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2004

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MPRA Paper No. 27788, posted 04 Jan 2011 08:00 UTC

Preprint of chapter 12.1 in *India Infrastructure Report 2004, Bringing about value for money in infrastructure*, Morris S. (ed.), New Delhi: 3iNetwork and Oxford University Press, 2004.

## Getting Water from Public Private Partnerships

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*Abstract:* The paper explores contractual types of public private partnerships that would deliver maximum value in the Indian context. Under incomplete contracts social institutions, tailored to the specific context, can contribute to effective governance. We first draw out some implications of contract theory, then examine recent international experience with PPP in water supply, and finally draw upon all these to illustrate how services from public utilities, specifically from Mumbai's water supply, can be improved, with cost saving through the reduction of waste. While assets should continue to be in public hands, well-designed service contracts would improve coverage, consumer orientation and low level accountability which is missing in public provision; reduce wastage; encourage competition and entrepreneurship; achieve financial viability; and develop a thick network of low-risk credit-customers for banks and financial institutions. They would, however, require support from price reform, independent regulators, and user groups. Citizen groups can use voting power to motivate politicians to shift from direct subsidies and hidden costs to the delivery of quality services. Some specific issues in water supply reform are that the easy availability of quantity rationing in public water supply perpetuates low quality and distorted prices, and heavy use of non-transparent taxes and fixed charges lowers efficiency and welfare. It follows that re-balancing between fixed and volume charges would contribute to welfare and improve quality.

*JEL codes:* H42, H54

*Key words:* public private partnership, water supply, user groups, fixed and volume charges

*Acknowledgement:* An earlier version of this paper was presented at the IIR workshop, June 15, 2003. The participants were knowledgeable and generous, and I thank them for very useful comments and discussion. It was also presented at a symposium in honour of Jyoti Parikh at IGIDR, July 7th, 2003. Again I am grateful for very encouraging responses, and a valuable discussion with A Vaidyanathan. I thank Sebastian Morris for suggestions and encouragement, Anirban Acharya for helpful research assistance including site visits, and T.S. Ananthi for drawing the diagram.

“Filthy water cannot be washed”—West African Proverb.

## 1. Introduction

The paper will explore what should be the contractual type of public private partnerships (PPP) in order to get the maximum value from such partnerships in the Indian context. Well-designed and chosen contracts improve governance. We first draw out some implications of contract theory, then examine recent international experience with PPP in water supply, and finally draw upon all these to illustrate how services from public utilities, specifically from Mumbai's water supply, can be improved, with cost saving through the reduction of waste. Then value is attained for money since the same resources yield more welfare.

As the literature has developed PPP itself has come to be defined more broadly, to include not only a contract between a government and a formal commercial business firm to deliver a public good or service, but also wider interactions between the government and informal small scale providers (SSPs) that can improve the efficiency of delivery of public services. In many developing countries SSPs provide the majority of the coverage. Except in the UK and France it is the public sector that manages water supply (Gutierrez, 2001).

Civic society also has a major role to play in making such partnerships work well. We take the transaction cost perspective that contracts are essentially incomplete. Then many social institutions have to contribute to ensure effective coordination. An effective structure of interaction would improve governance.

Experience with reform had clearly shown market failure to exist along with government failure, especially in the provision of public services. PPP could be a way to utilize the best of both worlds, while overcoming the specific weaknesses of each, thus removing the governance failure. But for this to be feasible contracts and regulation have to be carefully designed. Theory is helpful in analyzing these weaknesses and suggesting design elements. They also need to be tailored to the specific context. Menard and

Saussier (2002) empirically establish that PPP contracts in France have endogenously adapted to suit local conditions.

In a developing country water supply system PPPs to deliver value must satisfy the following objectives:

- The poor have access to desired quantities and good quality of affordable water.
- Scarce water sources are enhanced and water is conserved.
- Competition and other countervailing forces give consumers a better deal.
- Local entrepreneurial activity and innovation is encouraged and it improves quality and reduces costs.

The structure of the paper is as follows. Implications from theory for the design of contracts in PPP are derived in section 2, section 3 collects recent experience on the working of PPP contracts in water in different parts of the world, section 4 gives the basic features, including strengths and drawbacks of Mumbai's water supply system, section 5 pulls together lessons from each section to suggest possible improvements that would deliver value for money, and section 6 concludes.

## 2. Contracts in PPP

Contract theory recognizes that there is much more to a market transaction than just price and quantity<sup>1</sup>. A contract is a bilateral coordination arrangement (Brousseau and Glachant, 2002). There are a number of difficulties associated with coordination. Laws, regulations, incentives and other mechanisms are required to achieve it among agents who may have asymmetric and incomplete information.

Contracts tend to be incomplete, but even more so in developing countries, and difficult to enforce using only the courts. A variety of institutional features that enforce commitments are needed. At the same time, unanticipated shocks are more frequent in such countries. Therefore some ex-post flexibility in contracts is also essential.

Renegotiations, sanctions, private conflict resolution mechanisms, organizational forms, and norms, all have a role in providing the required mix of commitment and flexibility. Since private conflict resolution mechanisms are imperfect, coordinating rules and sanctions are also required. These mechanisms have been highlighted in the literature on transaction costs theory.

Transaction cost theory views contracts as inherently incomplete because it is not possible to costlessly include unforeseen or unspecified contingencies in contracts. Therefore the ex-post bargaining position is important. Residual rights of control, in uncontracted for circumstances, determine agents' incentives. For example, either residual control rights must be given to the party who makes a relationship specific investment or that party will underinvest. When such allocation of control is not possible internalizing the transaction can improve welfare. This is one of the justifications for the existence of a firm.

If complete contracts could be written public or private provision of public services would be equivalent. Public goods and services are often experience rather than search goods, and their quality is revealed only by consuming. Contracts are incomplete for such goods because all dimensions of quality of service cannot be fully specified. Under complete contracts agents are induced to take appropriate discretionary actions and reveal their information. Control rights, however, cannot fully substitute for this mechanism. If control rights are conferred on a single group it may result in self-serving actions. Therefore control rights have to be carefully divided and civic society and other democratic pressures used. Supervisory or coercive mechanisms may be required to ensure that parties respect their commitments, but these should not restrict the flexibility required to ensure ex-post optimal coordination. A wide variety of institutions that impinge on the transaction and have the potential to improve its efficiency should be considered.

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<sup>1</sup> The discussion in this section largely draws upon Tirole (1994), Hart. et.al. (1997), Brousseau and Glachant (2002) and papers collected in the latter.

Different transaction structures solve the coordination problem to different degrees. A contractual structure can evolve endogenously as a way of resolving the problem. Differing contract forms will be more appropriate in differing circumstances and will vary in their efficiency properties. In considering the conscious design of contracts these aspects have to be kept in mind.

A choice of PPP in a particular public service delivery normally offers a menu of contract choices, ranging from outright privatization or divestiture, to long-term concessions or management contracts where asset ownership remains in the public sector, to outsourcing of specific jobs. Control, asset ownership and risk shared by the private sector falls in moving from the first to the last. The general principle is that risk should stay with agency most able to bear and best able to alleviate it. Service contracts normally vary over a period of 6 months to 2 years. Private sector expertise is used or it may be developed and competition increased. The responsibility for coordination and for investment rests with the public sector. Management contracts transfer responsibility for operation and maintenance (O & M) also to the private sector. These run typically for 3 to 5 years. They may have a fixed fee and include a performance target. In a lease contract the private party buys rights to the income stream so it assumes the commercial risk. Incentives for reducing costs and quality standards can be written in. Concessions last for 25 to 30 years. Responsibility for operation and management (O&M) as well as investment is transferred while asset ownership remains with the Government. The contracts set out performance targets, standards, investment amounts, mechanisms for adjusting tariffs, and arrangements for arbitrating disputes. Assets are to be returned in good condition and consumers are to be protected from monopoly pricing. Under divestiture, asset ownership also passes into private hands and the Government is only left with the task of regulation (Suresh, 1998). Contract theory suggests a number of factors to consider in deciding the position taken on this range.

*1. The more specific assets are to the particular service the more ownership and control should stay with the public sector. The private sector would have an incentive to*

*underinvest, since it is liable to "holdup" once it has invested in assets, which have no use elsewhere<sup>2</sup>.*

This explains why there is so little private ownership of water sources and distribution networks since the assets are highly specific. Well-written contracts may be able to ameliorate the problem to some extent but will not resolve it entirely.

*2. A financially constrained public sector entity has a greater incentive to outsource, and a larger population or consumer density will make outsourcing more feasible<sup>3</sup>.*

The private sector may be able to provide funds that highly indebted governments lack. But the former will be motivated to provide the funds only if it is possible to recover the investments through user charges. Therefore, the key reform is one of pricing. Reasonable user charges can make either a public or a private project viable, and a larger customer base will increase profitability.

*3. Public sector provision should dominate, the greater the uncertainty affecting the quality, and the more difficult it is to enforce quality standards.*

If it is not possible to contract for quality, integration is to be expected, and provision of the good or service would stay in the public sector. The literature generally expects quality to be higher in the public sector because incentives to reduce costs and quality are too high for the private sector. With residual control rights or under a price cap from a regulator the private sector would retain any profits made from a reduction in cost. If quality falls with a reduction in cost such high powered incentives would reduce quality. Incentives therefore have to be low-powered, such as they are in a bureaucracy, or with cost plus pricing rules, in order to maintain quality (Tirole, 1994).

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<sup>2</sup> This is a basic premise of TCT, developed by Olivier Williamson (see Brousseau and Glachant, 2002).

<sup>3</sup> In French water utilities almost the entire range of PPP contracts is to be found. Menard and Saussier (2002) empirically test for the factors that determine endogenous adoption of a particular contract type, and find size of population to be an important variable.

In the public sector the bureaucrat-manager has poor incentives or control rights since he is transferable, but there may be a mission, reputation or career concerns, or political pressure to ensure quality service. Hart et. al. (1997) point out that while private provision will always have lower costs than public, quality in private provision may be lower or higher, if quality decreases with costs but increases with innovation. The latter is normally higher under private provision and is likely to be more important in some kinds of services. Private provision would be superior in cases where quality can be contracted for, or is insensitive to cost reduction, or opportunities for cost reduction are small. Private provision will also dominate if incentives for quality improvement are poor for public managers.

The poor quality associated with public sector provision of services in developing countries is a paradox in the context of these arguments. The answer may lie in the use of poor quality as a rationing device in order to target the poor and serve them within resource constraints. As we argue below, this is particularly relevant in the case of water where demand is highly elastic at low prices so that quantity rationing becomes necessary at low user charges.

*4. If there are multiple, non-measurable aspects of quality, public provision will do better.*

Incentives have to be low for bureaucrats partly because they have to satisfy multiple objectives, some of which are not measurable. High-powered incentives or residual control rights for measurable performance targets lead to a neglect of non-measurable aspects. Among non-incentivized tasks a public good provider has to satisfy is inclusion of the poor, or geographically dispersed difficult to serve categories, and other universal service obligations. In the water sector, it is ironic that the instruments used to target the poor, such as public standposts, or rationing of piped water for limited time-periods, require a steep fall in quality.

*5. Public goods provision is compatible with some competition.*



Many public goods and services are local monopolies. Even so, a regulator can introduce elements of yardstick competition, where relative performance of one local body is compared to that of another, which is similarly placed, and thus forced to reduce costs. Another example is allowing local water boards to compete with each other through bids, for the award of management or concession contracts, in the supply of public services. Unbundling makes competitive supply possible for parts of the public good or service. If the latter is a search good, where consumers can assess quality for themselves, and suppliers are perfectly competitive at each level of quality, private supply would face socially optimal incentives (Hart et. al. 1999). Citizen or user groups are another useful source of information for the regulator, to discipline public monopolies. Such countervailing pressures make it feasible for incentives to be high powered even in the provision of public goods.

So far we assumed the public servant really serves the public. But there are a number of features contracts must cover to control self-interested bureaucrats or politicians, or to prevent regulatory capture.

*6. Transparent rules that minimize discretion may be necessary even at the cost of some flexibility.*

Parts of the public sector may have more information compared to others. If they have discretion they could use the informational advantage to benefit interest groups they favour. In general interest groups that benefit from withholding of information stand to gain. They have an incentive to persuade the official not to release information that harms them. If the officials have to follow a rulebook, then interest groups have less of a stake in the decision and therefore less incentive for regulatory capture. This is one reason officials are made to follow rules. Thus low-powered cost plus rules are less subject to regulatory capture, since they leave low rents with the firm, and the regulator has little discretion. If high-powered incentive schemes such as price caps are to be retained then

alternative pressure groups such as user groups are required to guard against regulatory capture by the supplier. Control rights need to be divided among countervailing groups.

In government auctions there is more discretion in judging quality, and therefore more scope for favouritism. Therefore tangible variables such as price are given precedence (Tirole, 1994). Klein (1996) points out that the large discretion French municipalities have in the award of contracts for water supply are responsible for allegations of political funding received from firms.

*7. Commitment for public service contracts should be short-term and they should be subject to re-bidding.*

In many situations social welfare is enhanced if a benevolent government can make an intertemporal commitment to a long-term complete contract--this would remove fears of expropriation and encourage utilities to achieve optimal efficiency and investment, as is argued in point 1. But short-term commitments provide a check against decisions taken to favour interest groups. Thus re-bidding water contracts may not only keep a check on costs but also allow removal of a corrupt or inefficient firm. Elections are another disciplinary device and a change in the elected government makes it more feasible to force an exit of its corrupt or inefficient cronies (Tirole, 1994). Such considerations explain why governments cannot commit not to 'hold-up' sector specific investment, and therefore why private investment would not be optimal.

*8. Checks and balances are required to prevent corrupt politicians making money from privatization or using public utilities for patronage.*

If the first tendency dominates less sale of government assets would raise social welfare and if the second more independent private sector management or sale of public utilities would be beneficial. The latter would prevent the non public-spirited politician from obliging special interest groups such as trade union vote banks (Hart et. al. 1997). Control rights for any particular decision must not devolve on a single group. In a democracy

these are divided among the judiciary, and executive as well as the legislature; and the media, user and other independent groups must play a major role. Often advocacy by each group reveals valuable information for a decision-maker (Tirole, 1994).

After the theoretical arguments we turn to wide experience gained worldwide in the functioning of different kinds of contracts for the provision of water.

### 3. Experience with Water Contracts in Other Countries

Experience in different parts of the world has tempered the enthusiasm of the nineties for private provision of water, which itself had been caused by severe municipal failure. For a long time the World Bank was the dominant international voice pushing for private participation, especially concessions and divestiture, as a response to the latter (World Bank, 2000). But new, more nuanced, voices have emerged. A selective survey of some of the experiences they recount is useful.

It turns out that the contractual forms gave too much ex-post bargaining power to private parties. Major concessions given with fanfare in Manila in 1997 have exposed many potential problems. The companies made unrealistic bids just to win the tender and then passed on large price increases using loopholes and weakness in regulation. Bidding low and hoping to renegotiate is regarded as an acceptable entry tactic in the water business. Officials complain that once having won the concession, the companies make their own rules. There was some increase in coverage of the poor and of slum areas, but the companies exaggerated it. For example, they would provide a single water main to a group who would then have to set up a committee and hire a contractor. The company would charge the committee but count each household as a connection. Since the charge was higher for higher water consumption, these poor households ended up paying more. But sometimes the companies were unable to collect user charges. The companies had promised to reduce leakage and theft, but were unable to do so. Non-revenue water increased slightly and accounted for between half and two-thirds of the water supplied. The reason was the incentives built in. Since the companies installed meters near the

mains and the leakage took place in the distribution lines they were able to bill the households for the water losses (Landingin, 2003, Gutierrez, 2001).

Cost plus pricing, non-transparent accounting and padding of bills, results in higher user charges for consumers even in developed countries like France. Companies tend to distribute their costs across all municipalities they work for in a non-transparent way. In the Grenoble corruption case it was shown that this allowed them to pay kickbacks to political parties. The concession was investigated after a series of letters from Grenoble citizens complaining about the sudden jump in water prices. The contract even had the regressive feature of discouraging conservation, since the company could increase the price if consumption fell below a contracted amount (Godoy, 2003). Often there are systematic incentives to exploit new water sources rather than conserve water by reducing both leakage and consumption.

Despite the nineties wave of privatization, water utilities remain publicly owned and operated, in most countries of the world except the UK and France (Gutierrez, 2001). One of the key factors facilitating efficient public delivery is a reasonable user charge. Bogota, Columbia, is an example of a public water utility that transformed itself in the nineties after it was allowed to revise user charges (Ronderos, 2003).

Competition can come not only from rebidding but also from encouraging niche domestic informal firms or SSPs. These are often the ones that reach large sections of the population left uncovered by large water utilities. In Paraguay they have proved themselves to be more efficient, competitive and cheaper in serving niches. These *aguateros* lay pipes from ground water wells they dig. They pay taxes and the government regulates them and tests their water quality periodically. Thus open entry and competition becomes a possible model of water supply (Solo, 1999).

In the US in 1850 the majority of water systems were privately owned, but this was reversed in the early twentieth century because of a concern for poor quality and for public hygiene. Today 81 % of the population is served by public utilities. Thus quality is

a concern in private utilities. In 2003 Atlanta Mayor Shirley Franklin cancelled a concession contract, which had been running for 4 years, on grounds of non-performance (Hobbs, 2003).

In developing countries administrations are less resolute and water companies were often able to renegotiate contracts on terms favourable for themselves, because of ex-post monopoly power and the high cost of terminating a concession once given. Moreover, transnationals do not bring in money themselves, but borrow from local resources, and then recover the cost through user costs (Gutierrez, 2001). Their only contribution is management experience, but even there they do not have experience of local conditions. An argument is sometimes made for their starting with management or service contracts so that they can gain knowledge of the functioning of the utilities and local conditions before moving on to concessions (World Bank, 2000). But building governance structures that allow public utilities to run on more commercial lines could be an alternative solution. This is the strategy of strengthening the capacity of the public sector.

A thorough review from Gleick, et. al (2003) recognizes that some privatization is required to improve efficiency, but warns that better regulatory controls are required to ensure safe, affordable, high quality environmentally sustainable water supplies. It is necessary to have transparent contracts with clear dispute resolution mechanisms and all stakeholders involved in the negotiation. At the same time it is necessary to strengthen the ability of governments to meet water needs. An NGO, WaterAid, in their private sector participation framework document emphasize benefits for the poor, strengthening of the local community, government capacity, and the domestic private sector to deliver according to standards (despite support usually from only a small and unstable financial sector) and give VFM (Gutierrez, 2001).

Contextual analysis is also essential to decide on the specific form of outsourcing, and to yield insights on the ideal features of the contracts to be entered into. In a developing country, the main objectives in water supply provision must be, first, to maintain the quality and quantity essential to life. The poor must have access to adequate quantities of

affordable water<sup>4</sup>. Second, to conserve water or prevent its waste, given the pressures on world water resources<sup>5</sup>. Since water is a scarce resource essential for life, it is necessary to conserve its use, develop water sources, and ensure the poor have access to water at affordable prices. The lessons from the problems with both government and private sector provision of water suggest a third objective--the importance of maintaining some competition in water supply provision to ensure consumers a better deal. Finally, encouraging entrepreneurship is a fourth objective, to strengthen the local community. Contracts should be designed with these objectives in mind. These features of an ideal water service, together with the current structure and larger context, will be used to deduce appropriate contractual forms for PPP.

We next present some stylized facts about the Mumbai water supply, before drawing together lessons from theory and international experience for contract design in this specific context.

#### 4. Water Supply in Mumbai

We start with a brief description of the current state. Then some gaps are highlighted, where PPP can contribute. It turns out that PPP may even be self-financing if it is successful in removing waste. Then it would truly be a partnership, with gains that are potentially very high.

Since Mumbai's population is around 1 billion and is expected to stabilize at around 150 million by 2021, its water requirements are huge, and the water supply system is among the eight largest in the world. The Brihanmumbai Municipal Corporation (BMC), which runs the system, is justifiably proud of its assets. In 2002, the total supply was 3000 MLD (million litres per day) compared to estimated demand of 3975 MLD. Taking leakage as 20% or 600 MLD, the average consumption was 167 lpcd (litres per capita per day), with

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<sup>4</sup> This is a major part of the millenium development goals recently established by the United Nations.

<sup>5</sup> The World Water Development Report, subtitled "Water for People, Water for Life." From UNESCO released ahead of the Third World Water Forum in Japan in 2003, calculates that by 2050, between two billion people in 48 countries and up to seven billion people in 60 countries will be faced with scarcity of fresh water (source-press reports).

total domestic consumption at 2160 MLD, and non-domestic 240 MLD. Although the supply ratio to the two was 90:10, their respective contribution to revenue was 50:50. The cost of production was Rs. 5 per kilolitre<sup>6</sup>.

*Organization Structure:* Although in Mumbai the BMC directly runs the water supply system, in many municipalities water boards run the system on behalf of the ULBs (urban local bodies). The water boards are state level organizations with more power than municipalities so that the latter are unable to monitor their services. Moreover, their cost plus administration charges of 18 to 22 % (Suresh, 1998) give them no incentives to reduce costs.

A standing committee of elected representatives approves the setting and revision of tariffs in municipal corporations. For municipal councils and ULBs state governments dictate tariffs. Under present governance structures politicians cannot credibly assure coverage or quality but they can effect prices and tend to use that as a populist tool (Nanavathy, 2001).

*Pipe network, maintenance, and leakage:* The daily average water supply to the city is 2 hours, and to the suburbs 3.5 hours. Trunk, feeder, and distributory water mains form the water supply network. The trunk and feeder mains carry water continuously. They are of large diameters and made of mild steel (MS) which requires protective coatings. Among other materials used ductile iron (DI), and galvanized iron require internal mortar lining and external painting or plastic coating. Cast iron (CI) distributory mains are of smaller diameter and carry water only at specific times. Since of intermittent water supply they are subject to alternate wet and dry conditions which induces corrosion. This is a major cause of contamination and wastage of water. Corrosion is also aggravated from aggressive soil conditions, vicinity of the sea, and currents induced by Railway's DC traction system. The pipes develop internal scaling, pitting, tubercular and micro-bacterial growths. Periodic cleaning and scraping is required after internal inspection

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<sup>6</sup> The source of these statistics is pamphlets from the Brihanmumbai Municipal Corporation (BMC). We are grateful to deputy municipal commissioner R K Bhatia for a personal interview and for making these documents available. We also visited the Bhandup plant.

through video equipment. (GI) water connections to customer premises corrode over time. They are the most neglected and a major source of contamination and leakage. Periodic renewal or use of non-corrosive materials and leakproof joints is required. More recently Poly-Ethylene (PE) is used for laying pipelines in particularly hostile conditions (MEA and BMLPA, 2003). Domestic companies have started manufacturing these and accessories are now available.

Contamination arises from intermittent supply, low water pressure, leaking pipes, and inadequate wastewater collection systems. In slums because of inadequate sewage disposal the soil around the water pipes is polluted. Moreover, since some pipes run close to sewage lines there is great danger of contamination. The danger is compounded by slum dwellers that break the pipes, and then cover the hole with cloth or other rough plugs, which are removed to draw water whenever needed. During periods when water supply is stopped the contaminated soil then gets sucked into water pipes (MEA and BMLPA, 2003). Box 1 illustrates the problems consumers have to face.

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### **Box 1 -- Water or Poison?**

(Cunha 2003a) reports one horrifying but not unusual case. The water supply line to Lokhande Marg in Mumbai passes through several slums whose residents have punctured the line at 135 points. Vacuum during non-supply hours causes contamination to be sucked in and carried to the housing societies tanks. The Deputy Municipal Commissioner who located the holes got them plugged but they were unplugged in 3 days. He ordered installation of a new pipe bypassing the slums, but the order was not carried out. The Welfare Association and the housing societies wrote 51 letters of complaint, which were not answered. Two young people died of infection. The area pays 3 lakhs in municipal water taxes; for the slums water is free. This illustrates the problems of maintenance, absence of prompt response to consumers, and intermittent supply. Privatization and competition could address all of these issues.

Delhi witnessed its first water war in April 2003. One consumer wanted to put a pipe to boost low-pressure water supply to his house. His cousin up the street was afraid this



would lower water pressure to his own house. Harsh words led to a battle in which 15 were injured. The position was expected to worsen in the hot summer. From 1st May water was to be supplied only once a day in South and West Delhi (Times of India, Delhi Edition, 24-04-03).

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The Mumbai water engineers association (MEA) reports that while water leakage in developed countries is between 8-12%, in India it is 30-60%, and in Mumbai 20-25%. Bringing this below 15% is not cost effective. A NEERI study finds that 17 to 44% of total flow in Indian distribution system is lost through leakages, and about 82% of this takes place in the housing service connection, and the rest is due to leakage in pipelines.

The components prone to failure are generally pumping stations, pipelines and appurtenances. Preventive maintenance is required. But there is a poor stock of maintenance materials in the municipal store, and low availability of funds. The sanctioning procedure is cumbersome. Repairs are undertaken during crises only. Maintenance staff report daily for attendance at the ward office, then require 2-3 hours to reach the actual work site.

The cross-section of pipes for household distribution varies from 0.5 to 2 inches. Metering is efficient at 1.5 to 2 inches pipe width in large housing societies, where water supply is 24 hours.

There have been major investments and improvements in the nineties, but mainly in the water sources and plants. BMC has drawn up a Rs 100 crore plan to replace old corroded pipes in a phased manner. Leak detection is possible through sounding and electronic methods, or by-pass meters can be used at the two ends of a water main and variation in flows recorded. A leak detection cell has been set up since 1973, and there are 615 leak detection zones. Quality monitoring is undertaken with 6500 water samples collected

daily<sup>7</sup>. Consumer satisfaction is reported at 73%. But customer orientation is still poor and commercial principles are not applied fully. Supply is released for various points in the city with almost no knowledge of demand, just rough estimates.

*Tariff structure and use of meters:* For unmetered water connections water tax and sewerage tax is based on the rateable value of the property (65% for residential and 130% for non-residential). Metered connections are charged tariffs in Rs. per kilolitre: stand-posts in slums 2.25, buildings and chawls 3.5 (it is planned to raise this to Rs 5.8), commercial and industrial establishments 10.5-35. A sewerage charge of 60% of the rate is added. In addition all premises are charged water and sewerage benefit tax based on the rateable value of the property (12.5% for residential and 25% for non-residential). Thus users pay charges or tax plus benefit tax. The revenue is sufficient to fund 40% capital works in addition to operation and maintenance costs, 40% is spent on the latter. Actual recovery works out to 82%. There are large outstandings from other government agencies, which often do not pay.

Till May 1997 water charges were only 60 paise/1000litres (consumption of a family of 5). After that they were revised 3 times. They are expected to increase in future to cover higher capital costs of new assets. Only from 1997 were other households required to pay higher charges compared to those paid by slums. Mumbai is doing well compared to Delhi where the lowest slab for domestic connection is only 35 paise per kilolitre and the Delhi Jal Board loses Rs 260 crores annually on the revenue account alone (Delhi Times, April 21, 2003).

Since April 2001 a decentralized computerized billing system has been introduced, with appropriate software. There are 2,46,000 metered connections, and 75,000 un-metered connections, of which municipal meters are 48,550, and private meters 1,97,450. But

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<sup>7</sup> A study by SOCLEEN reported in the Times of India, July 10, 2003, Mumbai edition, however, found levels of bacterial contamination hovering at about 20% in many wards. In some areas, especially those surrounded by slums, the level of fecal coliform (fc) touched 1600 fc per 100 ml of water. The safe norm (Bureau of Indian Standards) is 10 fc per 100ml. The contamination was higher than that found by BMC perhaps because the tests were undertaken at the household level. They were also found to be temporary suggesting that the BMC does respond to complaints.

only 20% of domestic meters and 60% of commercial meters work. Water meters are defective, and get clogged. Problems arise with metering since water supply is intermittent, booster pumps are used, good quality non-magnetic water meters are not available, and it is difficult to find locations for housing water meters in the old city and slums. Illegal tapping creates more problems in metering for less developed areas. Moreover, there is an acute staff problem. It is not possible to send meter readers in the field, house to house, and the reliability of the task performed is questionable (MEA 2003). Absence of full cost recovery therefore is due not so much to absence of willingness to pay as to absence of infrastructure and personnel to collect dues (Suresh, 1998). Since it is difficult to bill the consumer correctly, disputes arise. A gap is assigned based on average monthly consumption for last month/year. BMC argue that since domestic demand is almost constant it can be determined by size of the connection, number of hours of supply, and pressure difference at key points on daily basis--or discharge capacity. For high consumption consumers, meters are used, as demand is seasonal depending on business conditions.

## 5. Improving Water Supply

Theory, international experience and the current domestic context suggest that Indian water supply can benefit from PPP in the form of service and management contracts, although assets should continue to be in public hands<sup>8</sup>. Since Indian cities have large populations (except for small towns with about 24% of the urban population), potential revenues from water supply are huge with price reform (theory point 2.2). Water assets will be developed better, however, and their quality maintained, in public hands because of disincentives for optimal private investment (the asset specificity argument made in the theoretical section 2, point 2.1), incentives to overuse scarce water resources, and the ability of large foreign firms to renege on contractual commitments in developing countries. Divestiture would give too much of residual control rights to one party, the private firm. But strategic PPP in service contracts would strengthen the public provision

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<sup>8</sup> A Vaidyanathan made the observation that if rain harvesting techniques become widespread some water sources would effectively be in private hands. We need to distinguish such private measures to augment water supply from development of large water sources.

of water. Weaknesses in quality of customer care would be removed (point 2.3 and 2.4) and competition improved (point 2.5). Examples in Box 2 show the beginnings of such low level service contracts, suggesting that a wider adoption of such contracts may be feasible.

The key to these changes is price reform, and the establishment of independent regulators, who would set tariffs on the basis of economic principles, free from political interference. But efficiency prices, with a lower dependence on non-transparent fixed charges, and higher volume charges require improved metering and billing. The latter are aspects of improved quality of service, which will increase willingness to pay. The waste and slack in the system gives an opportunity for designing service contracts that will finance themselves by removing this waste. Institutionalized user groups have a major role in monitoring contractors, ensuring quality, encouraging conservation, providing information to regulators, and preventing the misuse of political power in patronage or corruption (points 2.6, 2.7 and 2.8). Such user groups have leverage in aligning politicians' incentives since they represent potential votes. Tax concessions, reputation and recognition aspects can provide incentives for these groups. We examine these aspects in greater detail below, and show why these interacting changes are feasible, and why they would achieve the objectives we listed, in the introduction, for a water supply system in the Indian context.

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### **Box 2 -- Examples of partial privatizations**

Chennai Water Board has privatized water delivery to the poor through tankers. Tanker service is contracted to the private sector with payment per trip, and annual contracts. The contractor therefore has incentives for regular trips and for the provision of good service<sup>9</sup>.

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<sup>9</sup> Subir Gokarn made the point that since tankers are non-specific assets, there tends to be overuse of tankers in private water supply although this mode of supply is more expensive compared to piped water. The explosion in credit to small road and water transport operators from commercial banks validates this point. The figure rose from 2979 crores in 1994-95 to 4973 crores in 2000-01 (RBI, 2003, Table 54).

In Mumbai one private maintenance contract has been given in K-East ward. Operation of two pumping stations, one in Raoli and the other in Sion, which were privatized, is successful.

CIDCO, Navi Mumbai, has privatized water pumps, meter reading and billing, maintenance of parks and gardens (Suresh, 1998).

In Delhi complaints cells have been privatized in 2003 after complaints about rudeness of the water supply staff. Poor attendance to water supply complaints is a sore point.

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The major reason independent regulators are essential in the Indian context is to free the pricing of water from political influences. The Suthankar (2000) Committee has recommended a State level independent regulator for Maharashtra. Since water is a State subject, the regulator would have to be at the State level, but some general principles may be laid out to apply across States through a central body such as the Finance Commission.

*Regulation:* The general principles for ensuring efficient, independent regulation, and preventing regulatory capture are well known, and there is large international experience in the functioning of regulatory commissions, which can be drawn upon (Klein, 1996). In the Indian context experience has to be built up, but if the regulators have an understanding of basic economic principles and the ability to withstand political pressures, technical expertise can be hired. The regulators must not be from water utilities, retired government insiders, or be elected. There must be staggered retirement, and the term must not coincide with that of the elected government. Elected officials tend to favour consumers too much, and officers earlier associated with water utilities would favour the latter.

The pricing rule selected must provide good incentives for conservation in water use, efficiency in water production, investment, and financing, and efficient allocation of risks among consumers, utilities, and taxpayers. A price cap that subtracts productivity

improvements, and rises with cost shocks that are out of the utilities' control works best. But public reviews of proposals, and feedback from user groups are necessary for the regulator to obtain information to be able to impose effective yardstick competition, and to limit regulatory discretion or regulatory capture (point 2.6). Retired bureaucrats have captured the first few regulatory commissions set up in India showing the necessity of countervailing pressure by user and voter groups. Comparisons across similar local utilities can give a regulator the necessary information to separate idiosyncratic risk from aggregate risk. The utility is then held accountable only for the former. For example, the monopoly can be allowed to pass on aggregate cost shocks, which are not in its control. Thus utilities should not have to bear the risk of exogenous shocks.

Presently local bodies revise water tariffs steeply once in 5 years, which meets with consumer resistance. Suresh (1998) suggests a 10% increase every year. But this is cost of production pricing which does not pass on productivity gains to consumers or motivate utilities to lower costs. A price review could occur every year or two initially, and then, as learning proceeds could even be every 5 years, so as to give firms a longer period during which they can retain profits from cost reductions.

The regulator can also monitor compliance with other service standards, such as quality of service and of water supplied.

*Tariffs:* Is a reform in pricing politically feasible? Box 3 suggests that even the poor would benefit from such reform. An independent regulator can free politicians from the status quo of low user charges they are caught in, partly because each party is afraid the other will make political capital from such subsidies. Political pressures have kept user charges low, with indirect and hidden costs, which are much larger as a result. These costs include the inefficiencies in water supply and use, coping costs to compensate for poor quality and coverage, and rack renting for industry, which just passes on costs to consumers. Coping costs include time spent queuing for and purifying water, use of domestic tanks, pumps, use of private vendors and bottled water, which cost much more than piped water. There are also social costs such as water hoarded due to irregular

supply and then wasted. User groups can make such indirect costs clear to voters, so that the latter demand quality from politicians.

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### **Box 3--Two-part tariffs and benefits for the poor**

Water is a peculiar good in that it is essential to life. Therefore the utility it contributes at low levels of consumption is very high. But it has many non-essential uses, and at high levels of consumption the contribution to utility of the marginal unit may be very low. Demand is inelastic at low levels of consumption but very elastic at high levels<sup>10</sup>. This has clear implications for the pricing of water. Figure 1 develops a simple example with one rich (R) and one poor (P) consumer. The rich consumer has income level  $Y_R$  and the poor  $Y_P$ .  $Y$  can be measured in terms of time available, with the assumption that time can be translated into income<sup>11</sup>. Indifference curves are drawn for each type, showing the combination of water and consumption of other goods  $O$ , which would keep the consumer at the same level of utility. The indifference  $U_O$  is the reservation level of utility. It originates on the  $Y$ -axis when other goods consumption  $O$  equals income. Initially the indifference curve is steep, the consumer is willing to give up large amounts of other goods when water consumption is low. The curve also approaches the  $X$ -axis asymptotically since water consumption can be very large at a low price in terms of other goods foregone.

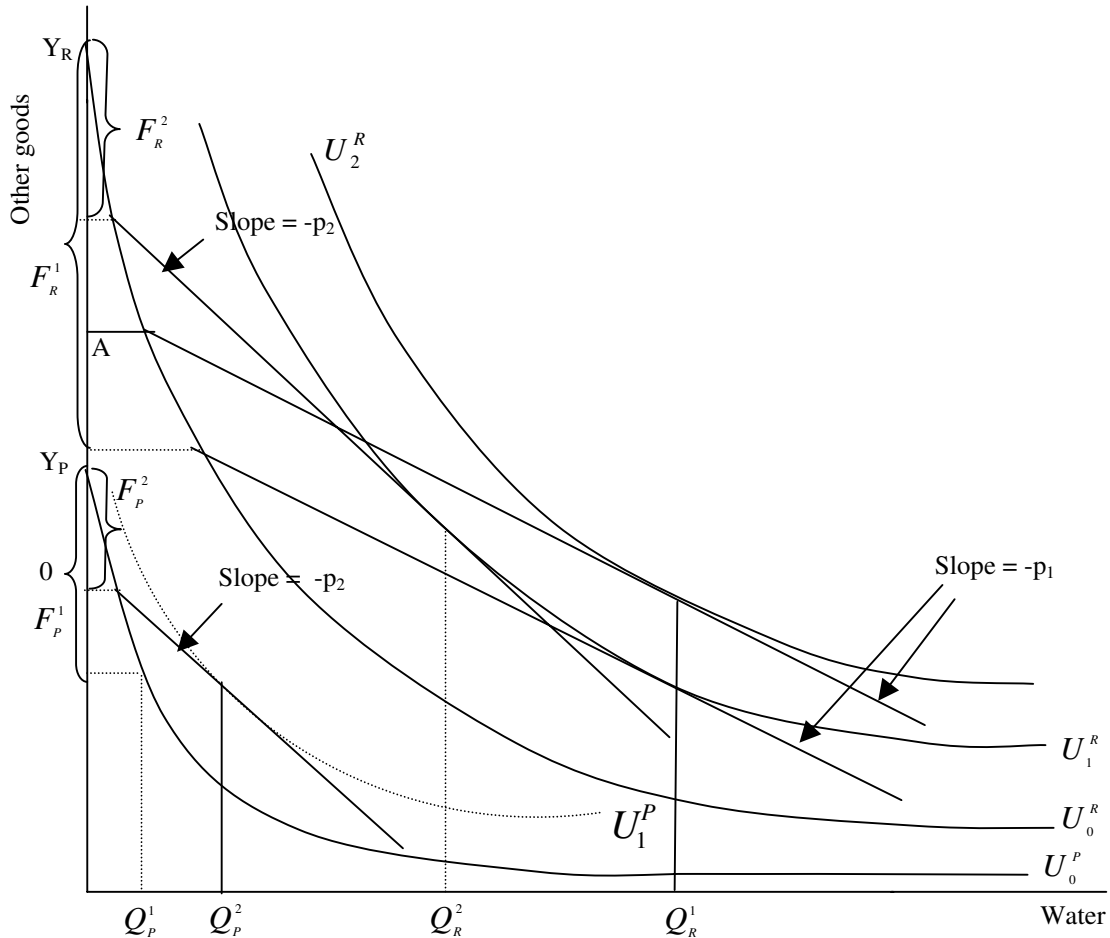
Water is priced through a two-part tariff consisting of a fixed payment ( $F$ ), which entails some free units of consumption, and a price per unit of additional consumption or volume charge. Since normally the fixed payment is less than the maximum amount the consumer would be willing to pay for his consumption of water, he is able to reach a level of utility

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<sup>10</sup> Samuelson in his famous textbook had used this paradox to illustrate the difference between total and marginal utility. He pointed out that diamonds, which are not essential to life, have a very high price, but water whose contribution to total utility is much higher has a very low price. The reason is that water is supplied to the point where its marginal utility is very low. Like air it is almost a free good. But in modern communities delivering potable water to every doorstep is quite expensive, and costs have to be recovered. See (Morris, 2001) for an earlier treatment which does not, however, analyze two part tariffs.

<sup>11</sup> TC Anant made the point that the poor may not be able to convert time into income. Indeed this belief is the reason that queuing is used as a means of targeting the consumption of the poor. But the poor cannot afford to be unemployed and often have multi activity going on so that there is an income loss in queuing. Since water is essential to life high time costs of collecting it can have very large opportunity costs. I know of one poor family who, since it took a large amount of time to collect their daily requirement of water, and the mother had a job, withdrew their daughter from school to perform the task.

higher than his reservation level. Now suppose in period 1 there is no charge for the poor consumer, but he is subject to rationing of water. The implicit cost of queuing etc. he is subject to,  $F_P^1$ , drives him to his reservation utility  $U_0^P$ . This  $F_P^1$  is a net welfare loss since it does not go to the service provider but is a real coping cost for the poor consumer.



**Figure 1: Price reform and welfare**

The rich consumer is charged a fixed cost  $F_R^1$ , which covers consumption of some water units along the horizontal section, and pays a low price  $p_1$  per unit of additional water he consumes. The budget line gives the rate at which he can convert other goods consumption of  $Y$  minus  $F$  into extra units of water. The fixed cost is measured on his reservation utility curve and the price line starts from the point on  $U_0^R$  giving free



consumption at the fixed cost charged. His water consumption is at  $Q_R^1$  where his budget line is tangent to his indifference curve. A fixed cost that does not extract all surplus and his ability to adjust his commodity consumption at the margin take him above his reservation utility  $U_0^R$ . Since he is on the elastic portion of his demand curve, he consumes a large amount of water but derives a low utility from the marginal unit.

Now consider a price reform in period 2 where both consumers are charged a higher unit volume price  $p_2$ , but lower fixed costs than they were paying in period 1. Thus the rich consumer pays  $F_R^2 > F_P^2$ . The consumption of the poor consumer goes up  $Q_P^2$ , but he remains on the inelastic part of his demand curve, and he reaches a higher level of utility,  $U_1^P$ . Although he is paying a small fixed cost, lower than his earlier coping costs, his choice of additional units of consumption is voluntary, and takes him to a higher indifference curve. A French student of BMC's water supply reported that in the current rationing regime consumption is taken to be 240 cc per head for the rich consumer and 45 cc for slums<sup>12</sup>. The changes proposed would improve water equity and the welfare of the poor.

The consumption of the rich consumer falls much more. But since he was on the elastic part of his demand curve, the total utility loss from the marginal units of consumption is not very high. A high fixed and low volume charge turns all rich consumers into high volume consumers. If the fixed cost he was paying earlier was high, he may continue to be on the same utility level  $U_1^R$ . If the fixed cost he was paying earlier was lower at  $Y_{RA}$  ( $< F_R^1$ ) his utility level may fall from  $U_2^R$  to  $U_1^R$ , after the change, but he would continue to be above his reservation utility.

Moreover, social welfare will rise since the consumption of the rich falls about double the rise in the consumption of the poor. Assume that there are constraints in expanding the supply of water, and that earlier some poor were uncovered. Now enough water is released to cover two poor consumers. The move is revenue enhancing, since a higher price is paid per unit of water, and the fall in fixed costs charged for the rich consumer is

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<sup>12</sup> Presentation at IGIDR by a French engineer from Cerna in 2002.

more than made up by the smaller fixed costs now actually paid by double the number of poor consumers. Although in order to simplify the diagram we have kept  $p_2$  the same for rich and poor consumers, the poor could be charged a lower price that varies with the consumption slab. Such differential pricing is common. If the coping strategies of the poor earlier included puncturing pipes, and stealing water, these changes will reduce such wastage, and further improve revenues for the water supplier.

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Piped water supply has one peculiar feature--the easy availability of quantity rationing. Managers can just turn off the water supply to whole areas, especially to selected slums. Since this instrument allows them to cut demand to fit available supply, it is not surprising that they make so many excuses about the difficulties in extending metering more fully. They say household demand tends to be constant, so they can fix a daily amount and just shut off the valves after this is dispatched. Lump sum connection charges and taxes are easy to collect to cover costs. But a study in UP found a 50% fall in domestic water consumption upon full metering (Suresh, 1998). An ADB (1997) study showed 67% metering in Mumbai compared to 0% in Calcutta and 94% in Colombo, while in Malaysia, Indonesia, China major cities all had 100% metering.

*Incentives for service contracts and conservation:* Section 4 has made clear the enormous health and wastage costs of this system of quantity rationing. It has also made clear that intermittent supply, and poor maintenance affects mainly household distributory mains. About 82% of the leakage takes place in the household connections and the rest through deliberate puncturing of the distributory mains, and household consumption accounts for 90% of the water supplied. Irregular supplies lead to considerable additional wastage through water hoarding and disposal. If service contracts are given at a pipe width of 150 mm<sup>13</sup> in various localities, the contractors could be made responsible for maintenance of the distributory pipes, attending to complaints, 24-hour water supply, metering, billing, and collecting. Uninterrupted water supply would reduce corrosion, leakage,

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<sup>13</sup> Mr. R.K. Bhatia, Deputy Municipal Commissioner, Mumbai, suggested in an interview with Anirban Acharya on 9th April, 2003, that if retail privatization were to be considered the most efficient pipe width would be 150mm.

contamination, and metering would reduce the demand for water and wastage at the household level, thus keeping demand below available supply. Slum households could be given one tap each, and the number of standposts reduced. Households could be given a choice of a high fixed cost and low or zero unit charge compared to a low fixed cost and a water charge that increases with consumption slabs. It may become worthwhile for peak consumption households to install meters themselves. Box 4 shows that even slum households are willing to pay, and prefer a combination of volume and low connection charge. A connection charge has some justification as recovering capital costs, and taking advantage of high willingness to pay, but non-transparent water taxes should be avoided. Giving the contractor part of the reduction in water leakage as incentive payment would motivate him to put in capital equipment unlike Manila's private water companies that could pass on the cost of leakage to the consumer. Bypass meters could measure the leakage he saves and give him some percentage of this. His profits then would come from improvement in quality, giving him strong incentives. If the volume charge makes a large part of payment contingent on delivery, delivery would take place, and the tendency to rationing would be lowered. The whole package could be self-financing. Experience is slowly accumulating in designing PPP contracts. The Andhra Pradesh Infrastructure Act passed recently gives a useful prototype that may be used elsewhere.

Such service contracts could be tied with new initiatives in privatizing metering of electricity consumption. Broad synergy may be possible between service provision by different utilities. Local high-level storage reservoirs, maintained by the private contractor, may save the electricity costs of 24 hour water supply, and allow cheaper local treatment of water<sup>14</sup>.

Another irony is that the municipality complains of staff shortage for maintenance and meter reading but its staff per 1,000 connections was 33.3, compared to 17.1 in Calcutta and 7.3 in Colombo (ADB 1997). Although many workers with low skill and education were recruited but even so there is a large store of tacit knowledge and information in

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<sup>14</sup> Participants at the IIR workshop made the suggestions in this paragraph. Joel Ruet was interested in breaking up water according to its uses (only 8% is used for drinking) with recycling and local treatment of other parts.

older workers. For example, daily 757 valves are operated. The service contractors may be able to usefully employ some of these workers.

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**Box 4--Willingness to pay and distribution between fixed and volume charge**

The Vijayawada Municipal Corporation is responsible for household connections. In 1999 it used to charge a connection fee of Rs. 4000 plus a monthly fee of Rs 40. Standposts were dysfunctional and leaking. A cut to Rs 2000 generated a huge response from slum dwellers, and household connections were laid. Communication from Arvind Kumar, IAS Municipal Commissioner, VMC, April 9, 1999.

A non-refundable one time deposit or connection charge covered 37% of project cost in Tirupur. Under these “own your own tap” schemes, which are becoming common, charges vary from 4000-7000 per connection in large towns and Rs 2000- Rs 3,500 in small towns (Suresh, 1998).

In Baroda upper and middle income households paid 20% less than the actual cost of the water they consumed. Adding opportunity costs, the average citywide cost of water was 1.7% of household income. For poor households in income groups less than Rs 1,500 a month, the cost was 2% of their household income. They were willing to pay Rs 275 pa against the prevailing Rs 43. Wealthier families in income groups Rs 4,500-6,000, were willing to pay Rs 440 against actual charges of Rs 200 (Vaidya, 1998).

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Another group of potential employers for these workers could be user groups or water committees. Box 5 gives examples of how well these have worked in some cases. Some such groups may perform monitoring of contracted quality, conservation, and information functions as by-products of other club activities, others may usefully perform meter reading and collection functions as sub-contractors, or be motivated by tax exemption or awards for water conservancy. Pilot groups and institutions aiding the widespread adoption of efficient structures are required. Websites are a useful instrument to achieve

these ends<sup>15</sup>. These user groups would put pressures on politicians for improved delivery, force the municipality to coordinate these service contracts, to adopt transparent bidding and a customer orientation, and to develop and guard precious core water resources.

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**Box 5 -- Examples of community initiatives**

CIDCO, Navi Mumbai, has given the collection of service charges to Senior Citizens Clubs, to whom it pays 1% as commission (Suresh, 1998).

SALMA, or senior ALM activists, has delivered promising results in solid waste management in Bandra. Municipal citizen partnership has worked effectively through ALM (advanced locality management) and its senior wing. The ward office commits to responding to the needs of a street committee and the households commit to follow segregation and composting. The 'Marinisha Award' is given monthly to buildings that successfully handle their solid waste (Cunha 2003b).

In Delhi the Bhagidari or participative system of civic governance is working well. District councils have been established where representatives of residents' welfare associations (RWA) and the local government meet discuss and resolve problems relating to water supply, energy and environmental issues.

From Kolhapur, Maharashtra comes an example of sustainable community management of a multi-village water supply scheme. Operating for more than 20 years as a self-help group, it has a revenue surplus even though charges are lower than in other neighbouring water schemes. It operates 1723 household connections and 43 standposts. Transparency, committed leadership, and importance given to consensus and discussions explain its success (Suthankar 2000, chapter 2, pp. 22).

The Suthankar Committee suggests an interacting multi-tiered institutional structure for water supply, with an independent regulator at the State level, and ULBs and RLBs who would appoint service contractors through local Water and Sanitation Committees, with

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<sup>15</sup> Chetan Vaidya points out that networking initiatives have started for utility managers.

open feedback from many groups including NGOs and customer councils. Women are to constitute the majority in these committees. These autonomous entities would have the basic responsibility for the provision of water services. There would be centrally sponsored 'Urban basic services for the poor' in slum areas with neighbourhood groups of 20 houses represented by Women Resident Community Volunteers. Responsibilities of village level "water and sanitation committees (WATSAN)" would include formation of rules for use of water supply and sanitation. Thus an institutional structure would be created for local distribution of water by community groups.

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There are many ways in which citizens can reduce water wastage, and water committees can play a major role in establishing these practices. With community pressure households would learn to replace leaking fissures, not throw stored water, install 5-10 litre slim dual flushing cisterns or control cocks, use flow control taps, avoid overflow of storage tanks, replace rusted pipes and fittings, inform about leakage, and theft. It is possible to capture runoff from rooftops in special water harvesting tanks. Currently a Mumbaiite uses 40 litres a day for flushing, and 80% of distributed water is discharged as wastewater. If a part is reused it would help to cover the huge projected demand deficiency, and reduce the necessity of developing new sources.

Mumbai buildings constructed after 2001 have to put in water recycling procedures to get a no-objection certificate. Filters allow water used in the kitchen to be reused in the bathroom.

*Financial Viability, Entry and Competition:* Reform of pricing, and transparent tariffs allowing price recovery is a precondition to attract private firms to water supply. Foreign and domestic firms both lack experience in Indian conditions, service and the occasional management contracts are the best way to acquire these. Both will also be looking for domestic capital to finance them. Service contracts will attract largely the small entrepreneur, well-structured contracts will make the enterprise viable allowing financial closure. Thus domestic enterprise will be developed and banks will find more safe

avenues to deploy their excess liquidity. Performance clauses, such as connection targets to be met, and annuities will ensure high standards and local accountability. Foreign firms are also welcome to bid for the service contracts, and their management experience will be valuable, but they must not be allowed special concessions such as exchange cover. Foreign exchange risk can be hedged in the market. On a larger scale, efficient water boards and large private firms should be allowed to bid for management contracts in other States, thus improving yardstick competition.

## 6. Concluding Remarks

While assets should continue to be in public hands, well-designed service contracts are incentive compatible. They would improve consumer orientation and low level accountability which is missing in public provision, reduce wastage, encourage competition and entrepreneurship in SSPs, achieve financial viability, and develop a thick network of low-risk credit-customers for banks and financial institutions.

They would, however, require support from price reform, independent regulators, and user groups. Since contracts cannot be fully specified the latter two have a vital role in enforcing contracts. Since citizen groups have voting power, they can motivate politicians to change focus from direct subsidies and hidden costs to delivery of quality services. The elements of the suggested reforms fit together nicely and complement each other. Examples demonstrate that the changes are feasible.

The paper brings out some neglected aspects in the discussion of reform in water supply, namely:

- The role of easy availability of quantity rationing in public water supply in perpetuating low quality and distorted prices.
- The heavy use of non-transparent taxes and fixed charges that lower efficiency and welfare.
- The contributions to welfare and quality of a re-balancing between fixed and volume charges.

Although the arguments have been carefully related to context, details of the price structure and its effect on demand, estimates of cost savings and incentive structure in specific service contracts, need to be more fully worked out.

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