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The New Institutional Economics of India's Water Policy

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Much institutional analysis in the water sector at national as well as global levels has focused principally on the working of law, policy and administration of water sector—the three pillars of water institutions. In New Institutional Economics, these constitute the IE (IE) of the water economy, which is distinguished from institutional arrangements (IA). The latter are humanly imposed 'rules in use' that govern the behavior of water users and producers, and dealings between them. Water User Associations, pump irrigation markets, fishery co-operatives and contractors, urban tanker water markets are examples of institutional arrangements (IA). NIE's central concern about 'why economies fail to undertake appropriate activities if they had a high pay-off' is of great interest to actors in the IE —governments, NGOs, donors, policy makers, legislators, local administrators. These therefore have views about and keen interest in shaping IA to improve the working of the water economy. In this paper, we explore issues involved in unleashing performance-enhancing change in IA's.

Keywords: New institutional economics, irrigation, India

Introduction

The paper offers three overarching propositions:

- First, IA's prevailing in a country's water sector depend on the degree of its formalization, which in turn is determined by the overall development of the national economy. In mature economies, where water sectors are highly formalized, water policy, law and administration are able to bring into their ambit all or most water transactions. In poor and emerging national economies, in contrast, the water sectors are predominantly informal; here water policy, law and administration have a limited reach, except in urban pockets and rapidly industrializing regions. As a result, the only way players in the IE can improve the performance of water economy is by designing indirect instruments of influencing the IA's in the water sector.
- Second, whether or not institutional and policy initiatives/reforms produce intended effect depends on the balance between attendant pay-offs and transaction costs. And several kinds of institutional reform tried or suggested in the Indian water sector have either entailed high transaction costs or low pay-offs or both. In contrast, and more interestingly, IA's changes which have quietly and spontaneously occurred because pay-offs are high and transaction costs low are either ignored or even discouraged or, at least, not built upon by players in the IE.
- Finally, whether a new IA emerges, sustains, disappears, mutates, succeeds or fails often depends critically on the posture adopted by players in the IE. Herein lie the opportunity for fostering performance enhancing reforms in water sector IA's.

Institutional Arrangements and Institutional Environment

A recent review of institutional changes in global water sector in 11 countries by Saleth and Dinar (2000) deal 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 of water resource management (see, e.g., Bandaragoda and Firdausi 1992; Merrey 1996; Frederickson and Vissia 1995; 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 must be covered in the ambit of institutional analysis (see, e.g. Mestre 1997 cited in Merrey 2000:5; Livingston 1993).

In an effort to build upon existing institutional analysis of Indian water sector, this paper takes this broader view in attempting a preliminary analysis of water institutions in India, if anything because it helps us access the vast field of New Institutional Economics (NIE) in analyzing ways Indian society is responding to its changing water situation. We begin right away by borrowing from North (1990) the notion of institutions as 'formal rules, informal constraints (norms of behavior, 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 arrangements* (IA's) and *institutional environment* (IE). Thus aspects that Saleth and Dinar (2000), include in their 'institutional analysis' represent, mostly, IE in NIE except for the operating levels of IE (irrigation department *chawkidars,* operators of public tubewells) which sometimes interact closely with IA's .*Institutional arrangements* (IA's), in contrast, 'are the structure that humans impose on their dealings with each other' (North 1990). In the particular context of the Indian water economy, then, when we refer to IE, we include various government agencies at different levels that directly or indirectly deal in water, international agencies, governments' water policy, water related laws, and so on. And in talking about *institutions* or *institutional arrangements* (IA's), we refer to things like groundwater markets, tubewell co-operatives, water user associations, Rajendra Singh's *johad* movement in Alwar (CSE?), groundwater recharge movement in Saurashtra (Shah 2001), tank fishery contractors in Bundelkhand (Shah 2002), emergence of defluoridation plants in cottage sector in North Gujarat's towns (Indu 2002), and such like.

We begin with three propositions: [a] water institutions of nations at any given point in time depend critically upon the level of *formalization* of water economies; by formalization, we mean the proportion of the economy that comes under the ambit of regulatory influence of the IE [1]; [b] in this sense, water sectors are highly informal in primitive economies, and become more formalized as national economies grow; [c] the *pace* of water sector formalization in response to economic growth varies across countries and is determined by a host of factors, including likely the degree of population pressure on land and water resources, extent of dependence on farming for livelihoods, macro-economic policies, the nature of the 'State' (principally, how hard or soft it is). How much difference these make in the pace of formalization of water sectors is difficult to say; however, it is clear that India can not have Europe's level of formalization of its water sector at its 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 IA's and its water IE—or by what North (1990) calls the 'transaction sector'[2] of the water economy. Informal water economies are marked by heavy dependence of water users on self-provision (through private wells, streams, ponds) or informal, personalized exchange institutions, community-managed water sources, absent or limited use of price or user charges to recover costs of service provision or resource use, or to guide resource allocation or to clear markets. 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 resource allocation. Here, water emerges as an industry.

Just how informal India's water economy is was explored by a large nation-wide survey NSS 54th round of survey (NSSO 1999, report 452:46) carried out in June-July 1998. It is based on interviews with 78990 rural households in 5110 villages throughout India to understand the extent to which they depend upon common property (and government) land and water resources for their consumptive and productive uses. It 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 privately owned and managed by households or owned by government/community but *not* managed by either.[3] If receiving domestic water from 'tap' is an indicator of getting connected to a public water supply system, the same survey also showed that over 80% of rural households self-supplied their domestic water needs, and were not connected with any public or community water supply system. In urban households (sample =31323 households), the situation was the opposite; 3/4th were connected to a public water supply system. A somewhat different 2003 survey (NSSO 2003: report 487) showed that of the 4646 villages covered, only 8.8 percent had a public/community water supply system; people living in the rest depended on wells or open water bodies for domestic water supply to rural households.

A strong imprint of economic growth was evident too. The proportion of villages with public water supply system increased rapidly as we move from a poor state like Bihar, where none of the 364 villages covered had a public/community water supply, to Haryana where over half the villages had public water supply system, and to Goa where every village surveyed had a public water supply system.

Irrigation economy too is equally informal. The 1999 survey of 48419 cultivators throughout India showed that nearly 65% of them used irrigation for Five Major Field Crops cultivated by them; and, for nearly half of them, the source of irrigation were informal, fragmented pump irrigation markets (NSSO 1999:42) which are totally outside the ambit of direct influence of water law, policy and administration. The 2003 survey of 4646 villages (NSSO 2003: report 487) showed that 76.2% of the villages reported they irrigated some of the lands; but only 17.3% of the villages had access to a *public* irrigation system; the rest depended primarily on wells and tubewells (64.3%), tanks and streams. All these surveys suggest that rural India's water economy—both domestic and irrigation use—is highly *informal,* based as it predominantly is on self-supply and local, informal water institutions; it has little connect with public systems through which water law, policy and administration typically operate.

Contrast this picture with a recent account by Louis-Manso (2004) of the highly formalized water economy of Switzerland. 70% of its population is urban; 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 in the 18th century; today, 98% of the Swiss population is linked to public water 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 liters of water (CHF =0.786 US $). Per capita water bill Swiss 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, co-operative water service providers; it has stringent laws and regulations about water abstraction from any water body which can be done only through formal concessions. However, these concessions are held only by *formal* service providing public agencies; as a result, their enforcement entails little transaction costs

Much discussion on the water problems of developing countries like India—and the IA's needed to solve these—arguably give too much importance to their water endowments and their characteristics. A good deal of this discussion also ends up advocating water sector IA's (such as tradable water rights in Chile, or tradable salinity credits as in the Murray-Darling basin or farmer associations managing irrigation systems as in Turkey or Columbia) or organizations (such as the Murray Darling River Basin Commission) to countries in Asia and Africa where national water economies are still predominantly informal.

We suggest that water institutions that exist in a country or can be externally catalyzed depend, besides several other factors, on the stage of formalization of its water economy which in turn depends upon the overall economic evolution of that country as outlined in figure 2. Water IA's we find in India, Pakistan and Bangladesh—such as, say, pump irrigation markets, urban tanker water markets--are unlikely to be found in Australia or Spain because they would serve nobody's purpose there. Likewise, water IA's that are standard in industrialized countries—multinationals managing a city's water supply system--would not begin to work until Dhaka as a water service market evolved, at least, to Manila's or Jakarta's level[4].

The Process of Institutional Change

In understanding how societies adapt their institutions to changing demands, Oliver Williamson (1999) suggests the criticality of four levels of social analysis as outlined in Figure 3. The top level is referred to as social embeddedness level where customs, traditions, mores and religion are located. Institutions at this level change very slowly because of the spontaneous origin of these practices in which 'deliberative choice of a calculative kind is minimally implicated.' The second level—where the IE of a society is involved—evolutionary processes play a big role; but opportunities for design present themselves through formal rules, constitutions, laws, property rights; the challenge here is getting the rules of the game right. The definition and enforcement of property rights and contract laws are critical features here. Also critical is the understanding of how things actually work-'warts and all' in some settings, but not in others.

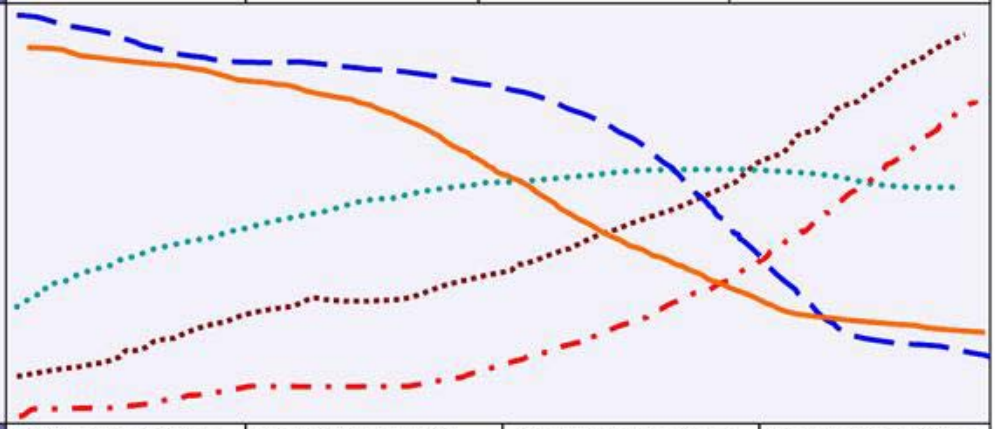
	Stage I: Completely Informal	Stage II: Largely Informal	Stage III: Formalizing	Stage IV: Highly Formal Water Industry
% of water users in the formal sector	<5%	5-35%	35-75%	75-95%
Examples	Sub-Saharan Africa	India, Pakistan, Bangladesh	Mexico, Thailand, Turkey, Eastern China	USA, Canada, Western Europe,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

Figure 1. Transformation of informal water economies in response to overall economic growth

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 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, firms, bureaus--is an effort to craft order, thereby to mitigate conflict and realize mutual gains; and good governance structures craft order by reshaping incentives, which leads to the fourth level of social analysis—getting the incentives right.

From the viewpoint of policy analysis for action, it is also useful to recognize that institutional changes at L1 and L2 levels would be economy-wide, encompassing all aspects of social and economic life of a society. For the particular purpose of analyzing water sector institutions, therefore, we must regard L1 and L2 almost as given[5]. This may seem trite but sectoral interventions aiming to achieve at least L2 level changes[6] are not uncommon. Discussions on institutional changes needed in the water sector often refer to reorienting the bureaucracy or modifying property rights in water; but it is virtually impossible to enduringly[7] transform *only* the water bureaucracy while the rest of the bureaucracy stays the same. All things considered, it is practical to leave L1 as given; L2 as amenable to change at the margins; and L3 and L4 can be taken as the relevant playing field for institutional reform in the immediate run.

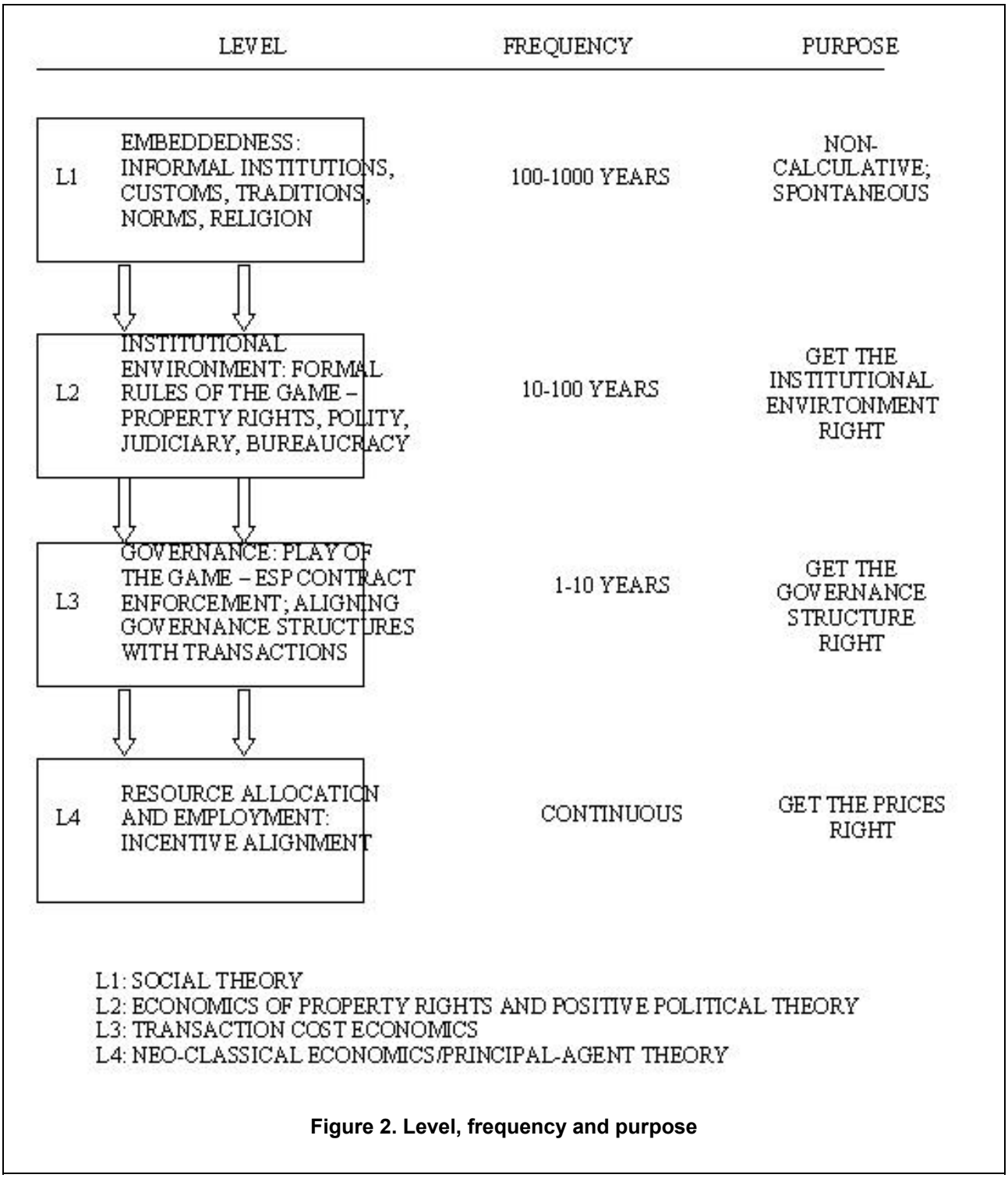


Figure 2. Level, frequency and purpose

In NIE, the most interesting aspect of study of institutional change is about 'why economies fail to undertake the appropriate activities *if they had a high pay-off*' (North 1990). India's water sector is replete with situations where appropriate activities can potentially generate a high pay-off and yet fail to get undertaken; in contrast, much institutional reform being carried out will likely not work because it entails high transaction costs and low pay-off.

In analyzing the Indian institutional experience in the water sector, our key propositions are embodied in the 'payoff-transaction cost matrix' in figure 4. Several kinds of institutional reform tried or contemplated have

either entailed high transaction costs (quadrants 2) or low pay-offs (quarter 4) or both (quarter 3). In contrast, changes in IA's which have quietly occurred because pay-offs are high *and* transaction costs low (quarter 1) are either ignored or even discouraged or, at least, not built upon. In the following sections, we briefly analyze a sample of situations in each of these four quarters in figure 4 before drawing some general implications arising from this analysis.

		Transaction costs	
		Low	**High**
Pay offs	**High**	• Bounded service provider; • Gujarat's Public tubewell transfer • Intelligent management • of farm power supply • Private RO plants+clean water vouchers for the poor. • Decentralized groundwater recharge movement in Saurashtra **1**	• Participatory Irrigation Management • Community RO plants • Fishery co-operatives **2**
	Low	**3** • Andhra Pradesh Water and Trees Law • GoI Water Policy 2002 • Maharashtra Drinking Water Protection Act	**4** • Community regulation of groundwater overdraft; • Metering farm power supply

Figure 3. Payoff-Transaction cost matrix of IAs

Low Transaction Costs, Low Pay-offs

The experience of industrialized countries had 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. However, in a predominantly informal water economy such as India's, the transaction costs of enforcing a water law effectively are so high that these attempts have had to 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 in circa 1970 is a case in point; it has been tossed around for 35 years across state capitals but there have been no takers. Gujarat assembly passed the law; but the Chief Minister decided not to gazette the act in view of high transaction costs of enforcing it.[8]

But other chief ministers were less transaction-cost-savvy. So in 1993 Maharashtra made a law with a limited ambition of disabling irrigation wells within 500 meters of a Public Water Source during droughts with a view to protecting drinking water wells. 10 years after its enactment, IWMI-Tata Program studied the enforcement of this law (Phansalkar and Kher 2003). The law provides for stern action against violation but gets invoked only when a 'Gram Panchayat 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 meter norm,

yet not a single case of legal of action resulted because Gram Panchayats 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. IWMI also did a quick assessment of the Andhra Pradesh Water and Trees Act (Narayan and Scott 2004), [9] and concluded on a similar pessimistic note. A similar exercise has been the formulation of official GoI Water Policy of 1987 and 2002. Both these pieces are an excellent example of bland enunciations which are *not* designed to change anything in any manner[10]. As a result, they have low transaction costs, but also no pay-off.

Low Pay-offs, High Transaction Costs

Other widely espoused proposals entail high transaction costs and promise doubtful benefits at least in the prevailing circumstances. A very good example is the effort to introduce volumetric pricing of electricity supply to groundwater irrigators. 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, of controlling pilferage, tampering with meters with or without collusion with meter readers, etc—that obliged State Electricity Boards (SEBs) to switch to flat tariff during the 1970's. Flat tariff 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 SEB's 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 flat tariff while compelling the SEB's 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 in Shah, Scott, Kishore and Sharma (2004).

In the thinking of SEB's and multilateral donors about ways out of this imbroglio, returning 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 Andhra Pradesh 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 likely change little because if anything, transaction costs of metered power supply are much higher today than they were in the 1970's. Most states have at least 8-10 times more irrigation tubewells today than they had during the 1970's; and farming livelihoods depend far more critically on electricity today than 30 years ago. If metering must work in India, we must learn from the Chinese experiments which have focused on modifying the incentive structures (see Shah, Giordano and Wang 2004).

Surprisingly, the electricity-irrigation nexus is not a subject of discussion in China at all. The Chinese electricity supply industry operates on two principles [a] of total cost-recovery in generation, transmission and distribution at each level with some minor cross-subsidization across user groups and areas; and [b] each user pays in proportion to his 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 O & M 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 electrician with dual responsibility, of maintaining the power supply infrastructure in the village as well as 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 has to tally with the power supply recorded at the transformer for any given period. The electrician is 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, 10% allowance is 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 program was undertaken by the National Government to modernize and rehabilitate rural power infrastructure[11]. Where this was done, line losses fell sharply[12]; and among a sample of villages I visited, 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 fairly modest reward of Y 200-250/month plus incentive bonus of around Y 200/month (Zhang 2004) which is equivalent to the value of wheat produced on 1 mu (or $1/15^{th}$ of the value of output on a hectare of land). For this rather modest wage, China's village electrician undertakes to make good to the Township Electricity Station 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 powerful incentive for him to reduce line losses. In the way 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 mal-practices can 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 likely 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 ensure that the electrician is able to do 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, similar experiment is being tried out in Orissa where private companies in charge of distribution first experimented with Village *Vidyut Sangha'*s (Electricity Co-operatives) 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 IWMI-Tata program visited a number of these *Sangha's* during 2003 and noted that 'none of the Village Committees were operational.." These worked as long as the support organization hired to catalyze them propped them up with constant visits and organizational work; as soon as the support organization was withdraw, the Village *Vidyut Sangha*'s became defunct. Mishra (2004) wrote, "The situation today is quite similar to that [which] existed earlier before the interventions were made through the Committee". *Sangha's* 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 were appropriately incentivized. 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 very high. If the ultimate purpose of volumetric pricing is to improve the finances of electricity utilities, I doubt if this purpose would be achieved.

In a recent paper (Shah, Scott, Kishore and Sharma 2004), we have argued that, in making an impossibly bad situation better, a more practical course available to SEB's and state governments is to stay with flat tariffs but rationalize it through intelligent management of power supply. Farmers' needs for power are different from 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 hours/day of poor quality power supply throughout the year. If SEBs were to invest in understanding farmers as customers, it should be possible for them to supply 20 hours/day of good quality power to farmers on 30-40 days of peak irrigation need while maintaining 3-4 hours/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.

High Transaction Costs, Potentially High Pay offs

Rather than evolving organically from the unfolding situation on the ground—and therefore being demanded by stake holders-- many of the reforms currently being pursued in India, such as Irrigation Management Transfer, River Basin Management, metering of electricity, are actually promoted aggressively by researchers as well as funding agencies[13], 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 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 programs of institutional interventions, commonly bank-rolled by an international donor. A classic example is Participatory Irrigation Management (or its cousin Irrigation Management Transfer) 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 despite virtually no evidence of it having succeeded anywhere except on an experimental scale[14]. WUA's have been tried out on small irrigation systems since 1960. Uttar Pradesh tried *Sinchai Samiti's (*Irrigation Committees) way back in early 1960's on irrigation tanks and reservoirs; following it, Madhya Pradesh too tried it on thousands of its minor irrigation tanks. Other states have been trying to make *Pani Panchayats* (Water Assemblies) work. But *Sinchai Samiti's* 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 Program as far back as in 1983 but the 17 Irrigation Co-operatives lost money and became defunct. In 1991; it made another attempt, this time around with assistance from NGOs; and 144 Irrigation Co-operatives 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 commands. Indeed, a core idea of Command Area Development Agencies (CADAs) in early 1980's was to involve farmer organizations in the management of irrigation projects; and we see no trace of CADA's or their Beneficiary Farmers' Associations (BFAs) including in Kerala where thousands of these were formed under a 'big bang' approach during 1986. An assessment by C J Joseph (2001) in late 1990's suggested that, even in this land of strong traditions of local governance, high education and high levels of people's participation, BFAs were damp squib[15]. *A la* Kerala, Andhra Pradesh overnight transferred the management of all its irrigation systems to over 10,000 WUAs created by 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 2004)[16] .

The central assumption underlying PIM/IMT is that once irrigation management is transferred from remote bureaucracies to WUAs, 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, and irrigation systems would better achieve their potential for food and livelihood security for farmers in their command. PIM/IMT programs 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 1996:153). The drift of the IMT discussion, in recent times, then 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 to which much public irrigation investment was 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, where average farm size is large enough for a typical or a significant proportion of the command area farmers to operate like agro-businessmen; where farm producers are linked with global input and output markets, and where 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 either enhance the pay-of or reduce transaction costs or both-- obtain in Mexico, USA, and New Zealand from where emerge the resounding success stories we hear about IMT[17] (Shah, van Koppen, de Lange, Merrey and Samad 2002). In South Africa—the commercial farming sector, which satisfies all these conditions, took naturally to PIM through Water Boards, which are WUA's par excellence; but the same logic when applied to irrigation systems serving small holders in former homelands met with resounding failure because these met none of the conditions that Water Boards satisfied.

Even where all conditions are satisfied, researchers have presented mixed picture on PIM/IMT impacts. An exhaustive global review done for IWMI of IMT impacts by Douglas Vermillion, a pioneer in IMT research, for example, showed that impacts are significant and unambiguously beneficial in terms of cost recovery in Turkey, Mexico, 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 1996:153). In Philippines, the Mecca of IMT and PIM, recent studies show that productivity gains from PIM have not sustained (Pannela 1999).

None of the conditions outlined above obtain in a typical Indian surface irrigation system. Most farmers in the command have small holdings, sub-divided further in to smaller parcels. A typical major system has hundreds of thousands of small holders, making it well nigh impossible to bring them all together to negotiate. Over 90% of surface water irrigated area in India is under field-crops yielding Rs 15-18 thousand (US $ 325- 400) per ha of gross value of output, compared to 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 tubewells, and booming pump irrigation markets in command areas and in the neighborhood 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 the 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 WUA's to assume arduous responsibilities—maintenance, fee collection, etc. Moreover, farmers take little time to figure out that PIM often means increased water fee 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 1980's and 1990's, not one has operated for more than a few months. An older experiment with communitarian model has been with inland fishery co-operatives. Numerous local water bodies controlled by irrigation departments, Zilla Panchayats, Taluka Panchayats and Gram Panchayats can potentially sustain a vibrant inland fishing enterprise and livelihoods system. However, government policy has always been to give away monopoly lease rights to registered fisher-people's co-operatives. Thousands of such co-operatives are registered; but probably a very small fraction—in my surmise, less than 1 or 2 percent—operate as dynamic producer co-operatives, like for instance, the dairy co-operatives do in Gujarat.

In South India, which has over 300,000 irrigation tanks, a decades-old concern has been about the break-down of traditions of maintenance of bund 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 better—condition. However, when rehabilitated tanks again declined and needed another round of rehabilitation, planners found something amiss in their earlier approach. Therefore, in new tank rehabilitation programs—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 Water User Association of command area farmers. Except where such WUAs have been constantly animated and propped up by support NGO's—as in the case of Dhan Foundation in Madurai, Tamilnadu—it is difficult to find evidence of productivity improvements in tanks because of WUAs on any significant scale. Besides the problem of high transaction costs of co-coordinating, negotiating, rule-making and, above all, of rule enforcement, 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 stake holders. Command area farmers have a direct conflict of interest with tank-bed farmers; and well owners in the neighborhood of tanks are a potential threat to all other users because they can virtually steal tank water by pumping 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 Water User Association of command area farmers and hoping that this 'institutional intervention' would increase productivity of tanks is naïve to the extreme. Improved management of public irrigation systems, tanks, and fishery—all represent opportunities for high pay off but have failed to get realized because the institutional models promoted have high transaction costs.

Low (or reduced) Transaction Costs, High Pay-offs

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 Indian water sector is brimming with institutional changes occurring on the margins which are doing this all the time, and yet are either glossed over or frowned down upon by the IE. Most such institutions we explore in this section are invariably *swayambhoo* (self-creating); 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 have raised productivity; and are commonly faced with adverse or unhelpful IE. Crucially, these are 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 of 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 tubewell 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 the reality of Indian irrigation at the dawn of the millennium is that its tail has begun wagging the dog.[18] IE in the Indian water sector has little or no interface with 75% of Indian irrigation occurring through tubewells and the institution of water markets.

The working of groundwater markets is now extensively studied (Shah 1993; Saleth..; Jana Karajan, Singh 2004; Mukherji 2004 for a good survey of literature). These find and analyze myriad ways in which their working differs across space and time. But common elements of groundwater markets everywhere in the Indian sub-continent are the features we listed at the start of this section: they are *swayambhoo*, they operate on so large a scale as to account for over a quarter of Indian irrigated areas; water sellers every where constantly innovate to reduce transaction costs and create value; finally, they are the *instrumentality* of buyers and sellers of pump irrigation service, and not of society at large or the IE; as a result, water markets are unrepentant when their operation produces externalities such as groundwater depletion or drying up of wetlands. Finally, despite their scale and significance, the IE has been blind towards the potential of water markets to achieve policy ends. When they take notice of their existence and role—which is infrequent-- water policy makers are often unable to decide whether they are good or bad.

Much the same is the case with many water institutions. In the previous section, I mentioned tens of thousands of fishermen's co-operatives which are lying defunct; however, fishery entrepreneurs have sprung up everywhere which uses paper co-operatives as front for operating profitable culture fisheries. Why don't fisher co-operatives exploit the opportunities that these contractors are able to? The most important reason is the transaction costs of protecting the 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 effectively defend their rights against poachers, against irrigators who may want to pump tank water below the sill level during dry periods to irrigate crops or tank bed cultivators who want to empty the tank so they can begin sowing. Fisher communities are commonly from the lowest rung of the village society; they would not only have difficulty in mobilizing capital to buy seedling and manure but also in protecting the crop from poaching from outsiders as well as their own members. Reserving fishing contracts for fisher co-operatives is therefore the best formula for sustained low productivity of in-land fishery economy. Just how high the transaction cost of protecting a fish crop is was evident when my colleagues and I studied who precisely the fishing contractors are in two separate studies in central Gujarat and in 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 if 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 2002:3). In central Gujarat, a fishing contractor had to kill a poacher and does a jail term to establish that he meant business when it came to defending his property right[19]. Despite this unsavory 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: introduction of new technologies of culture fishery along with its paraphernalia, and gradual emasculation by the fishing contractor of the idealized fisher co-operatives as monopoly lease holders on water bodies. Had the co-operative ideal been enforced vigorously, India's inland fishery would not have emerged as the growth industry it has today.

How does changing policy-IE unleash 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 1940's, Gujarat Government's Fisheries Department began supporting Village Panchayats to undertake intensive culture fishery in village tanks during early 1960. However, the program 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 fisher-folk that *Village Panchayats* as managers could not control. In a modified program, the Department took over the management of tanks from the *Panchayats* to raise fishery on a produce-sharing basis; but the Department was worse than *Panchayats* in checking poaching. In 1973, a special notification of the GoG transferred in-land fishing rights on all water bodies, including village tanks, to the Fisheries Department which now set about forming fishermen's co-operatives in a campaign mode. The idea was to entrust the management to the community of poachers themselves. In Kheda district of Gujarat, for example, 27 such co-ops were formed to undertake intensive culture fishing. However, the co-ops were none the better when it came to controlling poaching including by their own members; and the gross revenues could not even meet the bank loans. Coop members lost heart; and coops became defunct, a story that has been endlessly repeated in various fields in India's history of co-operative movement. While all manner of government subsidies were on offer, what made culture fishery unviable were three factors: [a] a lease offered for only 3 years, a period considered too short to recoup the investment made; [b] only registered co-ops could be given lease and the process of registration was transaction-costly; and [c] rampant poaching.

All this while, culture fishery productivity was steadily rising; although the co-ops were not doing well, culture fishery was, as entrepreneurs began using co-ops as fronts to win leases. This entailed significant transaction costs; they had to pay off the office bearers of co-ops; they had to keep the Panchayat leaders in good humor so that their lease would be renewed. Even then, whenever a Panchayat's leadership changed, the new order would terminate the contract to favor 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 Program. They began making changes in the terms of lease: private entrepreneurs

were, in principle, considered for giving away leases but there was a pecking order of priority: first priority was for a Below Poverty Line family, then to a local poor fisherman, then to a local co-operative, and if none of these were available, then to any entrepreneur who bid in an open auction. Earlier, the government paid a puny rental to the *Gram Panchayat*s for using them for fish culture; now that entrepreneurs were allowed, *Gram Panchayat*s began setting an off-set price derived as an estimate of the 'fishing value' of the tank, which was 20-30 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 co-operatives some discount in the 'upset price' and other benefits. In 2003, a series of new changes in the policy framework gave further fillip to productivity growth: the lease period was extended from 3 years to 10 years, which reduced the contractors' gullibility to changes in *Panchayat* leadership and also made investment in productivity enhancement attractive. The new policy also removed the last vestiges of special treatment to co-ops, and provided for a public auction of the lease after open advertisement.

During 1971-1998, inland fishery output of Gujarat increased six-fold from 14000 mt in 1971 to over 80,000 mt in 1998-99 (Govt of Gujarat 2004). Considering that Gujarat hardly had any culture fishery before 1950, it must be said that the credit for this growth rightly belongs to the government's efforts. 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: [a] 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 [b] 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 fulfill needs to serve which water establishments promote copybook institutions. I briefly mentioned earlier how hundreds of defunct community RO or defluoridation plants set up by governments 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 water have mushroomed in the cottage sector; over half of these were set up after 2001, mostly in mofussil towns to serve permanent customers as well as retail water in polythene pouches.[20] 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 made it compulsory for cottage RO plants to get ISI mark. This entailed that each plant had to invest Rs 0.3-0.4 million in an in-house laboratory and pay an annual certification fee of Rs 84,000. This single move put paid to 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 annual certification fee implied no guarantee of quality assurance because BIS inspectors hardly visit plants if ever. Many customers Indu (2001) interviewed wondered if the ISI mark—like AGMARK 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 vein, to cut their losses from operating mostly World Bank funded public tubewell programs by trying to transfer these to *idealized* co-operatives. If the purpose of a co-operative tubewell is to enable a group of farmers to mobilize capital, to install and operate a tubewell for mutual benefit of members, such tubewell 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 Banerjee 1998). The Government of Gujarat tried hard to transfer its public tubewells to *idealized* co-operatives, but thanks to the very high transaction costs relative to the pay-off facing potential entrepreneurs, the program made no headway until 1998 when the terms of turn over were rewritten.[21] Basically, the requirement that a co-operative be registered under the Co-operative Act was dropped; the lease period was extended from 1 to five years; and changes were introduced which made it possible for one or few major stake holders to assume the role of tubewell manager and residual claimant. These minor changes suddenly gave a fillip to the program, and over a 3 year period, over half of Gujarat's public tubewells, some 3500 in all, were transferred to farmer groups. An IWMI-Tata study of turned over public tubewells (Mukherji and Kishore 2003) showed that within a year after

the turn over, the performance of tubewells, in terms of area irrigated, hours of operation, quality of service, O & M and financial results improved; two years after turn over, 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 6 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 lpcd. 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 percent respectively of the demand in Chennai, Indore and Jaipur. In Chennai, they have year round operations and have an association. In other cities, tanker markets emerge during the summer and quietly disappear as monsoon arrives. Londhe etal (2004) estimate that some 3000 tankers in the six cities operate a water trade worth Rs 203 crore/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 absence of any government regulation on groundwater withdrawals. [Except in Chennai] in other cities. Authorities do not even acknowledge the existence of such markets.' (ibid). Tanker markets operate much like any 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 widely held belief that the poorest pay the highest for water, the IWMI-Tata study showed the poorest pay the lowest even when transaction costs and imputed cost of labor 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 briefly discuss has to do with the world famous Sardar Sarovar Project on 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 Water User Association would be organized in each VSA which would simultaneously construct the sub-minor and field channels to convey water from the *pucca* minor to the fields. SSP water was released for the first time in some 80,000 ha of the command just below the dam in 2001. SSP had registered WUA's as co-operatives in some 1100 VSAs on a war footing. When the water was finally released, however, village level distribution structure was not ready in a single village. And it will never be, as we learnt in 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[22] of constructing village distribution systems seemed to far outweigh the benefits people expected out 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 meters of rubber pipes were purchased by water entrepreneurs to take water to their own fields and to provide irrigation service 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 hell-bent on constructing 'proper' village distribution system in the SSP command, never mind if it will take 50 years to complete the canal network.

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 rain water harvesting and groundwater recharge that Saurashtra region of Gujarat saw from 1987 until 1998 when it got co-opted by the state government is a good example of such an institutional development (Shah 2001). Catalyzed first by stray experiments of 'barefoot hydrologists' to modify open wells to collect monsoon flood waters fired the imagination of a people disillusioned with government programs. Soon, well-recharge was joined by check dams and percolation tanks. With all manner of experimentation going on, a kind of subaltern hydrology of groundwater recharge developed and got energetically disseminated. Religious leaders of sects like *Swadhyaya Pariwar* and *Swaminarayana Sampradaya* helped to ennoble this work by imbuing it with a larger social purpose. The gathering movement generated enormous local goodwill and released philanthropic energies on 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 labor. In neighboring 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. Saurashtra's recharge movement was truly multi-centric, unruly, spontaneous and wholly internally funded with no support from government, international donors and the scientific community, until 1998 when the government of Gujarat piled on and proceeded to rid the movement of its quintessentially *swayambhoo* and voluntary character by announcing a subsidy program (Shah 2001; Shah and Desai 2002).

Table 1. Characteristics of *Swayambhoo* Water Institutions

	Fishing contractors using co-operatives as fronts	Reverse Osmosis plants in North Gujarat's cottage industry	Tubewell companies of North Gujarat and Gujarat's Public Tubewell transfer program	Urban tanker water markets	Irrigation institutions unfolding in the Narmada command	Decentralized groundwater recharge movement of Saurashtra
Scale of the institution	Tens of thousands of small and large tank fishery in India	Around 300 plants in Gujarat	Some 8-10 thousand 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 7-10 fold increase in inland fishery productivity during 1960-2000	Add and operate water treatment capacity to serve demand for clean water	Create irrigation potential where individual farmers would be unable 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 chance of a rabi crop
Raison de tre	Can protect fish better and therefore can invest in intensive culture fishery which co-ops can not	To profit from serving emerging demand for fluoride-free water by investing in and maintaining RO plant	To pool capital and share risks of tubewell failure in creating and operating an irrigation source in an over-exploited aquifer	To profit from supply of water in cities where public institutions can not 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	Swayambhoo; catalyzed by religious organizations.
Strategy of reducing transaction and transformation cost	Instilling fear amongst poachers	Cultivating annual customers	Vesting management roles into members with largest share in command area	Meet the demand as it occurs in flexible manner	Avoid making of sub-minors and field channels, reduce seepage, overcome topography	Swadhyaya Parivar and Swaminarayan Sampradaya reduced transaction costs of co-operative 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	Initially skeptical; but then, it piggybacked and lessened its swayambhoo character
Preferred Alternative in institutional environment	Registered Fishermen's co-operatives	Community RO plants	Idealized Water User Associations	Municipal water supply improved	Idealized Water User Associations	Narmada project; scientific recharge works

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 tubewells to counter the silt layer impeding recharge; farmers just direct floodwaters 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 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, decentralized recharge movement can be a major response to India's groundwater depletion because it can ensure that water tables in pockets of intensive use rebound to pre-development levels at the end of the monsoon season every year they have a good monsoon.

Table 1 offers a comparative view of six high-payoff-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 the six can be considered successful. Each can be found to operate on a significant scale thus permitting generic lessons. A notable aspect is that each institution has come up spontaneously and flourished as an instrumentality of its players, serving a purpose important to them. Each has devised its own methods to reduce transaction costs and manage incentive structure. Finally, each is widely viewed in the IE —by government officials, NGOs, researchers, international experts and even local opinion leaders-- as a *subaltern* alternative to a mainstream notion of an institution which is considered ideal but has not worked on desired scale. 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 emasculate them.

Analysis and discussion

Ideas about what kind of institutional change should occur and can sustain come to the IE from four sources.

- *First* of these are theories and hypotheses about how things work. For example, implicit in the thinking of donors such as the World Bank and ADB about metering of farm power is the neo-classical economic theory of marginal cost pricing and a slew of hypotheses and notions about impact subsidies have on the economy.
- *Second* source of ideas is what has worked elsewhere in a similar situation. If groundwater districts in Texas have been able to rein in groundwater overdraft there, why can not similar institutions serve the same purpose here? If IMT has met with some success in Mexico, Colombia, Turkey, why not in India?
- *Third*, and very important source, is what has worked *here*. The repertoire here includes numerous 'successes' of varied types and scales produced by exceptional 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, manpower—local leaders and NGO's are often able to

drastically reduce transaction costs of 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. IWMI-Tata Program studied some 50 of these during 2002-3 (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 he/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 *Sukhomajari* experiment with watershed institutions in Haryana in mid-1980's, Vilas Rao Salunke's *Pani Panchayats* in Maharashtra, Aga Khan Rural Support Program'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 tubewells 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/ declined once the 'transaction cost reducer' was removed from the scene as in *Sukhomajri,* Salunke's *Pani Panchayats,* and others.

- Fourth, and the most important source of ideas about what institutional change should occur and *can sustain* are the *swayambhoo* institutions that have already emerged and are thriving, as we explored in section 6 earlier. These have found ways of reducing transactions costs in ways that are more *natural* and *lasting.* This is evident in that these institutions multiply on their own, and are able to sustain and grow as long as they serve purposes of the participants in the transactions.

In my understanding, these latter institutions offer six useful lessons about how to make institutional change work in the Indian water sector:

1. *Instrumentality:* the first, and the obvious, is that institutional change that multiplies and sustains is invariably an instrumentality of the exchange participants, and not of the players in the IE. "Opportunism with guile" is the driving force even when high ideals and social goals are laboriously espoused as *raison de tre.* Trite as it may sound, design of incentive structures is amongst the most commonly ignored aspect in most institutional development programs. Ideas like community based groundwater demand management propose organizing co-operatives whose sole task would be to persuade their members to reduce their farming and incomes. Similarly, programs to revive traditional community management of tanks commonly overlook the performance-based rewards offered to *neerkattis* and focus primarily on generating voluntary contributions of time and effort for the greater good of the community.

2. Incentive diffusion or perversion: Institutions fail to emerge to take advantage of high-payoff 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 co-ops I discussed earlier, members faced perverse incentives; the co-op stocked the pond but members stole the catch; the secretary had no incentive to make enemies by stopping poachers. When incentives got concentrated in the contractor as the residual claimant, he was willing to control poaching, and invest in higher productivity. Gujarat's public tubewells 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 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 *nirakatti* 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, Giordano and Wang 2004). 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 which increases 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 fairly modest reward, the ditch manager too is able to improve water productivity for a modest bonus, if recent studies are any guide (Shah, Giordano and Wang 2004).

3. 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, key differences between the Chinese and South Asian villages are two: first, the Chinese in general, thanks to Confucian ethic, are much more law-abiding and respectful to State authority compared to South Asians;[23] second, 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 to India's *Gram Panchayats* and *Sarpanch.* This has great implications for transaction costs. North 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 as well as by recourse to coercion through the Party Leader. In India, in 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, pers. comm) because they have no effective local authority to either discipline them or 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.

4. Structures of Incentives and of Sanction: Catalyzing effective local IA's management is then a matter of not only designing appropriate incentive structures that entice an entrepreneur to undertake activities with high pay off but also of putting into place a community sanction or authority structures that:[a] enforce his right to do so; and [b] establish the boundaries within which he operates. Here is where a community organization has a role in providing legitimacy or sanction and boundary to a service provider, and thereby reducing his transaction cost of self-enforcement of rules. It is difficult to overemphasize this point which is commonly overlooked in programs of creating participatory institutions. In the much acclaimed traditional tank management institutions, all tank management was done not by the community but the *neerkatti* who had the sanction and legitimacy given by the community and a reward for services that was linked with the benefits they produced for the community. A self-appointed *neerakatti* (water manager) would find it impossible to enforce rules of water distribution amongst *ayakut* farmers. A recent study of *neerakattis* by DHAN Foundation shows that, for various reasons, many tank communities have begun withholding their sanction and questioning the legitimacy of the role *neerakatti's* have played for centuries; as a result, the institution of *neerakatti's* has begun to decline (DHAN Foundation 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 *neerakatti,* a service provider whose rewards were linked to his performance.[24] The value of this lesson for improving the quality of 'social engineering' is evident in Gujarat government's public tubewell transfer program; after getting nowhere for a decade, it suddenly took off the moment entrepreneurial service providers were offered concentrated incentives coupled by some legitimacy and sanction for undertaking service provision. On these counts, I reckon 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—such as the culture fishery contractor—operating without the sanction, legitimacy and boundary provided by a community organization too is bound to be fragile.

5. Institutional Environment: Finally, IE has a profound impact on what kind of IA's are promoted or discouraged, and what welfare and productivity impacts these produce (Mansuri and Rao 2004). Informal pump irrigation markets, the fishing contractor, decentralized groundwater recharge movement[25]are spontaneous and

seemingly autonomous; but each of these are amenable to strong positive or negative influence from the IE. Gujarat's cottage RO industry fell to a single swoop by 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. Gujarat's Public Tubewell Transfer program ploughed along without success for a decade and then suddenly took off because an actor in the IE changed the some 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 do 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.

6. Path-dependence: According to North, 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 catalyzing institutional change. This has particular relevance to popular institutional notions such as Integrated River Basin Management which have worked in highly formalized water economies in recent years. It is doubtful if 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.

Conclusions

In conclusion:

- institutional analysis of water sector normally focuses on law, policy and administration, the three pillars of water institutions; however, these constitute the *IE;* and the analysis can not be complete without understanding the *institutional arrangements,* which represent the 'rules in use';
- institutional alternatives available to improve the functioning of a water economy depends critically on the degree of its formalization; in informal water economies, the IE has limited sweep over water transactions which are dominated by IA's; as water economies formalize, the sweep of the IE expands to encompass most or all of water transactions;
- India's water economy today is at the level of informality that characterized many European water economies in 18th century; as a result, strategies of institutional reform that would be appropriate for India can not be what works in highly formalized water economies such as of Europe today;
- players in India's IE must seek opportunities for improved performance of the water economy by catalyzing productivity-enhancing reform in IA's;
- India's experience in doing this has been indifferent because reforms pursued have either low pay-offs or high transaction costs or both;
- on the other hand, we have overlooked and failed to learn from large-scale spontaneous institutional change which has enhanced welfare and productivity and reduced transaction costs;

Analyzing these issues suggests that *induced* institutional reform can succeed provided:

- it is instrumental to its participants rather than to the actors in the IE;
- it concentrates incentives in the bearer of the transaction costs;
- provides effective third-party enforcement of rules; failing which,
- it uses community consensus to create legitimacy and authority structure; and designs incentive structure to entice entrepreneurs who will undertake activities with high pay-offs;
- IE has power to stimulate or impede institutional change; and
- institutional change is inherently incremental and context-dependent; transposing models of institutional change that have worked in other, markedly different contexts, seldom work.

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Notes

[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, Blitzer and Curtis (1987 cited in Fiege 1990, foot note 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, foot note 6) in 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] North (2) defines the transaction sector as 'that part of transactions that goes through the market and therefore can be measured' and according to North, rapid growth in the transaction sector is at the heart of the transformation of a traditional economy into a modern one.
[3] The survey estimated that approximately 36% of all rural households (which include farmers, farm laborers and households dependent on off-farm livelihoods) used some means of irrigation. Of these, 13.3% (i.e. 37% of irrigators) use their own source (well/tubewell), 15.3% (i.e., 42.5% of irrigators) used shared tubewells or purchased water, and 12.1% (36% of irrigators) used government owned tubewell, canal or river. Less than 2% used 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 78990 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 source 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'.
[4] If recent accounts of the travails facing global water companies like Vivendi and Thames Water who are forced to wind up even in these increasingly affluent east- Asian cities is any guide, we must conclude that South Asian cities have a long way to go before they can afford water supply systems of European or North American quality (see, The Economist, August 15-21, 2004).
[5] 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 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 1940's; and Saurashtra's water harvesting movement too is now energized by Gujarat Government's 60:40 scheme of government versus community contribution rather than the ideal of self-help the religious leaders had inspired.
[6] A good example is Francis Corten's work during the 1980's on reorienting the irrigation bureaucracy.
[7] A charismatic and energetic political or bureaucratic leader does often produce significant attitude and behaviour change; however, these generally fail to last for long after the leader is removed from the scene. In this sense, such change is not enduring.
[8] Anil Shah, an illustrious former bureaucrat from 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 why there are no takers for the draft Groundwater Bill that MoWR of GoI has been tossing around to states since 1970.

[9] The AP 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.

[10] The 1987 Water Policy to Saleth (2004:29) is "..such a simple non-binding policy statement".

[11] Although the Network Reform program is a National Government program, 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 country of Henan got a grant of Y 60,000 under this project for infrastructure rehabilitation. To match this, the village contributed Y 60000 too; of this 60% came from the funds from the village collective; and the remaining 40% were raised as farmer contributions by charging Y 80/person. All the power lines and other infrastructure was rehabilitated during recent years under this national program. 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.

[12] The village electrician's reward system encourages him to exert pressures to achieve greater efficiency by cutting line losses. In Dong Wang Nnu village in Ci county, in Hebei Province, the village committee's single large transformer which served both domestic and agricultural connections caused heavy line losses at 22-25%. Once the Network Reform Program began, he pressurized the VC to sell the old transformer to the County Electricity Bureau and raise Y 10000 (partly by collecting a levy of Y 25/family and partly by a contribution from the Village Development Fund) to get two new transformers, one for domestic connections and the other for pumps. Since then, power losses have fallen to the permissible 12% here.

[13] Saleth (2004: 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.

[14] 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 normally not possess. Some of the best known examples of successful PIM/IMT are Ozar on Waghad project in Nashik, Maharashtra, Dharoi in North Gujarat, Pingot and a few more medium schemes in 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 which is unlikely to be replicated on a large scale. In catalyzing Ozar co-operatives, Bapu Upadhye and Bharat Kawale and their Samaj Pragati Kendra, and senior researchers of SOPPEKOM invested years of effort to make PIM work (Paranjapye and Joy 2003). In Gujarat, between Aga Khan Rural Support Program and Development Support Centre, Anil Shah and Apoorva Oza have invested at least 30 professional staff time to organize say 20- 30 thousand flow irrigators in to 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 can sustainably raise the productivity of the 28-30 million ha of flow irrigated area in India over say 15 years.

[15] Some random excerpts from Joseph (2001) based on his study of 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 Rs 5 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 percent (of the BFAs) were formed in these two years (1986 and 1987) .. for making possible the utilization of funds.. .Only 57 CC meetings were held by the 8 Canal Committees during a span of 10 years..43 of them were held without quorum and 35 with zero attendance of non-official members.. The level of knowledge .. about CCs.. and there structure and functions is very low…"

[16] 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 and have concluded that these have not been particularly successful in targeting the poor; they also concluded that there is no evidence to suggest that participatory elements and processes lead to improved project outcomes and qualities; that community-based development is not necessarily empowering

in practice; and 'there is virtually no reliable evidence on community participation projects actually increasing a community's capacity for collective action.' (p. 31)

[17] Even in middle-income countries, huge inequalities in land holdings 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 —Water User Associations par excellence—have managed irrigation systems successfully for long; 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 succeeded because, as with South African Irrigation Boards, in many respects, there already was a 40-year old tradition of farmer participation in the maintenance of the canal system through informal village level organization. Equally, irrigation fees under self-management in Turkey was 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 Gladys 1997).

[18] A large survey, which covered over 48,000 farming households throughout India during January-June 1998, suggested that over 66% of India's Gross Cropped Area under 5 most important field crops (which accounts for over 90% of the Gross Cropped Area) is irrigated; only a quarter of irrigated area is served by government canals. Amongst other interesting things it suggests is that every fourth Indian farming household likely owns a diesel or electric pump; and that area irrigated through groundwater markets is as large as the area irrigated by all government canals (NSSO 1999).

[19] 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." (North 2).

[20] An IWMI –Tata study (Indu 2001) surveyed a sample of 14 such plants which served 4890 households. RO water in 10 and 20 litre cans is delivered daily at the customer's door step; charges are levied on an annual basis (Rs 1500 for a 10 litre can daily; Rs 2500 for a 20 litre can). Plant capacities vary from 500-2000 litres/hour. In addition, most plants also retail RO water in pouches at bus-stands, railway stations and crossings, 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 to 150-300 ppm TDS water and fluoride levels reduced to 0.25-0.5 mg/litre. People had no way to ascertain the quality; but 60 customers surveyed by Indu (2004) asserted that RO water taste was distinct. Many also claimed relief in pain from skeletal fluorosis after taking to RO water.

[21] Registering a co-operative itself meant great hassle and cost in time and money. The policy also required that 2/3rd 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 were specified the violation of any of which would qualify the Government to take back the tubewell.

[22] Transformation cost would include the cost of labour and material in making 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 carry water to down-stream farmers.

[23] This has much to do with their histories. For 2000 years, right until 1911, China has been a unified, tightly-governed state through a large, organized bureaucracy that ensured respect for law and the authority of the state. The seeds of an organized bureaucracy in China were sown in BC 250 by Qinshi Huangdi, its first Emperor. Starting from the present day Shaanxi, Huangdi—who ruled for all of 11 years-- unified numerous feuding kingdoms in what is today's China (or most of it) and created a legalist political system of governing his subjects as an 'austere totalitarian society in which everyone informed on each other.' (Becker 2000). This, in its essentials, has survived to date. He created a single currency, nationalized all land and natural resources, standardized weights and measures, gave China a single script with 3000 characters and produced homogeneity in people's thought by destroying all books apart from legalist works and rallied society around the common goal of creating a 'rich and powerful country'. The empire created by Huangdi was overthrown by a succession of dynasties starting with the Han who fought to recreate the old kingdoms. However, until well into the 20th century, China retained the tradition of a unified state with a centralized bureaucracy, the penal code and the Legalist political system espoused by Huangdi. In contrast, never in the history of South Asia have ordinary citizens been subjected to a unified system of governance for a sustained period of time. A major reason probably is that except for brief periods—when regents like Asoka, Harshawardhan, Akbar

ruled huge empires— what are now India, Pakistan, Bangladesh, Sri Lanka and Nepal were ruled over by numerous kings through feudal chiefs and overlords constantly engaged in internecine strife. Indeed, plundering neighboring states was the principal source of revenue of many a South Asian ruler. These regions came under unified administration only during the Colonial period which created a bureaucracy as an instrument of governance.

[24] This is put into bold relief in a new, unpublished case study of traditional community management institution in Mudiyanur tank in a system of 10 tanks in Uthanur watershed in Kolar district (Reddy, Hiremath and Mohammad 2004). 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 to oversee general administration of all 7 villages sharing the tank and the role of *neerkatti's* (water managers) and *Thooti's* (village guards)-- as management-agents of the Council of Elders. Most routine aspects of decision making is 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 *neerakatti's* and labour contribution in maintaining supply channels. The role of the *neerakatti's* 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 10 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 *neerakatti* or when circumstances arise that require responding to a new discontinuity. Recently, 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 acreas of ayacut into 3 parts and irrigate one part per year in annual turns. Helping the CoE to decide if 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 to be given at different stages of crop growth, undertaking repairs and maintenance of sluice (himself) and canals and supply channels by mobilizing labor from member are amongst the tasks performed by the *neerkatti.* Cleaning of distributaries is done by farmer/s benefiting from them; however, main canals never get cleaned of weed and silt unless the *neerkatti* summons all farmers to work on it on a fixed day. All in all, in the smooth management of the tank, the *neerakatti* plays the pivotal management role; he *is* the operating system of the institution; the CoE, mostly invisible and unobtrusive, vest in him the authority and sanction to play that role on behalf of all the members. A tank management institution without CoE or the *neerakatti* would be a far lesser institution.

[25] In 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 in the tank foreshore; when it found out, 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.