irrigation systems. In the command of one such small reservoir, Padhiari (2005) found 1200 such private irrigation service providers serving an area larger than was originally designed to be commanded. These entrepreneurs resolved most key problems that canal irrigation faces in India: while most canal projects are unable to collect even 3–5% of the gross value of crop output they help farmers produce, private service providers in the Upper Krishna basin regularly collect 25% as irrigation charge. They have a much better record of providing irrigation on demand. It is difficult to understand what this is if not Participatory Irrigation Management.

[31] This is put into bold relief in a new, unpublished case study, by Reddy *et al.*, 2004, of traditional community management institutions in a Mudiyanur tank in a system of ten tanks in the Uthanur watershed in the Kolar district. Despite sweeping socio-economic changes in its surround during recent decades, as if stuck in a time warp, the management institution of this 1200-year-old tank has still retained many of its traditional features. Its striking aspect is the fine distinction between the specialized governance role of the caste-based 'Council of Elders' (CoE), the community organization responsible for overseeing general administration of all seven villages sharing the tank and the role of the neerkattis and *thootis* (village guards) – as management-agents of the CoEs. Most routine aspects of decision making are taken care of by inherited rules and norms that result in 'well-established patterns of behaviour' such as on crop choice, time of opening the sluice under different rainfall regimes, payments to be made to neerkattis and labour contribution in maintaining supply channels. The role of the neerkatti is to execute these routine tasks on behalf of the CoE; and his reward is a piece of cultivable, inheritable *inam* land in the command and ten bundles of hay with grains per each of the 250-odd roughly equal pieces of ayacut land cultivated. The CoE gets into the act only when conflict mediation goes beyond the authority vested in the neerkatti or when circumstances arise that require responding to a new discontinuity. As water inflow into the tank has steadily declined, the CoE decided to disallow sugarcane 20 years ago or, more recently, to make a new rule that divided the 240 acres of ayacut into three parts and irrigate one part per year in annual rotation. Helping the CoE decide whether water available can support the irrigation of a summer crop, orderly distribution of water in the ayacut without any intervention from farmers, deciding the *amount* of irrigation water to be released at different stages of crop growth, undertaking repairs and maintenance of sluices (himself), and canals and supply channels by mobilizing labour from members are amongst the tasks performed by the neerkatti. Cleaning of distributaries is carried out by farmer(s) benefiting from them; however, main canals never get cleaned of weed and silt unless the neerkatti summons all farmers to work there on a fixed day. All in all, in the smooth management of the tank, the neerkatti plays the pivotal management role; he *is* the operating system of the institution; the CoE, mostly invisible and unobtrusive, vests in him the authority and sanction to play that role on behalf of all the members. A tank management institution without a CoE or the neerkatti would be a far lesser institution.

[32] In the Vadodara district, several leases given to fishing contractors were withdrawn because the communities rejected the contractors. In one case, for instance, the contractor used dead animals as manure, a practice that offended the community. In another, the chemical fertilizers used by the contractor ended up in a drinking water well within the tank foreshore; when this was discovered, the village refused to renew the lease. Such aberrations would not occur if the contractor had to obtain the legitimacy and sanction of the community to operate.

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