Institutional and Regulatory Economics of Public Private Partnerships in Infrastructure: Evidences from Stochastic Cost Frontier Analysis and Three Case Studies of Urban Water Utilities.

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A dissertation submitted to

The Faculty of
Columbian College of Arts and Sciences
of The George Washington University
in partial fulfillment of the requirements
for the degree of Doctor in Philosophy

August 31, 2009

Dissertation directed by

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The Columbian College of Arts and Sciences of The George Washington University certifies that Manish Kumar has passed the Final Examination for the degree of Doctor of Philosophy as of 30 April 2009. This is the final and approved form of the dissertation.

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Dedication

I dedicate this work to my parents, wife and children.

Acknowledgements

I wish to first acknowledge the support I received from my Chair and Committee members in completing this work. I also wish to thank my friend, Ms Carina Agaro in Philippines who helped me set up a number of meetings and took time to help me with my research. I thank officials of Mynilad, Manila Waters, Delhi Jal Board and New Tirupur Area Development Corporation Ltd., for sparing their time for this research. I thank Arjun Thapan and Sekhar Bonu of Asian Development Bank for helping me organize meetings in Manila and granting me access to utility data. I thank Caroline van den Berg and Philippe Moran of the World Bank in Washington DC for granting me access of IBNET data and spending time discussing some of the issues with PPP in water utilities. I thank David Ehrhardt and Ben Koehler of Castalia, Washington DC, for sharing utility data and for spending time discussing my research. I thank my friend Sameer Jain of Citibank, New York, for spending hours reading my draft, talking to me and supporting me in all manners possible.

There are a number of others who helped me in conducting this research and I am thankful to all of them for their cooperation.

Abstract of Dissertation

Institutional and Regulatory Economics of Public Private Partnerships in Infrastructure: Evidences from Stochastic Cost Frontier Analysis and Three Case Studies of Urban Water Utilities.

This dissertation explores institutional designs for public private partnerships in water supply systems in case of developing countries. Quantitative and qualitative methods are used to derive generalizable findings. In most cities of developing countries water utilities are, currently, publicly managed. The quality of service is poor with high quantity of water lost to leakages, a few hours of running tap water each day, and a large population living outside coverage area. Most public utilities are over-staffed, charge tariff insufficient to recover maintenance costs and depend on huge budgetary support from the government. With population in cities rising, governments in developing countries are becoming increasingly concerned about improving and sustaining water supply services.

Public Private Partnerships (PPP) have been one of the reforms model attempted in several developing countries but its outcome has been mixed. The difficulties associated with PPP in water supply in several countries, as experienced over last two decades, has led many scholars to believe that institutional designs are crucial for PPP to succeed, particularly with respect to contract design, credible commitments and overcoming of principal agent related problems of information asymmetry and incentives alignment.

This dissertation uses quantitative and qualitative methods to analyze and explore institutional designs suitable for PPP in water supply. The research finds that overall institutional environment (non-water specific) in the country could impact cost efficiency of public sector run utility in non-intuitive ways. As for example, high level of property rights security in a country/region is found to be positively associated with cost efficiency but higher level of business freedom is not necessarily positively associated. Importantly, private sector ownership of utilities, by itself, does not appear to contribute significantly to cost efficiency.

Case study method is used to explore, drawing from experience of Manila, Tirupur and Delhi, institutional designs which are suitable for PPP in water supply. Manila and Tirupur serve as examples of PPP models which were adopted and are currently operational. Delhi serves as a counterfactual – as a city where PPP failed to be adopted and the utility is run by public sector agency. Some of the key findings of the study are: understanding culture and history is important for planning water supply service reforms, relational contracts are favorable for PPP in water supply, autonomous and competent regulator embedded into contracts are preferable, transparency and consumer inclusion are critical for allying accountability concerns and rate of return regulation with periodic rebasing could serve well in developing country context. Policy recommendations are made at the end of the dissertation to the specific context of India.

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CHAPTER I: INTRODUCTION

1.1 Background:

Nearly 1.2 billion people in the world lack access to safe drinking water and 2.4 billion lack adequate sanitation (Davis, 2005). Of these, 725 million are in urban areas (van den Berg, Pattanayak, Yang & Gunatilake, 2006). About 1.8 million people die of diarrheal disease each year of which 90% are children below the age of 5. Lack of access to water has economic consequences and is linked to poverty (The World Bank, 2006). To confront the challenge of poverty eradication, United Nations has formulated Millennium Development Goal in which Goal 7, Target 10, specifically addresses water supply and sanitation issue: "*Halve, by 2015, the proportion of people without sustainable access to safe water and basic sanitation*". The World Health Organization (WHO) has found through an analytical study that achieving MDG 7 would result in substantial economic gains with each US $1 investment yielding an economic return of between US $3 and US $34, depending on the region[1].

The cities in developing countries are growing rapidly but the problems relating to water supply management, its magnitude and importance are yet to be fully comprehended and internalized by many governments. Globally, as many as 70 million people are moving into cities each year (Varis, Biswas, Tortajada, Lundqvist, 2006, p.377). The population growth rate of cities in developing countries is faster than the developed ones. Moreover, urban poor in developing countries are nearly 1 billion strong and with slums increasing over time, is expected to double by 2030. Varis, et al, (2006) argue that this increase in

[1] Water Supply and Sanitation link at http://www.worldwatercouncil.org/index.php?id=23 accessed on 10 Jan 2009

urban population in developing countries differs from the past urban growth experienced by developed countries in two major ways. First, the magnitude of current growth is explosive compared to slow growth in cities of developed world over last few centuries. Second, the urban population growth in developed countries was in tandem with economic growth because of the industrial revolution, but this is not the case with developing countries today. Many of the developing countries have weak economic growth while their urban population rapidly burgeons.

The type of urban water supply reforms pursued by a country will eventually be a political choice, but one of the options many countries have been considering is public private partnerships. India, for example, is seriously exploring public private partnership as a potential model for water utility reforms. In October, 2007, Ministry of Finance and Ministry of Urban Development, Government of India, jointly organized, with the assistance of Asian Development Bank, workshops for States on public private partnership in urban infrastructure, including water supply and sanitation.

With the GDP of India growing at 9% per annum, and private sector performing excellently in various sectors, Government of India has adopted policies attracting private sector competence into public infrastructure traditionally managed by government owned agencies. However, in regard to water supply, the effort to engage private sector has been low key because of concerns peculiar to water sector. The challenges for India, and for many other developing countries, is to draw private sector efficiency into the sector while

addressing genuine concerns about potential or perceived private sector control over water resources.

1.2 Water Supply Management – Trends and Issues:

The global annual demand for water is nearly 4.25 cubic kilometers. About 69% is used for agriculture, 21% for industry and 10% for domestic use. Municipal piped water supply distributes 0.312 cubic kilometers per year, meeting 42% of domestic and 15% of industrial demand worldwide. About 58% of the world's population has access to piped water supply but the average in developing countries is far much lower. Only 20% of population in Sub-Sahara African and South Asian countries has piped water access while the access is slightly higher at 50% in East Asia & Pacific countries.

Broadly, there are three types of municipal systems managing water utilities in urban areas of the world. About 87 countries are served by single national utility and 25 by regional or provincial utilities. However, these countries account for only one sixth of the world's population. Hence, they do not constitute the dominant management system of water utilities. The most common form of utility management, as found in remaining 82 countries accounting for five sixth of the world population, is service management at the individual town and city level.

In total, there are, approximately, 250,000 water utilities in the world of which about 3,500 serve population of 120,000 and more. Some utilities provide water, sewerage and drainage services while others provide only one of these. It is more common to find water

and sewerage jointly provided by a utility in case of developed countries than developing ones. In US, there are more than 50,000 utilities. In Japan, Germany, France, China and India there are more than 10,000 utilities – some serving as little as 100 people. The municipal utilities can have variety of structures. Many function as department of the town hall, with no independent budget and sharing back office functions. Others are part of larger municipal service groups which provide services such as gas, electricity, highway maintenance, etc. Still others are corporatized, operating at a distance from government, maintaining its own account and reporting to the city council in the same manner as a company reports to its shareholders.

Public Private Partnerships in water utilities are essentially transfer of managerial responsibility from the public to the private for a fixed duration of time. Depending on the type of managerial responsibility transferred, PPP can be of various types – Management Contract, Lease, Concessions and Divestiture. The risk and responsibility distribution varies in each, as also the reward associated with assuming risks and responsibilities. For example, management contracts have low risk for private sector, linked to achieving contracted performance indicators, and are generally perceived as returning low reward. Concessions, on the other hand, have higher risks because private operator is expected to achieve performance indicators as well as make capital investments.

Out of 6 billion world population, only 5% are served by private utilities, i.e., 290 million people (126 million in Europe; 72 million in Asia and Oceania; 48 million in North

America, 21 million in South America and 22 million in rest of the world) but their number is growing over time. Private sector provides water to 75% population in France, 86% in UK, 27% in Spain. In the US, private supply covers 13% of the households, mostly small communities. In Asia, private sector has been wary of other countries but has invested aggressively in China (Ouyahia, 2008).

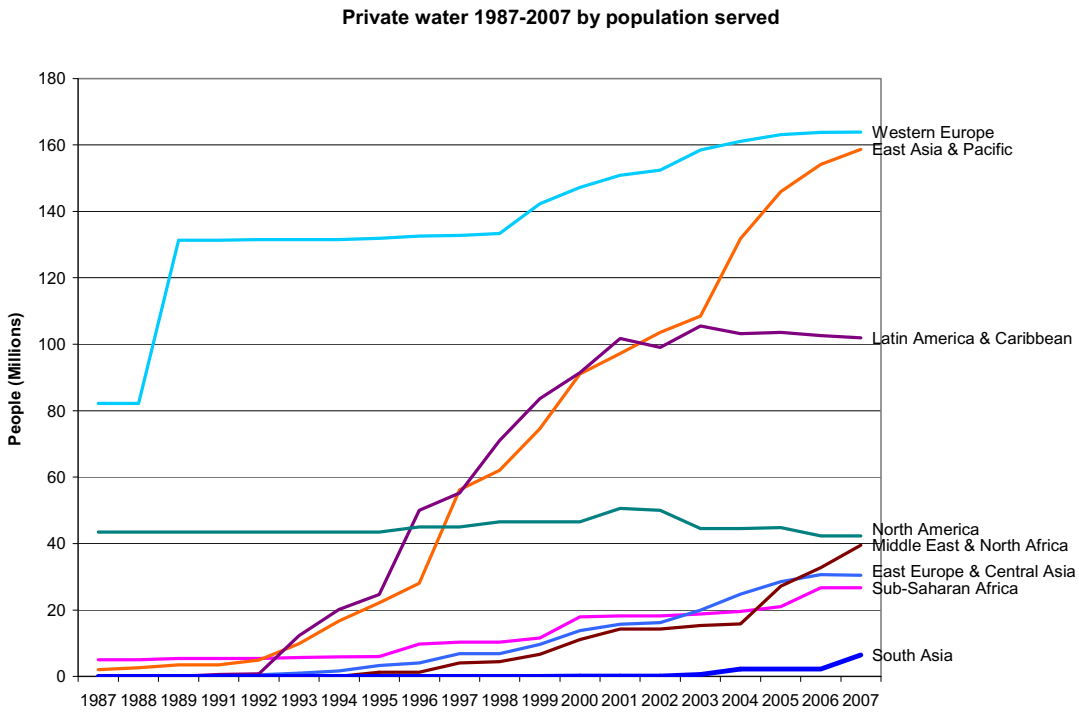


Figure 1.1: Private Water Supply by Population Serve, 1987-2007
(Source: Global Water Intelligence)

Fig 1.1 indicates that Public Private Partnership trend in water supply is increasing in many regions. East Asia and Pacific has seen the largest increase among the developing countries. The trend in Latin America has been flat over last 5 years. While there is an increasing trend for PPP in water supply, there has been lately many opposition to private sector based reforms. Cochabamba in Bolivia became known worldwide when people of the country revolted against the government because of PPP based reforms in water

supply. They were protesting against tariff increase. The President of the country had to resign. Many other PPPs in water supply have been claimed as failures, such as Buenos Aires, where the private operator re-negotiated contract terms and was eventually forced out by the government. There were cases of corruption too, with water companies trying to win bids by influencing developing country politicians and officials (Barlow & Clarke, 2002).

While many question the very concept of PPP in water supply (Araral, 2008; Barlow and Clarke, 2002), others believe that public sector management of water supply in developing country is trapped in a "low equilibrium" which demands PPP initiatives to escape out of it (Savedoff and Spiller, 1999). One of the important drivers of PPP in water supply is the need for finance (Davis, 2005). With many governments in developing countries facing fiscal crisis, and the private sector increasingly capable of financing infrastructure, the need for PPP in water supply will exist. Information asymmetry, incentives and credible commitments are three main problems in respect to PPP in water supply (Savedoff and Spiller, 1999; Shirley & Menard, 2002; Spiller and Tommassi, 2008).

Institutional choices impact economic outcomes (Eggertson, 1996). Changes in the "rules of the game" can lead to improved economic outcomes depending on how incentives are structured (North, 1996). Transaction costs characterize economic exchanges but the type of governance structure chosen for managing exchange can reduce transaction costs (Williamson, 1979). Secure property rights through laws and

enforcement mechanisms strengthen market forces and encourage technological innovations (Furubotn & Richter, 1997; Ruttan, 2006). The reform path is dependent on historical experience and occurs by institutional refinement (Greif, 2006). It is not possible to transplant institutions from developed country to the developing ones, without understanding the context (Greif, 2006; Minogue, 2005). Good institutional arrangements have the attributes of coherence, credibility (includes predictability) and legitimacy, including accountability and transparency (Ehrhardt, Groom, Jonathan & O'Connor, 2007).

While past empirical and theoretical studies indicate problems with PPP in water supply systems, current trends reveal that demand for PPP will persist. As institutions impact economic outcomes, insights from institutional analysis bear the potential to resolve problems associated with PPP in water supply.

1.3 Purpose of the Research:

The purpose of the research is to explore institutional and regulatory design requirements for Public Private Partnerships (PPP) in urban water utilities of developing countries, and make policy recommendations for India using research insights. Traditionally, water utilities have been owned and managed by the government because of its monopoly characteristics and associated large externalities. But the quality of service in terms of coverage, service hours, cost and efficiency has been declining even as urban demand has expanded (Davis, 2005; van den Berg, et al, 2006; Varis, et al, 2006). Most government owned utilities are not financially sustainable (Savedoff and Spiller, 1999). Reform

initiatives have taken two different paths. The first has concentrated on improving performance of government management practices, following the new public management principles (Schwartz, 2006). The second has concentrated on harnessing private sector initiatives in water utility through public private partnerships (Davis, 2005).

Public private partnerships is expected to reduce deficiencies observed in publicly managed utilities, but empirical evidences show that PPP contracts often encounter problems of their own. The reasons can be several. First, water supply has peculiar characteristics and a clear understanding of this fact should reflect in the contract. Secondly, historical evolution of water supply in a country or region impacts the effectiveness of organizations, laws and institutions. Third, PPP as reform option in water supply leads to concerns about market control, high tariff, accountability issues and exclusion of poor. To resolve these concerns, the incentive structure underlying institutional arrangements should be in alignment with public and private interests. To design such incentive structures, it is essential to have a clear knowledge of how institutional arrangements create incentives in water supply systems and how competing interest can be aligned. The case studies in this research are meant to inductively discover such institutional arrangements. The findings from the case studies are then applied to the specific context of India, resulting in several policy recommendations for designing PPP in urban water supply.

The scope of the research is limited to exploring the design of institutions for urban water utilities when PPP is selected as a reform option. The research is specific to the context of developing countries. The research is not intended to be a normative comment on PPP vis a vis other modes of utility reforms. It is assumed that the choice of reform options will be made through political processes specific to the country. This research assumes salience in case PPP is chosen as the mode of reforms through such processes, explaining institutional design requirements.

1.4 Definition of Water Supply Systems:

The US Environmental Protection Agency (USEPA) defines water supply system as:

"*collection, treatment, storage, and distribution of potable water from source to consumers*".

The thesis is based around this definition. It is noteworthy that water supply systems are different from water services. The Water Framework Directive of the European Union defines water services as:

"*all service, which provides for households, public institutions or any economic activity:*

(a) abstraction, impoundment, storage, treatment and distribution of surface water or groundwater,

(b) *waste-water collection and treatment facilities, which subsequently discharges into, surface water* (as quoted in Schwartz, 2006)".

Thus, water service includes water supply systems but is more than that. It can also include irrigation. Further, water service includes wastewater management but water supply systems, by definition, does not.

This research is limited to water supply systems as defined by USEPA.

1.5 Economics of Water

The economic concept of water is complex in comparison to other essentials of life such as food and shelter. The price of water is different from its value. Adam Smith, in his book "Wealth of Nations", discusses the *value in use* and *value in exchange* attributed to goods by taking the example of water and diamonds. While water has high value in use, very little of other goods can be exchanged for it. In contrast, diamonds scarcely has use, but can be exchanged for many other goods. Thus, price, representing the "*value in exchange*" or market value is different from the actual "*value in use*" or true value. True value is enduring while market value can fluctuate depending on demand and supply conditions. More importantly, many goods may have no market value and yet have economic value (e.g., clean air).

The economic concept differentiating price and value was improved by Duipuit and Marshall by distinguishing marginal from average (or total) as the value associated with a unit change in quantity and argued that marginal price declines with quantity. Thus, in accordance with this concept, water may have smaller value than diamond at the margin

even if it has a larger true value. The concept of marginal value was further strengthened by Hicks in 1930s, using utility functions.

Water is different from other essential commodities such as food, shelter and clothing for various reasons. Water is both a private and public good. When water is used at home or in a factory, it is a private good. But, at source, it is a public good. One of the problems is that water is mobile, making it costly to track and account. It is also expensive to transport relative to its value per unit weight, in contrast to liquids such as crude oil. Economically, it is easier to store than transport. Water supply systems are also highly capital intensive compared to other manufacturing industries. As for example, in the USA "the ratio of capital investment to revenues in water utility is double that in natural gas, and 70% higher than in electricity or telecommunication"(Hanemann, 2005). The life span of equipments in water supply systems is as long as 100 years which is much more than equipments used in other infrastructure sector.

The pricing of water all over the world, including in the USA, does not take into account the value of water. Water "is owned by the State, and the right to use it is given away for free. Water is thus treated differently than oil, coal, or other minerals for which the USA government requires payment of a royalty to extract the resources"(Hanemann, 2005, p. 16). The pricing of water usually reflects the capital and operating cost of supplying water, or a part of it. But this observation by Hanemann (2005) may not be entirely true as there are well-developed water markets in some parts of the USA where water rights

are transferred through auctions. Although the auctioned water is generally meant for irrigation, part of it may be consumed for household purposes.

An important economic concept of water is its "essentialness", i.e., water is a vital input for fundamental survival needs of human beings. The minimum need has been assessed by the UN and WHO to be 20 liters per person per day. However, once the threshold needs are met, individuals also utilize water for other needs that bring pleasure and satisfaction. The average consumption in the USA ranges from 455-530 liters per person per day as against approximately 110 liters in Jordan.

The economic issue in water supply system reforms is usually not how much households value access to water. In fact, at any give point of time, all households already have access for their essential needs else they would not be surviving. The issue, therefore, is how much the households are willing to pay for "piped water supply systems" that improve access (relates to geographical proximity) to safe water (relates to quality).

Water was recognized as an economic good in the Dublin Principles adopted at International Conference on Water and Environment, 1992, Dublin, Ireland. The four guiding principles were;

Principle 1: Fresh water is finite and vulnerable resource, essential to sustain life, development and the environment.

Principle 2: Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.

Principle 3: Women play a central part in the provision, management and safeguarding of water.

Principle 4: Water has an economic value in all its competing uses and should be recognized as an economic good.

The last principle emphasized the economic value of water use and has guided the multilaterals such as the World Bank, Asian Development Bank and others in their lending operations.

1.6 History of Water Supply Services:

The early human settlements were all near reliable sources of drinking water. Neolithic sites excavated in last few centuries were found to be invariably located near water bodies. Urban settlements demanded better water management. Excavation is Syria, dating to 2350 BC, have found cisterns and wells dug from rocks. The Incas at Machu Pichu moved water from springs to their capital located at 7000 feet through sloping canals, delivering water to the Emperor first and then, through fountains, to the city residents below[2].

[2] Jeff, B, "Water Supply and Drainage at Macha Pichu" at www.waterhistory.org/histories/machu/ accessed on 31 Dec 2007.

The traditional norms for access to drinking water in different societies have surprising commonalities. Jewish Laws regarding drinking water date as far back as 3000 BC. Water in springs and streams were perceived to be "provided by God", and they were treated as common property. Their commercial use was prohibited. Drinking water was also accessed through wells. Though the wells were not open access resource, laws gave highest priority of use to drinking, including for those individuals not belonging to the community owning the well. This "Right of Thirst" was also reflected in Isaiah:

"*Let all you who thirst, come to the water*"(Salzman, J, 2006, p. 7).

The Islamic laws were similar to the Jewish. The Koran considers water as coming from God:

"He sends down water from the cloud, then watercourses flow (with water) according to their measure, and the torrent bears along the swelling foam,… …"[3].

The first priority in Islamic law was to drinking and then to agriculture and other use.

In Hinduism, access to water from different sources was based on social hierarchy. The wells for higher castes were different from the lower. In fact, physically touching the wells of higher castes by someone of the lower was believed to render water impure.

[3] Koran 13.17 at http://etext.virginia.edu/etcbin/ot2www-koran?specfile=/lv2/english/relig/koran/www/koran.o2w&act=surround&offset=392205&tag=Koran.013&query=water

Despite such strong distinction on water access, religious texts enjoined upon the higher castes to allow access to drinking water to the lower castes during periods of scarcity or dire need. Sharing water was viewed as a spiritual act necessary for karmic evolution.

The commercialization of water started with the Roman Civilization. Rome was perhaps the first city which managed drinking water as a priced resource. About 11 aqueducts were constructed over 550 years with the earliest construction in 312 BC. The water from the aqueducts were branched out by pipes into three types of use: (i) *usus publici*, dedicated to city's basins and fountains, (ii) *privati*, dedicated to private uses and (iii) *balneae*, dedicated to bath houses. *Lacus*, originating from the first class of public watercourse, was used by ordinary citizens for gathering domestic water free of cost. Many of the outlets were decorated with magnificent statues. This free distribution of water was meant to be an act of imperial beneficence for less privileged, and had political connotations. However, nearly 50% of the total water went to rich private users, with residents paying *vectigal*, a water tax. Piped delivery to the households was a status symbol. The city derived economic benefit from the demand for private use.

The history of water supply in New York and London over last few centuries exemplifies the changing trends in management of water supply systems. After 1626, when the Dutch became the first Europeans to inhabit New York, they obtained drinking water from a few private wells while relying on "Kalch-hook", a freshwater lake in Manhattan, for water to cook and brew beer. There were no public water sources. When attacked by the British, the Dutch quickly capitulated as available water resources were inadequate to

support an army defending the city. Among the first actions the British took after occupying New York was forcing the inhabitants to construct new wells. Up to the early part of 18th century the city inhabitants depended on "collect" (anglicized name of Kalch-hook) and the private wells. But the quality deteriorated so very sharply that by mid-18th century the better off citizens preferred "Tea Water", which was fresh water carried from sources far from the city and sold by private entrepreneurs. Late in 18th century, the cholera epidemic forced the city to experiment with privatization. The Manhattan Company was formed to operate as a private entity in water sector but its interest in water supply proved short-lived. The company laid down merely 23 miles of pipeline in 32 years and eventually transformed into Chase Manhattan Bank (Salzman, 2006, p.19). In the meanwhile, the quality of drinking water worsened. After another outbreak of disease and damages from fire in 1830s, the city set up a permanent Board of Water Commissioners for raising capital and constructing a sustainable water supply system for the city. The supply and distribution of water, thus, passed on to a public entity.

1.7 Public Private Partnerships:

Classical economics emphasizes the centrality of clearly defined property rights for well functioning markets. The concept of property rights has its origin in the doctrine of natural rights which recognize humans as self-interested, rational and individualistic. Hume has attributed three distinguishing characteristics to property rights (i) "the stability of possession" (ii) "the transference of property by consent" and (iii) "the performance of promises"(Furubotn et al, 1997, p. 70). Thus, property rights are assigned

to individuals in the context of the classical liberal state following the principle of private ownership, and "ownership rights are transferable in accordance with principle of freedom of contract" (Furubotn et al, 1997, p.71). The third characteristics concerning performance of promises results in "relative property rights" when time elapses between a promise and its actual execution. Contractual obligations are, therefore, relative property rights.

Property rights are useful for understanding social dynamics and adopting economically efficient practices. Furubotn, et al., (1997, p. 72) hold that "the prevailing structure of property rights in a society can be understood as the set of economic and social relations defining the position of each individual with respect to the utilization of resources". They also posit that allocation and use of resources patterns are predictable from the content of property rights and that the property-rights assignment has systematic relationship with economic choices.

The Theory of Privatization states that some types of business are more amenable to market based competition than others. The effectiveness of competition depends on how feasible it is to exclude others from using the good or services, and whether consumption is individual or joint. In other words, markets function well when property rights can be well defined. In general, the government should stay away from goods and services in which market based competition can occur. Although markets do not operate well in the case of collective goods or services that have monopolistic characteristics, government

can regulate to make competition possible in many such cases. For example, toll goods are easier to privatize with competitive pricing despite their monopolistic character.

As per Theory of Privatization, water supply, although a monopoly, is amenable to private sector participation because technological advances have made the service excludable through piped supply and volumetric metering. Property rights in water are, thus, easier to define. Piped water supply, with measurement of consumption by meters, has assumed the characteristics of toll goods.

National Council for Public-Private Partnerships, USA, defines PPP as

"a contractual agreement between a public agency (federal, state or local) and a private sector entity. Through this agreement, the skills and assets of each sector (public and private) are shared in delivering a service or facility for the use of the general public. In addition to the sharing of resources, each party shares in the risks and rewards potential in the delivery of the service and/or facility[4]*".*

Public private partnerships for water supply systems in developing countries are characterized by information asymmetry, lack of incentives and absence of credible commitments for protecting property rights. Investment needs are high. The capacity of governments to monitor and regulate private sector is weak. Most often, private sector is a foreign entity with superior technical ability compared to the government they are dealing with. As water supply pipes are underground, a number of relevant information,

[4] http://www.ncppp.org/howpart/index.shtml#define accessed on 10 Jan 2009

such as leakages from pipes, illegally diverted water, etc., are difficult to obtain. Systematic records on utility functioning are lacking.

Although public private partnership begins with each party selecting their best response to the anticipated action of the other party, often under the guidance of international lending bodies such as the World Bank, the parties discover, in due course, information asymmetry in their relationship. If this is not resolved early, the parties may behave opportunistically, resulting in violation of contractual agreement and its eventual termination (Davis, 2005; Shirley and Menard, 2002).

PPP arrangements are an issue of concern to consumers because of fear that tariff will increase. The control of market power over water, combined with fear of rising tariff, often results in stiff opposition to PPP based reforms. Poor are afraid of being excluded from the new service delivery mechanism because of the fear that they may not be able to afford connections.

1.8 Institutions:

Institutions are defined as "the rules of the game in a society or, more formally, the humanly devised constraints that shape human interactions" (North, 1996, p.344). More comprehensively, institutions are defined by Greif (2006) as a "system of rules, beliefs, norms, and organizations that together generate a regularity of behavior". He states that institutions have four important aspects. First, institutions promote regularity

of behavior implying that actions in response to a given social situation become predictable. Second, institutions influence behavior because of man-made nonphysical factors. As for example, the impulse to abide by rules does not follow from construction of prison houses but follows from internalized norms, and expectations that a penalty of imprisonment will follow from violation of law.

Thirdly, institutions are exogenous to the individuals whose behavior they influence. The individual does not normally have the power to change institution all by his own. Finally, institution is a system of rules, beliefs, norms and organization which together contribute to generating behavior. Rules specify normative behavior and provide shared cognitive systems and information. Rules can be formal or informal. Beliefs and norms provide motivation to follow rules. Organizations produce and disseminate rules, perpetuate beliefs and norms and alter the set of feasible behavioral beliefs.

Williamson (2000) argues that theories about institutions are still fluid, and pluralism on the subject should be accepted at the current level of theory development. He believes that determinants of institutions can be analyzed using tools of economic theory. He sketches four level of social analysis. The first (or Level 1) consists of informal institutions, customs, traditions, norms and religion which are embedded in the society and change over hundreds of years to thousands of years. Level 2 is the institutional environment which consists of formal rules of the game, specially those relating to property rights as may be contained in, say, the Constitution, or such other high laws (difficult to amend). Bureaucracy, judiciary and polity are part of this level.

These change over ten to hundred years. Level 3 is the governance mechanism which is the play of the game and consists of governance structures aligned to the transaction. Contract governance (or regulatory governance) is part of this level. It changes from 1 to 10 years or so. New Institutional Economics (NIE) is mainly dealing with Level 2 and 3, and is concerned with economizing on transactions costs. The Level 4 institutions relate to resource allocation, prices, quantities and incentive alignment. It can be characterized as regulatory incentives.

PPP can succeed if institutions are designed to align interest of both private sector and the government. The concern of private sector is regarding political opportunism which denies them a fair value of return. The concern of government is regarding unsustainable tariff increases, exclusion of poor, abuse of market power by the private entity and loss of political control over water. Institutional arrangements which are harmonious with the past experience of the country/region/city and provide incentive structure favorable to all stakeholders has the potential to improve service delivery through PPP models.

1.9 Research Questions and Methodology

While past empirical and theoretical studies indicate problems with PPP in water supply systems, current trends reveal that demand for PPP will persist. As institutions impact economic outcomes, insights from institutional analysis bears the potential of resolving problems associated with PPP in water supply. This expectation has led to the

framing of main research questions for this dissertation which are centered on designing institutions in case of PPP in water supply systems. There are two main questions. The first is to understand the impact of country-wide (but not water supply specific) institutional environment on efficiency of water supply systems. The second is specifically about designing institutions for PPP in water supply systems. The first question is answered using quantitative method while the second is answered following qualitative method.

Quantitative analysis:

Question 1: What is the impact of country-wide institutional environment on the efficiency of water utilities?

The purpose of this question is to appreciate whether country wide institutional environment has significant effect on the efficiency of water utility. If they do not have significant impact, the implication is that design of regulatory institutions for PPP in water supply will need greater caution. Three institutional variables are analyzed - Property rights security, Business Freedom and Ownership of utility (public or private). Quantitative method is used for answering this question. Cost efficiency is the criteria for measurement. The following are the hypothesis for these variables:

Hypothesis 1: Secure Property Rights should result in improved cost efficiency.

Hypothesis 2: Greater Business Freedom should result in improved cost efficiency

Hypothesis 3: Privately managed water utility should be more cost efficient than publicly managed utility.

Stochastic Cost Frontier estimation techniques are utilized to test these hypotheses.

Qualitative analysis:

Question 2: How to design institutions in case of Public Private Partnerships in water supply systems?

The focus of this question is how property rights, regulation and contracts reduce the problems of information asymmetry, incentives and credible commitments, which have been found to constrain PPP in water utilities. This question, therefore, concentrates on level 3 and 4 of Williamson's (2000) characterization of institutions, although it draws information relating to level 1 and 2 also, because they all must be in harmony for being effective. Case Study methodology is followed in answering this question.

The remaining portion of this dissertation is divided as follows. Chapter 2 highlights the economic basis for water supply policies and reviews literature on Institutions and Public Private Partnerships. Chapter 3 discusses the framework for the research, the research questions and methodology of the research. Chapter 4 gives the findings of the stochastic cost frontier analysis, with reference to the impact of ownership and institutions on cost efficiency. Chapter 5 undertakes detailed analysis of case studies of Manila, Tirupur and Delhi. Chapter 6 presents the findings from case studies. Chapter 7 concludes by applying the findings to specific context of India, giving policy recommendations.

CHAPTER 2: WATER SUPPLY SYSTEMS, NEW INSTITUTIONAL ECONOMICS AND PUBLIC PRIVATE PARTNERSHIPS

This chapter first introduces three broad themes which constitute the theoretical core of this dissertation– "Economic Theory of Water Supply Policy", "New Institutional Economics" and "Theory of Privatization". Theory of Water Supply Systems is the economic principle underlying water supply system management. New Institutional Economics highlights the importance of transaction costs and bounded rationality in shaping economic decisions. Theory of Privatization underpins the modeling of Public Private Partnerships.

2.1 Economic Theory of Water Supply Policy:

There are several features of water services that are similar to private goods. The service is fairly homogeneous commodity purchased for domestic or industrial consumption. There is reasonable information about its quality and characteristics. Demand is normal and fairly stable with predictable elasticity in prices and income (Savedoff and Spiller, 1999). While these suggest potential for market determined exchanges, the economics of water supply is actually complex because of variety of factors.

The organization of markets for water supply systems is influenced by four main factors. First, costs, availability and quality of water are predicated on resource endowment in a geographical region. Therefore, the choice of market structure, regulation and prices vary from one place to another (Noll, Shirley and Cowan, 1999). Second, direct competition is possible on some aspects of water supply systems and is either not possible or not

desirable in others (Shirley, 2006). Third, asset lives are long, as much as 100 years for some components, making it difficult to attract private investments. The financial markets are less interested to invest over such long time horizon because of higher risks and uncertainty associated with future (Davis, 2005). Lastly, health and environment externalities associated with water supply systems are not easy to internalize through regulations or market organization.

Institutions and regulations are more important in economic management of water supply systems compared to other infrastructure class (Noll, Shirley and Cowan, 1999). Effective economic policy relating to water supply needs to address the issues of cost, competition, demand, externalities and pricing.

2.1.1 Cost of Water Delivery and Potential for Competition:

Water use is sustainable if use (current and future) is less than the inflow. Thus, if the annual diversion of surface water and extraction of groundwater for use in water supply systems do not exceed the inflow from precipitation and groundwater recharge, respectively, water use is sustainable. The opportunity cost of incremental water use, in such case, is zero. The only relevant costs are (i) private cost of treatment and distribution and (ii) external cost of exploitation and use (Noll, Shirley and Cowan, 1999). But when not sustainable, the cost also includes the opportunity cost of foregone use in future.

The private supply costs are incurred on account of capturing basic natural resources, transporting, treating and delivering to customers. In all the four activities, fixed cost is the major component, and as much as US $10 to $12 will have to be invested up front in order to generate revenue of US$1 (Seidenstat, Nadol and Hakim, 2000). Although water supply systems exhibit engineering economies of scale, thus appearing to be a monopoly, they need not be so for management purpose. In fact, engineering economies of scale can be offset by management diseconomies of scale, production inefficiency from lack of competition and quality differentiated demand. It is, however, common to find water supply systems as monopoly compared to other infrastructures because of simplicity and comparatively low cost of water supply systems (Noll, Shirley and Cowan, 1999).

Transportation and distributional systems show economies of scale because capacity increases in proportion to the square of external dimension of the pipe, while not compromising the strength of pipe. Also, larger the cross section of pipe, lower is the turbulence, resulting in rapid capacity expansion. Water capture also exhibits natural monopoly characteristics. For example, reservoirs have substantial economies of scale up to an upper bound determined by the geology of the site. However, if a city receives water from multiple dams, competition is feasible (Noll, Shirley and Cowan, 1999).

Pumping underground water is not a monopoly, though centralized regulation may be necessary. The policy choice could range from deliberate promotion of a monopoly (generally state owned) for controlling over-extraction to imposing output based production taxes for extracting groundwater. Water treatment is mildly monopoly.

Overall, if urban area is dependant on multiple sources of water then some degree of competition is possible in capture, transportation and treatment. However, distribution is the greatest natural monopoly bottle-neck (Noll, Shirley and Cowan, 1999).

The cost structure of water supply has implications for pricing. In general, if average water flow is greater than average use, the optimal pricing structure is a two part tariff. The capacity charge is user's maximum use during peak demand. The usage price is the charge for volume of water consumed. The capacity charge and the usage charge together equal the marginal cost of supply. However, as the capacity charge is not easy to observe, because the user's maximum use during peak demand is not observable, other alternative pricing methods are used. Instead of capacity charge, imposing a fixed-charge, which is not a function of usage, is a popular one (Renzetti, 2000) . Charging usage price based on volume requires metering. To justify meters, the efficiency gains from giving customers incentive to curtail usage must offset the transaction costs of metering. Importantly, if externalities constitute a substantial part of the cost, charging for usage is likely to result in high benefits (Noll, Shirley and Cowan, 1999).

There are external costs of exploitation and use in the case of water supply systems which can be offset by appropriate regulations. These occur because of the private cost structure, rents and the political economy of water supply systems. Noll, Shirley and Cowan (1999) describe three types of rents possible in water supply systems:

(i) Quasi Rent: The revenue received from water supply systems are quasi rents because of high ratio of fixed to variable cost. If government could make credible commitments, the private investor could recover investments through collection of quasi rents over time.

(ii) Monopoly rent: The utility can set price above the average cost.

(iii) Ricardian Rent: This arises in the case of multiple sources or storage sites and is due to superior productivity of the better resources. In such cases, usage price recovers only the cost of superior resource, which is lower than the cost of other resources. The pricing is, therefore, lower than optimal.

The regulatory design becomes a problem because of political pressures to extract rent (Savedoff and Spiller, 1999). The challenge is to make credible commitment without capture by vested interests. Rents can be extracted by stakeholders in several ways. For example, consumer groups can organize politically to expropriate Ricardian Rent (forcing prices to average total cost) or even quasi rent, forcing price down to average variable cost (Noll, Shirley and Cowan, 1999). On the other hand, utilities can siphon off substantial cash from revenue returns for non-productive purposes instead of paying off investors or making repairs and replacements (Savedoff and Spiller, 1999).

While the government is normatively expected to control monopoly rents, the challenge is also to control expropriation of quasi rents and inefficient extraction of Ricardian rents. Regulation can create credible commitment mechanism but the risk of regulatory capture

increases when design of regulatory agencies make them vulnerable to capture by utilities or other organized interest groups such as customers/suppliers, etc.

Credibility of commitment can be increased by insulating governance institutions, creating "High Laws" that are difficult to amend (such as amendments to Constitutions/ Laws that are difficult to modify easily), adopting representative systems that reduce the likelihood of advocates of expropriation from coming to power and committing financial resource to the project, as a signal of government's commitment (Spiller and Tommasi, 2008; Noll, Shirley and Cowan, 1999).

It is also essential to have design instruments for the regulation that prevent undue influence by well organized interest groups, resulting in capture of the regulatory agency. Noll, Shirley and Cowan (1999) emphasize the following attributes for water supply services - open information, procedural transparency, standing and voice for anyone affected by regulation, space for competition policy advocates and broad scope for judicial review. Rouse (2007) strongly emphasizes transparency and voice for the people.

The economics of water supply systems can be extended to unsustainable water supply systems by including the opportunity cost of water usage to the marginal direct cost. In theory, if prices fully reflect the social cost of water exploitation and use, including opportunity cost of future use, the market could function as efficiently for water as for any non-renewable natural resource. However, transaction cost can differ substantially between users, and the valuation of water of excluded users may not be reflected in water

allocation. Moreover, collective action problem can result in some users being unable to participate in market effectively. For example, depletion of groundwater can result in subsidence in some parts of the city, resulting in damage to houses. But citizens whose houses were damaged were not part of the water allocation market. Thus, transaction cost, incompletely defined property rights and externalities are hindrances to efficient market allocation in case of unsustainable use. The government can choose to remedy the situation by taxing usage or controlling allocation, but these strategies will be distortionary if interest groups are politically powerful, failing to truly reflect the opportunity cost (Noll, Shirley and Cowan, 1999).

Under-pricing has significant relationship with demand and has negative impact on the society. Under-pricing is very expensive to the society because the upward distortion of demand leads to massive and uneconomic expansion of water treatment and distribution systems. Contrastingly, demand for good quality water at high price is often very low because of informational imperfections. The consumers are not fully aware or appreciative of the relationships between good health and water quality (Rouse, 2007). Hence, higher price for piped water can result in consumers shifting to contaminated water with adverse consequences to public health. The optimal social welfare solution is, therefore, not just limited to price increase. It should be accompanied by creating awareness about positive impact on health of good quality piped water supply.

2.1.2 Water Demand

Water utilities are different from other infrastructural industries because human survival depends on access to uncontaminated water. Therefore, up to some level, demand for water is un-elastic. However, all water needs are not for subsistence alone and water demand in urban areas exhibit elasticity, ranging between -0.25 to -0.70. Water is one of the inputs to many household chores. The demand for water can change when consumption behavior changes in response to relative prices of other inputs. Also, the demand includes Unaccounted-for-Water (UFW) which is water lost by way of leakages in the pipes. Fixing these leaks is a substitute to expanding diversion, storage, transportation, treatment and distributional capacity. But, if the cost of water saved is less than cost of pipe needed for replacement, and plentiful freshwater is available, it may not be efficient to fix leaks (Noll, Shirley and Cowan, 1999).

The common trend of forecasting demand has been to multiply per capita consumption with anticipated population in future. However, past experience indicates that this method over-estimates demand and results in costly over-investments (Baumann, Boland and Hanemann, 1997). Demand can be forecasted more precisely by understanding the type of customers and their utility functions.

The main demand for water comes from residential users, industrial users and commercial users. Minor demands are on account of public uses, firefighting, line cleaning, etc. The demand from industrial and commercial users can be viewed as inputs

to a production function, while that from residential users are akin to final goods. The production function usually is constructed out of various inputs, including water, wages and others. In the first stage, the industry attempts to reduce cost for a fixed output, given the relative cost of various inputs. Secondly, the industry attempts to choose an output level which maximizes its profit. This water input associated with the level of output which brings the highest profit to the industry reflects the demand for water. The demand for residential use is simpler. A household attempts to maximize its utility function from various goods, including water, subject to a budget constraint. The residential demand for water can be safely assumed to be normal good (Baumann, Boland and Hanemann, 1997).

While it is possible to compute demand for water as explained in the preceding paragraph, actual services in developing countries are not necessarily designed on the basis of demand. This is because of persistent low tariff. Water utilities in developing countries are, therefore, frequently supply driven (Estache and Rossi, 2002).

2.1.3 Usage externalities:

While extraction creates externalities as discussed, usage also causes externalities due to pollution and spillage. Pollution occurs because increase in water usage invariably results in increased wastewater production. If the wastewater is not disposed to the environment scientifically, it has negative influence on public health. If utility or customers are not accountable for usage, they will over-produce polluting water sources.

Imposition of tax is one the way to control pollution. An important aspect of the performance of water supply systems is whether it addresses environmental issues (Rouse, 2007).

Water spillage also causes externality because leaks from pipes or from open taps can collect into a standing puddle of slow moving water ways, becoming breeding grounds for disease carrying insects and micro-organism. If prices do not provide incentives for preventing spills, social cost from infectious disease is likely to be high. At the same time, if the price is too high, it can force consumers to switch from piped water to dangerously polluted alternative water sources (Noll, Shirley and Cowan, 1999).

2.1.4 Regulating Water Tariff:

As per optimal pricing theory, price systems should be based on social costs, avoiding both expropriation and capture. This implies cost-based price regulation of water utilities. But firms possess more information than regulators. If the prices are based on indicators that firms controls, the firms can easily distort indicators and maximize profits without producing at efficient level. The other alternative is price-cap regulations. This type of regulation that adjusts price index ceiling without considering cost solves several problems. First, the price performance is as good as it would have been in cost based pricing. Second, a firm facing price index constrain will maximize profits by setting second best optimal prices in relation to its privately known costs. Third, there is no incentive for the firm to distort its production levels, while generating incentive to

minimize costs. Finally, it saves regulator much expenditure it would have otherwise incurred for hiring specialist to audit the agent for cost-based pricing decisions (Noll, Shirley and Cowan, 1999; Jamison, Berg, Gasmi & Tavara, 2004).

In reality, the regulator does not have adequate information to develop a price cap regulation which completely eliminates expropriation or monopoly profits. Also, the usage externality associated with water supply system affects efficacy of price index. In trying to minimize cost, the firm is likely to reduce costly efforts to diminish externality. While taxes could be imposed for externality created, the firms could pass this cost to the consumers because of higher information firms possess. One possible way to overcome the externality challenge is to integrate water supply and wastewater treatment into a combined business entity.

In fact, the design of water tariff can have a number of objectives. These are revenue sufficiency, economic efficiency, equity and fairness, income redistribution and resource conservation. Revenue sufficiency implies tariff being set to a level which is sufficient to recover a particular revenue target. Economic efficiency is achieved by setting prices equal to relevant marginal cost. Equity relates to users paying an amount proportionate to the cost they impose on utility. Fairness is a subjective concept and can vary from one society to another. A marginal cost based pricing can be equitable but it may not be perceived as fair. Income redistribution occurs when large water users (who pay more) subsidize low water users (who pay less). It redistributes income within the society. Higher charges to firms compared to residential zones also redistributes income. Tariff

can be designed to discourage excessive use of water, conserving resources and promoting sustainability (Renzetti, 2002).

Tariff design is also impacted by public acceptability, political acceptability, simplicity and transparency, net revenue stability and ease of implementation. The tariff should not become controversial and not such that cause politicians to lose support, forcing them to interfere. Further, it should be easy to explain and understand. The revenue stream should be stable even in times of difficulties related to weather or economic shocks. Finally, tariff design should be easy to implement and practical.

Incremental Block Tariff (IBT) is a common tariff design popular in developing country although they are no longer in use in the developed countries such as the United States. The design is based on volumetric use and may or may not have a non-use charge. The underlying assumption is that water is a normal good, its use increasing with income. There can be several blocks of tariff and each block allows for certain volume of water usage before rates of the next block becomes applicable. The lowest block is the cheapest and the highest most expensive. Some of the blocks are below marginal cost and others above. The justification for charges below marginal cost is that resulting decline in communicable disease among those who otherwise would have been excluded from the network, is a positive externality from which all consumers benefit. Therefore, IBT design internalizes the externality. IBT also takes care of distributional concerns by charging least to the low income category. On the other hand, higher cost for larger volumetric use reduces demand, enhances economic efficiency and conserves resource.

One of the biggest problems with IBT is that politicians often create pressure to keep the rate for first block very low and volume use high, resulting in considerable decline of efficiency (Renzetti, 2002; Jamison, Berg, et al, 2004).

2.1.5 Defining Efficient Water Supply Systems:

Defining parameters of efficiency by which water supply systems could be compared is a difficult task because there are external factors which impact their functioning. The water resource endowment and quality is different and topography over which water supply distribution is arranged varies from one region to another. The demographic characteristic of service areas are never the same. There are also vast differences in rules and regulations relating to water supply and management (Shwartz, 2006). Cultural and political perceptions about water constrain options for water management.

Although there are limitations to defining efficiency in absolute sense as discussed above, comparisons between utilities, if possible, would be advantageous to society. Performance indicators have been devised with this objective in mind, covering operations, financial sustainability, coverage and quality. These indicators are made public with the expectations that consumers will become aware how their utility compares to another nearby, resulting in public pressure on poorly performing ones. Also, wide knowledge about poor performance is likely to limit political opportunism and rent seeking (Kingdom and Jagannathan, 2001). OFWAT publishes annually the performance indicators of all private utilities under its jurisdiction.

Tynan and Kingdom (2002) developed performance indicators for water supply utilities using a sample of 246 utilities in 51 developed and developing countries. They define efficient utilities as those having indicators which satisfy the benchmarks they have set (refer Table 2.1 below).

Table2.1: Tynan and Kingdom's Performance Indicators

Category	Indicator	Target
Operational Efficiency	Staff per 1000 connections	< 5 staff per thousand connections
Financial Sustainability	Working Ratio (Op cost/Revenue)	<0.68
Commercial Performance	Collection Period*	< 3 months Equivalent
Coverage and Access	Water Coverage	100%
Asset Maintenance	Unaccounted for Water	<20%
Service Quality	Continuity of Service	24 hours per day
Price and Affordability	Affordability of 20 L per day	<0.12% of per capita GDP

*Accounts receivable/ Annual revenue, expressed in months equivalent sales.
Source: Tynan and Kingdom, 2002

Schwartz (2006) argues that these performance indicators are too demanding and unrealistic. For example, operational efficiency measures labor productivity but comparing developed and developing country over this ratio can be misleading. The labor cost in developed country is high and, therefore, the ratio is obviously likely to be lower. Further, 100% coverage is not practical in case of cities in developing countries which constantly receives new migrants into its population. Further, the performance indicators suggested by Tynan and Kingdom (2002) fail to reflect strongly positive changes some

utilities might be experiencing; after all, reaching the benchmark is a process that will take time.

Schwartz (2006) modifies the performance indicators for developing countries, in light of above reasons, as reflected in Table2.2 below.

Table 2.2 : Schwartz's Performance Indicators

Category	Indicator	Target
Operational Efficiency	Staff per 1000 connections	< 8 staff per thousand connections
Financial Sustainability	Working Ratio (Op cost/Revenue)	< 1
Coverage and Access	Water Coverage	> 90%
Asset Maintenance	Unaccounted for Water	<25%

Further, Schwartz (2006) recommends that any recent turnarounds in these indicators should be taken into account for judging if a utility is performing well.

In this research, efficiency of utility is judged based on the criterion developed by Schwartz (2006) as well as the achievement of terms and conditions specified in contracts. However, it should be noted that performance indicators do not reflect the status of externality which has huge relevance in water supply. The issue of positive and negative externality is also considered in this research as far as practicable.

2.2 Institutional and Regulatory Economics:

This section reviews and discusses literature on institutions and regulations. Institutions are discussed and analyzed from New Institutional Economics (NIE) perspective. The objective is to have an in depth and multi-disciplinary approach to understanding institutions, the process of institutional change and how these are related to economic efficiency. Regulations are formal constituents of institutions, developed by governments to focus on specific economic sectors for controlling market power, monitoring performance and providing incentives. In later part of this section, literature on water utility regulation is reviewed and discussed.

NIE principles can be utilized to explain features of institutional failure in developing countries, particularly legal and contractual structures and rules of third party enforcement essential for market transactions. North (1990) states that complex economy, having considerable inter-dependence and impersonal exchange process, enhance the scope for opportunistic behavior. While western societies have developed mechanism to constrain opportunism through clearly defined property rights laws and effective enforcement mechanism, this is not the case with developing ones. An interesting aspect of New Institutional Economics (NIE) is that it assumes strong but limited government - powerful to enforce order but not exercising the power to confiscate property rights of private entrepreneurs. This is a complex balance to achieve.

There is no consensus on the definition of institutions and several frameworks have been developed to explain what they occur and how they function. In Institution-as-rules framework, central to establishment of institution is the rules that politicians prefer and contractual forms that minimizes transaction costs. The stability of institutions is explained only in terms of politics and efficiency. It does not answer what is the motivation or incentive for an individual to follow rules. While fear of punishment can be argued as a reason why people obey, this does not explain the motivation of those who will inflict punishment. The stability explained in terms of politics and efficiency is only a partial explanation.

Evolutionary institutionalism identifies institutions with attributes of interacting individuals such as behavioral traits, habits, routines, preferences and norms. It analyzes how evolutionary forces, combined with mutation, imitation and random experimentation result in equilibrium in the long run. But evolutionary institutionalism assumes experimentation, mutation and learning as exogenous. Also, it makes strong assumptions about human behavior such as individuals being myopic, unable to choose, unable to coordinate, etc.

The structural (or cultural) framework assumes that institutions transcend individual actors and are immutable cultural features of the society, determining behavior. The agency (or functionalist) framework assumes that individuals create institutions for serving various functions.

The comparative and historical framework attempts to integrate all different views of institutions.

2.2.1 Definition of Institutions and its Structure:

It is now generally agreed in economics that institutions matter. In neo-classical economics, institutions were treated as being exogenous in all economic transactions. The underlying assumptions were that everyone in the market had perfect information and faced zero transaction cost. All players in the market were rational, acting in their self interest. Institutions were corrected to their ideal state through trial and error process, learning with each exchange. However, over time, institutions were increasingly recognized as potential endogenous variables in economic policies. The players in the market were found to be constrained by bounded rationality, lacking perfect information and facing transaction costs depending on institutional characteristics.

North (1990) defines institutions as "rules of the game in a society or, more formally, the humanly devised constraints that shape human interactions". In neo classical model, markets were efficient because transactions were costless. The rationality assumption implied that that even if actors have erroneous institutional model to begin with, the feedback process will result in the model evolving into a correct one. The reasoning was that institutions were developed for economic efficiency and that eventually institutions don't matter because they will, in any case, turn efficient by experience. North (1990) argued that this expectation under neo-classical theory was far from truth. In reality,

individuals act on incomplete information, and the feedback information is insufficient to correct the subjective institutional models. Most importantly, institutions are not created to be socially efficient; the formal rules are created to serve interest of those with bargaining power to form the rules. As transaction costs are not zero, the bargaining power does matter in regard to framing of rules.

In addition, the political market is far from efficient. In framing rules, the politicians are hoping to exchange their support to a rule with votes from the constituents. But a constituent has no interest in being informed, both because he can scarcely influence the election by his own and also because he cannot enforce an agreement of such a nature (North, 1996). Thus, it is the polity which eventually defines and enforces property rights through rules, and often these may not be economically efficient.

North (1996) states that analytical understanding of the ways in which economies evolve over time is missing. He suggests modifying neoclassical theory because it ignores incentive structure embodied in institutions for investing in technological development and human capital development. To him, "institutions form the incentive structure of the society" (North, 1996, p. 343). He suggests modifying the rationality assumption and adding the dimension of time to understand how institutions change and economies evolve.

North (1996) states that interaction of institution and organizations shape the institutional evolution of an economy and changes are induced by learning process. Competition is a

powerful force which results in learning. The rationality assumptions do not hold true because the learning occurs in an environment of uncertainty. North (1996) argues that individuals develop mental models to explain and interpret their environment. These change as they receive feedback from experiences over time. Common cultural heritage is a means of reducing the varieties of mental model existing in a society. A unifying belief structure is passed down inter-generationally and gets transformed into societal and economic structures by institutions – both formal and informal. Mental models are internal representation individuals create to interpret their environment while institutions are external mechanisms created to structure and order the environment.

Institutions as they evolve may not necessarily assume forms supportive to economic growth. As economies advance, there is growing specialization and division of labor. With interdependence increasing, society requires complex institutions to gain economically, permitting anonymous and impersonal exchanges across time and space. Societies which evolve towards economic prosperity are those which provide incentives for learning (North, 1996). Incentive to learn and adapt new technology is present only when the private rate of return from new inventions and discovery is high enough to attract the best talents (Ruttan, 2006).

Eggertson (1996) states that neoclassical model can be extended, using concepts of property rights and transaction costs, to understand the link between institutions and wealth. The creation of wealth is enhanced by cooperation, specialization and exchange but all these occur within an institutional framework, which constrains wealth creation.

Property rights define the rights of an economic actor to use a valuable asset, and his ability to do so depends on both formal rules and informal norms. Ability to use a resource by an individual depends on external factors such as laws, statutes, regulation, etc., and internal controls such as monitoring, fencing, etc. Transaction cost is the opportunity cost for an individual in establishing internal control. At the higher level of analysis, such a country-wide analysis, transaction costs constitute both external and internal control. Voluntary exchanges involve transaction cost of contracting and various measures taken to lower the transaction cost are embodied in the contract. The State can play a significant role in lowering transaction cost by providing clear and stable property rights and supplying standards for measurement (such as weights and measures) and ensuring consistent enforcement mechanisms.

Searle (2005) analyzes institutions from the perspective of mental constructs and is particular in claiming that he is not proposing a model but advancing a theory to explain how society works. He states that institution "is any collectively accepted system of rules (procedures, practices) that enable us to create institutional facts" (Searle, 2005, p. 21). In these rules, an object, person or state of affair is assigned a special status such that it can perform functions which it could not have otherwise done. Institutional facts are thus created because of assignment of status functions, and the objective is to lend deontic powers to it. In sum, institutions consists of systematic relationships between collective intentionality, the assignment of function, the assignment of status functions, constitutive rules, institutional facts and deontic powers.

Searle (2005) agrees that there is still ambiguity about what institution exactly is, and believes that the study of institutions is still in its childhood stage. In trying to understand institutions, he distinguishes observer dependent phenomenon, which exist only because of human attitudes, from phenomenon that are independent of human feelings and attitude. The study of institution, he says, is an investigation of observer dependent phenomena. He further makes distinction between subjective and objective reality, explaining why it is possible to create from subjective attitudes such as beliefs and intentions, a reality like corporation, money and economic transactions, about which it is possible to make objectively true statements. The explanation, he states, lies in the difference between ontological and epistemic reality of subjectivity and objectivity. While ontological subjectivity occurs only relative to human (or animal) experience, the ontological objectivity can exist even when humans are non-existent. But epistemic objectivity and subjectivity are features of human claims. Some claims, such as the quality of a painting, are subjective while others, like the place of someone's birth, is objective reality.

Searle (2005) argues that it is possible to study phenomenon that are ontologically subjective but epistemically objective. Money, government, property, etc., are epistemically objective realities but are constituted by subjective attitudes and feelings, and, thus, subjective ontological realities. Such construction of reality is possible because of collective intentionality, assignment of function, status of functions and deontic powers. Collective intentionality is the "directedness of mind" which enables humans to engage in cooperative behavior. The special aspect of human collective intentionality is

that humans can assign functions to objects which it is not intrinsically endowed with, and grant it collectively a functional status. An example is paper currency which functions for voluntary exchange, although only a paper, and this status is granted to it by collective human intentionality. Private property and political leadership are other examples of such functions, their status backed by collective human intentionality.

Searle (2005) characterizes assignment of status function as "X counts as Y in context C" and when the procedure of counting X as Y becomes regularized, it becomes a rule. Institutions are, therefore, outcome of status functions imposed according to constitutive rules and procedures. Status functions are "the glue which holds human societies together" (Searle, 2005, p. 9). The purpose of institutions is, however, not to constrain human activities but to create new power relationships. Institutions enable new power relationships which are characterized by rights, duties, obligations, authorization, permission, empowerment, requirements and certifications. These are deontic powers and just about all institutional structures are matters of such powers. These power relation functions through institutional structures creating desire independent reasons for actions. Thus, recognizing something as duty or obligation implies that undertaking the action is independent of inclination at that moment.

Searle's (2005) theory helps in understanding how mental models of institutions may develop but there are some weaknesses too. First, he seems to assume that institutions are created out of status functions which are accurate. But many status functions are assigned because of myths, or are exaggerated and even patently wrong. Constitutive rules may

not be necessary for institutions to exist and such institutional structures may lack deontic powers. As for example, corruption is institutionalized in many developing countries. The status functions are obviously wrong and there are no constitutive rules or deontic power in corrupt practices. Hence, Searle's (2005) theoretical framework explains more about how good institutions are formed than how institutions, in general, are formed. His theory does not explain how bad institutions are formed and what could be done about it. Also, his theory suggests that all institutions are formed out of human intentionality but this may not be true in all cases (Alston, 1996).

Ruttan (2006, p. 250) defines institutions as "rules of a society or of organizations that facilitate coordination among people by helping them form expectations, which each person can reasonable hold in dealing with others". He mentions, however, the conceptual distinction often made between institutions and organization. In relation to economic activity, he cites Runge (1981) explaining that "institutions provide assurance respecting the action of others, and give order and stability to expectations in the complex and uncertain world of economic relations" (as cited in Ruttan, 2006).

Ruttan (2006) suggests a pattern (or structural) model that explains the equilibrium relationship among resource endowment, cultural endowment, technology and institutions. In this, there is a dynamic and recursive interaction between all four. The supply and demand for institutional change is nested within this equilibrium framework. History, Ruttan (2006) argues, matter in institutional change. He believes that it is possible to shape institutions by conscious choice, while also agreeing that they could

emerge spontaneously. In his opinion, study of institutions for better design is a legitimate endeavor.

Ziegler (1994) observes that institutions originate and change following reasoning that are specific to the philosophical stream from which the process is viewed. He describes three broad philosophical streams – Idealism, Positivism and Experimentalism – and how the process of institutional development is explained by each. In Idealism, reality is believed to exist outside of mankind as Absolute Truths which are fixed and unchanging, revealed only to a select few. People are creatures of God, endowed with innate nature. The Eternal Truth is revealed to political authority and institutions are established by such authorities to serve the absolutes. The more people confirm to such absolutes, the better is the institutional progression.

Positivism assumes that reality is outside mankind which he learns through senses. Knowledge resides in experience and, though people start as equals, the Truth each perceives is subjective. While equal in possessing sense organs, people differ in their emotional and intellectual capacity, as reflected in their struggles for survival. Out of the anarchy of feelings, emotions and knowledge, the need for political authority emerges for stability of the society, and leaders are expected to persuade all others about the truth as he perceives them to be. Institutions are, therefore, an extension of leader, embodying his beliefs. The progress of the institutions is measured by satisfaction of individual desires such as the desire for wealth, status and power.

Experientialism assumes that reality is in a constant process of change and man is part of this process, not outside. Knowledge is derived from interacting with this process; there is no absolute certainty but only degrees of probability. People are not born with inherited traits but acquire one as they grow, based on their experience. Ideas are constantly tested to see of they can resolve problems and leaders among the mankind are innovators applying idea for solving problems. The purpose of the institution is to solve problems and progress is marked by increase in human discretion and choice within the environment. Ziegler (1994) personally subscribes to this stream of philosophy.

Williamson (2000) argues that theories about institutions are still fluid, and pluralism on the subject should be accepted at the current level of theory development. He believes that determinants of institutions can be analyzed using tools of economic theory. He sketches four levels of social analysis (Fig 2.1 below). The first (or Level 1) consists of informal institutions, customs, traditions, norms and religion which are embedded in the society and change over hundreds of years to thousands of years. Level 2 is the institutional environment which consists of formal rules of the game, specially those relating to property rights as may be contained in, say, the Constitution, or such other high laws (difficult to amend). Bureaucracy, judiciary and polity are part of this level. These change over ten to hundred years.

Level 3 is the governance mechanism which is "play of the game" and consists of governance structures aligned to the transaction. Contract governance (or regulatory governance) is part of this level. It changes from 1 to 10 years or so. New Institutional

Economics is mainly dealing with Level 2 and 3, and is concerned with economizing on transactions costs. The Level 4 institutions relate to resource allocation, prices, quantities and incentive alignment. It can be characterized as "regulatory incentives" and is concerned with "rewards of the game". It can change continuously and aims to get the marginal conditions right, emphasizing neo-classical economics principles and agency theory.

The four layers of institutions are inter-related, each level boxed into the other, the higher Levels having much influence on the lower. Fig 2.1 below characterizes their relationship. As evident, level 4 institutions are embedded and bounded by Level 1, 2 and 3.

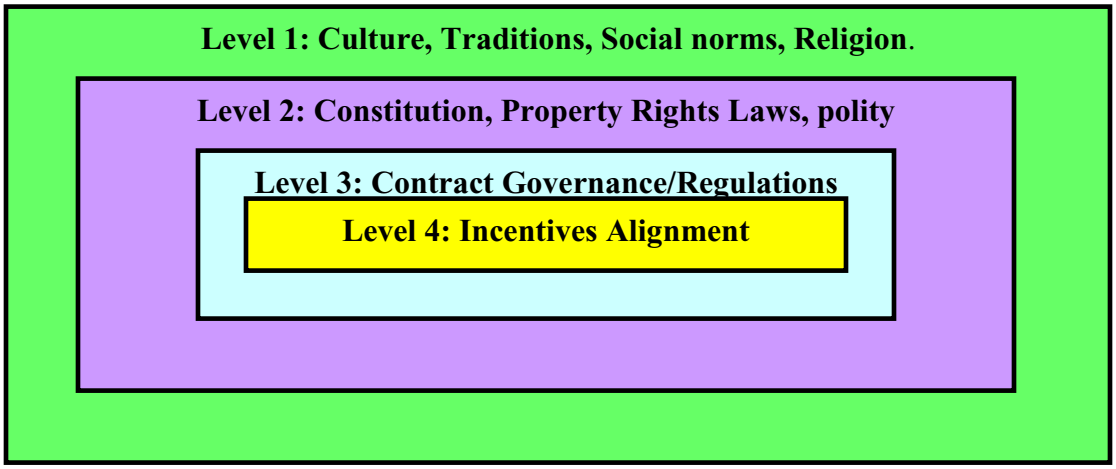


Fig 2.1: Illustration of various levels of Institutions - Williamson's Model.

The analysis of Williamson (2000) is helpful in differentiating the layers of institutions which public policy should address. Level 1 takes as long as 100 years or more to change, and is not relevant for most public policy issues. Changes directed to this level will have to be sustained for considerable period of time before their effects are felt. The changes

may not be witnessed in an individual's lifetime. Level 2 has relevance in public policy but demands a long term view. The changes to this level are possible in a lifetime. Changes to Constitution and Laws require time and sustained advocacy. Level 3 and Level 4 are most relevant for public policy because changes directed towards these layers can be achieved much faster.

Greif (2006) defines institutions as a system of rules, beliefs, norms, and organizations that together generate regularity of behavior. They shape expectations and are self-enforcing. He calls institution the "engine of history", and argues that current status of institution is a result of historical evolution and will influence future institutional development.

Greif (2006) believes that different institutional frameworks discussed so far are not mutually exclusive. He argues that they each portray only part of the reality, and offers his framework intending to be broad enough to accommodate all others, while also disciplined enough to be meaningful. He does not assume institutions to be monolithic but as consisting of interrelated but distinct components such as rules, beliefs, norms and organizations. These provide for an individual the cognitive, coordinative, normative and informational micro-foundation of their behavior.

Greif (2006) proposes a comparative and historical institutional analysis framework. His framework differs from earlier ones in three main ways. First, he attempts to integrate different frameworks of institutional analysis such as institution-as-rules, evolutionary

institutionalism, structural (cultural) view and agency (functional) view of institutions. Motivation or incentive is central to his argument.

Second, he treats transactions as the basic unit of analysis. Transaction is defined as transfer from one social unit to another an entity such as a commodity, social attitude, emotion, opinion or information. Exogenous non-physical factors such as money, praise or penalty, reflecting someone else's behavior, is transferred to an individual whose behavior is intended to be changed. Third, Greif (2006) takes historical factors into account for understanding institutional changes.

New Institutional Economics is criticized for two reasons. First that it ignores power relationship in the society, appearing to promote status quo in respect of wealth distribution. Eggertson (1996) refutes this argument and does not think institutional economics is normative. The analysis of economic of institutions are meant to understand the underlying forces which shape economic outcomes, and the direction which it could take is a choice, which will include the choice for wealth distribution if that is the intention of the policy makers. Secondly, new institutional economics is faulted for depending too much on rational choice theory, which is criticized by many scholars to incompletely represent human behavior. Eggertson (1996, p. 18) argues that NIE does not depend too much on rational choice theory. The concept of bounded rationality is included in new institutional economics. In this, rationality is limited but actions are purposive. Further, he argues that what is rational could vary by cultural context but the choice itself is consistently based on rationality. In other words, choice is based on

rationality in all society even if what is rational in particular instance could vary from one culture to another.

2.2.2 Functions of Institutions:

Grief (2006) emphasizes three important functions of institutions. First, institutions promote regularity of behavior implying that actions in response to a given social situation become predictable. Second, institutions influence behavior because of man-made nonphysical factors. As for example, the impulse to abide by rules does not follow from construction of prison houses but follows from internalized norms, and expectations that a penalty of imprisonment will follow from violation of law. Finally, institution is a system of rules, beliefs, norms and organization which together contribute to generating a behavior. Rules specify normative behavior and provide shared cognitive systems and information. Rules can be formal or informal. Beliefs and norms provide motivation to follow rules. Organizations produce and disseminate rules, perpetuate beliefs and norms and alter the set of feasible behavioral beliefs. Importantly, Grief (2006) adds that institutions are exogenous to the individuals whose behavior they influence. The individual does not normally have the power to change institution all by his own.

The inter-relatedness of rules, organizations and beliefs/norms, and their impact on regularity of behavior is explained through two examples in Table 2.3.

Table 2.3: Example of Institution as a System

Rules	Organization	Beliefs/ Internalized Norms	Resulting Regularity of behavior
Example 1: Formal Rules that water resource should be centrally managed	Federal Ministry of Water Resource	Belief that authority should be respected; Internalized norm that every agency will respond to Ministry's Master Plan.	Implementing projects following the master plan.(desirable behavior)
Example 2: Formal Rules against taking or giving bribes in water supply projects.	Department of Water Resource, Police, Courts	Internalized norm (because of past response of Govt ignoring/condoning/overlooking taking bribes) renders it profitable for incumbent to take bribes. Internalized norm that paying the bribe is the least costly way to advance one's interest makes people pay bribe.	Corruption (undesirable behavior)

Source: Adapted from Grief (2006)

The first example is a case where formal rules hold that water resource should be centrally managed. The organization expected to manage is Federal Ministry of Water Resource. The belief among the staff of all State level Departments that higher authority should be respected and internalized norm that Ministry of Water Resource directives should be complied with results in desired behavior. There is an alignment of normative rules and internalized norms in this case.

But example 2 is different, and is often encountered in many developing countries. Here, the rule holds that bribes should not be taken or given in water supply projects. The internalized norm from past experience is that government never acts seriously in controlling bribery. Therefore, the official will find it profitable to take bribe. The person

giving the bribe will also find it profitable to do so if it is the least costly way to advance his interest, given past experience. The result is the undesirable behavior of wide-spread corruption. If government wants to change this behavior, it will have to begin by planning how to change internalized norm. The institutions can be strengthened by making law enforcement authorities accountable and ensuring certainty of punishment, thus re-orienting internalized norm, and corresponding behavior, over time.

A new set of institutional structures are required when transactions, which are inter-temporal and inter-spatial, are not self-enforcing. Grief's (2006) analysis of trade relations in medieval Europe and North Africa of Maghrabi and Genoase traders is educative in this respect. He found that Maghrabi traders reduced opportunism in transactions through multi-lateral reputational mechanism, supported by credible commitment and enforcement mechanisms. An overseas agent of a Maghrabi trader would not act opportunistically because the code of Maghrabi traders barred all other members from conducting business with any overseas agent who had cheated a fellow trader. Unlike the Maghrabi trader, the Genoase traders relied on bilateral reputation mechanism which was more expensive. They paid more than the agent's reserve wage to ensure that the agent did not act opportunistically. In time, however, the Genoase developed impersonal, formal structures such as the court of law and rules which protected the traders and coordinated their actions. The development of formal laws, courts and rules reduced the transaction cost of doing business. The Maghrabis failed to adopt with changing times and perished as a community.

There are some notable weaknesses in Grief's (2006) analysis of medieval trade. First, the development of institutions such as rules, courts, etc., may have been influenced by multitude of events, which happened to coincide with trading interests at a particular period of time in history. Second, the Maghrabis may not have perished because of flaws in the way they conducted business. Historical factors larger than trade relationship issues might have caught up with them at an unfortunate historical junction. However, it is unlikely that they could have sustained the collectivist trading relationship as the economy became complex and relationships also grew in complexities.

Bardhan and Udry (1999) argue that recent experience in the South East Asian countries indicate that collectivist approach, similar to Maghrabis, can be viable alternatives to formal laws and courts. Many of the South East Asian countries developed economically over last few decades through family businesses with informal codes of conduct and behavior. All that is needed, the authors argue, is performance evaluation and goal congruence. The author's analysis, however, appears to ignore the complexity of transaction as economy evolves, and the necessity of formal structures to coordinate relations that become increasingly complex.

The multi-lateral reputational mechanism was also utilized effectively by the merchant guilds of medieval Europe against foreign rules in whose territory they were conducting business. The rulers had the powers to confiscate the goods of foreign merchants. But the merchant guild coordinated their actions, and held the threat of trade embargo to kingdoms where such confiscations occurred. This mechanism served well to protect

their property rights against avaricious foreign rulers. While such multilateral mechanism also existed in Asia in the past, including India, these did not evolve to form complex rules and institutions as in Europe. The reason could be social structures, political environment and cultural belief systems.

Efficient institutions and governance structures evolve as parties realize new cost-benefit potentials. The persistent change in relative price due to population change and technology can contribute to institutional change if property rights are defined in ways that benefits the owner. However, benefit distribution is not the only factors influencing change. There are various interest groups in the society and the ability of the powerful to constrain the actions of the others also shape evolution of institutions (Bardhan and Udry, 1999).

Williamson (1979) argues that the choice of governance structures is predicated on the need for economizing on transaction cost and bounded rationality. Opportunistic behavior is central to transaction cost, especially when economic activities involve transaction-specific human and physical capital. Williamson (1979) characterizes different forms of transactions, various types of governance structures and the logic by which transactions can be matched to institutions. He classifies contracting laws into three types – classical, neo-classical and relational. The classical contracting aims at 'presentiation', trying to foresee all future contingencies and aiming to include them up front in the contract. Trying to look into future is, however, costly and limited by bounded rationality considerations.

Neo-classical contracting recognizes the problem of accounting for all future contingencies. While the contracts are fairly detailed, neo-classical contracts assume possibility of new information or differences in interpretation as contract progresses. Many of the information may not be verifiable by a third part and too complex for resolution in a court of law. Therefore, such contracts have arbitration as part of its structure, which helps both parties to stabilize relationships in case of any dispute or misunderstandings. Relational contracting is preferred for complex contracting scenarios when the value of maintaining relationship between the two parties is paramount. The reference point is not a particular contract but the entire gamut of relationship as it has evolved. These contracts are incomplete and highly flexible, adapting to time and circumstances.

Williamson (1979) argues that complexity of transactions is determined by (i) uncertainty, (ii) frequency with which transactions recur and (iii) degree to which durable transaction-specific investments are incurred. The frequency can be occasional or recurrent. The type of investment may be non-specific (which enable sale in the market), mixed or idiosyncratic (which is specific to the contractual relationships). The matrix in Fig 2.2 below gives the governance structure best suited to different types of contracting. Market transactions can continue irrespective of uncertainty but this is not the case with transaction-specific (idiosyncratic) investments. It becomes necessary to work things out and have a contractual structure which is more adaptive. If uncertainty is not overcome in

recurrent transactions, the firm is likely to prefer vertical integration of activities under unified structure than relational contracting of the activities with bilateral structure.

		Types of Investment		
		Non-Specific	Mixed	Idiosyncratic
Frequency of transactions	**Occasional**	MARKET classical	TRILATERAL (Neo-classical)	
	Recurrent		BILATERAL (relational)	UNIFIED (hierarchy)

Fig 2.2: Types of Contracting – Williamson's Model

Locating water utilities in Williamsons (1979) matrix throws up interesting insights. Government owned water utilities are "unified, hierarchical" governance structures. This is because of recurrent transactions, with water supplied to customers every day, and non-specific investment requirements. In case of public private partnerships, the underlying effort is to move towards neo-classical contracting or bilateral contracting. With neo-classical contracting, the problem is on account of mismatch in frequency. Given that customer requirements for water remains the same, the occasional nature of neo-classical contracting between government and private operator limits the capacity for quickly

resolving differences. With bilateral contracting, public private partnerships in water should theoretically work, but there is an underlying principal-agent problem creating concerns about accountability. Under unified governance structure, the utility (officials and political leaderships inclusive) is the agent and customers the principal. When a private operator is engaged, it becomes the agent of the utility and not directly of the customer; the control of customers over the operator is now through an additional layer because of multiple principal agent relationships. Accountability, therefore, becomes a serious issue for the customers.

An important institutional issue is how disputes are resolved. Neo-classical economics aimed at improving market efficiency through sharper definition of property rights, implicitly assumes that full information was available to all parties and there were no transaction costs. Although opportunism by parties was a distinct possibility, the underlying institution of economic governance was expected to prevent such behaviors. Thus, existence of a well-functioning state law and its enforcement was taken for granted, preserving property rights and ensuring adherence to contracts. The State, with monopoly over coercion, was expected to enforce laws for maximizing social welfare. In the last 50 years, however, it has been increasingly recognized that these assumption of laws operating costlessly are incorrect. The ubiquity of information asymmetry and transaction costs related to law enforcement is being recognized (Williamson, 1979).

The Constitution, laws and social norms provide the institutional environment around which economic transaction between parties take place. Dixit (2004) argues that

contracting parties attempt to resolve disputes between them without recourse to the courts because the transaction cost of invoking formal laws and rules are high. They, therefore, economize on transaction cost and look for solutions that are speedier and satisfactory to both. In this context, Dixit (2004) does not believe that laws are on their own responsible for resolving disputes, although they do function as reference point in privately managed negotiations.

In the case of water utilities, this does not appear to be the case. There is an inherent asymmetry of power between the government and a private party to which government might delegate management. While Dixit (2004) may be right about two firms, with symmetrical power and common incentive, resolving disputes outside the court, this is unlikely to happen when the dispute is between government and a private entity. Hence, an independent and powerful regulator and/or judiciary, capable of protecting property rights of firms as conferred by law, is important for private sector involvement in water sector.

2.2.3 Designing Institutional changes:

Designing institutional changes require understanding of current institutional structure, variables to manipulate for inducing change and desired institutional characteristics. Also, there has to be a sound understanding of the temporal characteristics of institutions as explained by Williamson (2000). Some institutional changes may occur faster than others. While there can be no precise determination of time-period, a general

understanding of time needed for particular change can help sustain effort appropriately and control expectations. Institutional change is a process, and the key to measure design success is to examine whether desired behavioral changes are being observed.

Alston (1996) regrets the lack of empirical studies on institutions. Most of them are very descriptive or too abstract to be of practical value. While agreeing that history matters in institutional changes, Alston (1996, p. 25) cautions that unintended consequences of institutional change could assume a life of its own. Thus, functionalist approach to explaining institutional changes is not entirely correct.

How institutions change can be viewed from two perspectives – cause and effects (Alston, 1996). The effects perspective of institutional change is concerned with analyzing how results differ in respect to a situation under two different set of rules. This is a static exercise. On the other hand, the causes of institutional change uncover the dynamics of institutional change. The process of institutional change can be perceived as a demand and supply situation, where the demanders are the constituents in that specific context and supplier is the government. In this perspective, government is the supplier because it frames laws, rules and regulations. The political power of the supplier and demander and bargaining between them determines the shape institutions take. Alston (1996, p. 27) states that institution change in three different ways. In the first, the change could be endogenous to the system but exogenous to demanders and suppliers. There is little individual discretion. Laws which are framed because of general consensus in the society belong to such class. This type of laws will, evidently, not allow opportunistic

behavior by politicians. The legislator does not have a choice but to enact the law. On the demand side, no individual may have political power to force legislation but the aggregate demand of the individual can possess that political power.

Second, institutional change could be endogenous to certain demanders. This occurs in the case of interest groups which are politically powerful, such as pharmaceutical industries. Third, institutional change can also be endogenous to suppliers, such as the case of dictators who have firm control over its constituents. Such a dictator could legislate as he chooses. On the other hand, if the constitutes can monitor the ruler and have alternatives for him, the discretion of ruler – the supplier of change – is limited.

Alston (1996) adds that institutional analysis is possible by several methods - comparison across countries, quantitative measurements and case studies.

Ostrom (2000) suggests institutional design principles from his research on self-organized resource management regimes. Ruttan (2006) states that these principles are valid even for institutional structures at community and regional levels that are not self-organized. Analyzing these principles in the context of water supply reforms give important insights. The first principle is the presence of clear boundaries and rules. In case of water supply systems, citizens within the service area constitute the boundary. The rules by which water supply system function are not widely known, or are embodied in complex documents which may be difficult for many citizens to understand,

particularly the poor and unconnected. Second, local rules about use should exist. This is dependent on how active local political participation is in developing policies for utility service. As fund for utility operation is directly coming from the regional/national government in case of many developing countries, the rules are more likely dictated by them as well.

Third, individuals affected by resource regime should have the opportunity to participate in decision making. Although this may not be possible for water supply systems, given large number of customers, it should be possible to have a direct agent of the customers – either current elected representative or a special one such as non-government organizations – representing their interest in water supply management. Presence of local political leadership in the Board of utility management constitute such participation, although the level of participation is likely to be constrained by the amount of time local political representative can spare, given his multifarious responsibilities. Fourth, the regime should be able to select its own monitors who are accountable to users. Current water supply systems in many developing countries do not have good accountability mechanism and citizens are hardly informed about status.

Fifth, sanctions should be graduated. In publicly owned water supply systems, there are hardly any sanctions. Sixth, there should be low cost, local arenas for conflict resolution. While there are local arenas for resolving conflict relating to water service quality, these are often not responsive. Seventh, capability to deliver is affected by whether there is minimal recognition by government. This does not apply to institutions for water supply

which are invariably created on the basis of government rules and regulations. Eighth, enduring regimes are possible when small scale organizations are nested in ever larger organizations. Thus, given the complexity of managing water supply systems, and that all decision makers are not local, several principles of Ostrom (2000) regarding resource management are not satisfied.

Ruttan (2006) analyzes the factors underlying innovations in institutions. He argues that institutional changes are induced by changes in resource endowment, cultural endowment and technical change. Quite like technology, institutions must also change for development to occur and the gains likely from disequilibrium due to changes in resource endowment, cultural endowment and technical changes are powerful inducements for institutional innovation. Ruttan (2006) employs the term cultural endowment to mean informal institutional structures. He believes that institutional changes could occur by both organic means, implying changes that are not the result of a purposefully directed human will, as well as by constructive means, with a clear purpose behind the change.

Ruttan (2006) analyzes demand side and supply side of institutional change and argues that demand side changes are possible through new forms of property rights, more efficient market institutions or evolution of contracting by individuals at the community level. On the supply side, institutional innovation occurs only if marginal cost of political mobilization is exceeded by returns from innovation accruing to the political entrepreneur. Thus, the private returns to the political innovator have to coincide or exceed the social return, to support institutional innovation. The failure of developing

countries to capitalize from technical change is due, in part, to the divergence of social returns and private returns to the political entrepreneur. Cultural endowments also affect the supply side of institutional innovation.

In the case of water supply systems, resource endowment and technology change slowly and product demand is fairly inelastic and consistent. As a result, inducements for institutional change are few, and existing institutional arrangements are hard to change. However, product demand could change if service quality expectations turn high on account of increased customer income or greater information among customers about potential for improving quality.

Ziegler (1994) has suggested a methodology for analyzing institutions. He states that institutions involve a warranting system or general theory for justifying its existence to members. Also, members are expected to observe specific, measureable behaviors. Institutions can be analyzed and transformed by asking, broadly, the following three questions;

(i) what is going on,

(ii) what should be going on, given the current theory justifying institutional existence and,

(iii) what can be tried out, or experimented with, to bring the institutional outcome functionally closer to theory.

Ziegler (1994) observes that institutional changes encounters conflict between the instrumental criterion and ceremonial criterion. While instrumental criterion is associated

with efficient functionality, ceremonial is related to existing way of doing business. The former is associated with skills, experience, innovativeness, demonstrated competence and ability to synthesize while the latter is concerned with seniority, stability, age, race, sex, religion, nationality, genealogy, wealth, etc.

As the two criteria – instrumental and ceremonial – compete, the ability of the institution to adjust depends on technological feasibility, common comprehension and minimum dislocation. At any given time, society has a stock of technological knowledge which it cannot "un-know"(Ziegler, 1994). Therefore, any adjustments should be functionally related to the past knowledge (Greif, 2006). Second, even if technologically feasible, the change is not possible if it is not culturally feasible (Ruttan, 2006).

Existing institutions prescribe or proscribe certain behavior for its members. If any changes are to be made for reasons of functional efficiency, there is a need to change expectations, which implies a learning process. Individual must appreciate why they must change their habit patterns. Finally, human society is constantly undergoing changes which create dislocation. The rate, depth and extent of change determine the level of dislocation.

Ziegler (1994) suggests seven questions for institutional analysis and transformation. These are;

1. Does the institutional system comprise a genuine social problem?
2. What ceremonial items in the situation require readjustments?

3. What scientific-technological know-how is currently available with which to resolve the situation in conflict?
4. Of the alternative solutions revealed through the course of inquiry, which one appears most likely to affect an eventual resolution of the problem?
5. What portion of the full know-how necessary for the solution is already (or, shortly can be) brought into broad public understanding?
6. What are the predictable effects of the effort to resolve the problem at hand upon other correlated patterns of behavior within the same organization?
7. What are the predictable effects of the effort to resolve the institutional conflict upon the wider community of institutions?

In an article primarily addressed to engineers, Grigg (2005) develops a model for institutional analysis and transformation. The framework is applied to the context of drinking water quality, resulting in identification of main managerial and technical issues and gaps in institutional arrangement. Grigg's (2005) model for water utility is derived from Ziegler's (1994) model for institutional analysis.

The underlying rationale of Grigg's (2005) research is that engineers do not have adequate understanding of institutional issues, adversely impacting their management capacity. His purpose is to help engineers realize that many problems of water utility could be rooted in institutional issues and may lack engineering solutions. Hence, he argues, the need for engineers to evaluate institutional gaps. He defines institutions as laws, rules and societal norms which together constitute the rules of the game. The

analytical framework for determining institutional gaps has three parts. First, he emphasizes conceptualizing the current working model of management and control systems. Next, he emphasizes identification of key processes that needs adjustment. Lastly, he emphasizes identification of institutional practices that would lead to improvement.

More specifically, information on the following are sought to better understand the problems and explore context specific solutions;

1. What are the laws and rules? (laws, regulations, enforcement mechanisms)
2. Who has control? (designated authorities, stakeholders – mainly organizations).
3. What are the incentives? (ownership, property rights and incentives)
4. Who has what role? (roles, responsibilities and relationships).
5. What is the management culture? (management practices such as training, customs, ways of doing business, informal institutions).

In explaining institutional change, Greif (2006) believes that history matters and utilizes the concept of "fundamental asymmetry" to explain how past institutions shape future ones. A new situation arises when an institution which governed a transaction is no longer self-enforcing. The need for a new institution arises. But there is a fundamental asymmetry between institutional elements carried over from the past and technologically feasible alternatives.

Past institutional elements are default in new situation. The institutional elements are not only the attributes of the institution but also the attributes of individuals, residing in their memory and constituting their cognitive models. They are the micro-foundation of human behavior (Greif, 2006, p. 188). When faced with new situation, individual seek a cognitive framework, normative guidance and way to coordinate their behavior by anticipating the response of others. In doing so, they depend on institutional elements inherited from the past, even those that belong to institution which is not self-enforcing. Fundamental asymmetry implies that past institutional elements are the initial condition from which develops new institutions that are self-enforcing. These new institutions are established by a process Greif (2006) calls institutional refinement which implies marginally altering institutional elements inherited from the past. A radical departure from the past is uncommon and occurs only in crisis.

2.2.4 Regulation and its mechanisms:

Regulation occurs to control market power, facilitate competition or stabilize market. However, the practical reason why it comes into play is because government believes that private utility operators, left on its own, would act contrary to government's objectives. In early and mid twentieth century, governments formed state owned monopolies for providing utility services. However, the services were found to be inefficient in operations and ineffective in providing services to all (Jamison, Berg, et al, 2004). Micro-management by government departments resulted in overstaffing. Political opportunism

resulted in low prices, insufficient to cover cost. Fiscal constrains resulted in low investments, with infrastructure rapidly deteriorating.

In 1980s and 1990s there was a growing opinion among policy analysts that private participation in utility operations could benefit the society by reducing political opportunism and increasing efficiency through competition. Profit motive was a clear and consistent incentive for controlling costs and providing services which customer's value (Jamison, Berg, et al., 2004; The World Bank, 2006).

Regulation is also about improving sector performance but this is more likely in the case of private utility than public. In case of public utilities, interference from the government is higher, resulting in lower operating efficiency. If commitments are made by government that it would not interfere in utility operations, they are more credible when utility is privately operated than when publicly operated. Incentive regulation is also difficult to apply in case of public utilities because of principal agent problem. The government is a principal of the utility operator and agent of the citizens. In case of private utility, profit incentives can override principal agent problem. Ownership is also an important distinction because it has impact on several aspects of utility operations. Pricing is more efficient and competition a greater possibility in case of privately owned utilities.

The mechanism by which regulation is managed can be thought of as having two layers. At upper level of regulatory mechanism is "regulatory governance" which is concerned

with formal organizational structure for regulatory decisions and conflict resolution. It can be flexible or rigid and there is an implicit trade-off between the two – flexible regulatory governance allows for adaptation to changes in technology and environment, but a rigid one signals higher level of government commitment. The choice, quite obviously, should be guided by the context of the country.

The second level of regulatory mechanism is "regulatory incentives" which are concerned with rules governing utility pricing, subsidies, entry, inter-connections, etc. Regulatory incentives perform well when regulatory governance is successfully in place. Incentives are provided through a system of rules and organization that induce a particular behavior. The choice of rules and organization depends on the cultural context of the country and there are no best practices fully transferable to another cultural context.

Regulatory governance corresponds to Level 3 of Williamson's (2000) characterization of institutions while regulatory incentive corresponds to Level 4 (ref Fig 2.1)

Ehrhardt, et al (2007, p.9) define economic regulation for water utilities as "….the rules and organizations that set, change, monitor, and enforce allowed tariffs and allowed service standards for water providers". They hold that economic regulation mimics the pressure that ordinarily markets create through competition. They further argue that regulatory mechanisms are embedded in institutional environment, its characteristics determined by institutional determinants.

The different types of legal instruments for regulatory governance are contracts, licenses and statutes. The different types of organizations for regulation are Ministry, Contract Monitoring Unit and Regulatory Office. Ehrhardt, et al., (2007) hold that legal instruments and organizations type are independent variables while quality of regulation is a dependent variable. The choice is based on administrative and legal traditions of a country or region. If the selection is correct, the regulation is of high quality resulting in (i) coherence, (ii) predictability and credibility and (iii) accountability, legitimacy and transparency. These attributes are discussed later in details.

Minogue and Carino (2006) state that the understanding of regulatory governance has undergone change over time. In traditional literature the focus was on the role of legal institutions and practices, with regulation primarily being rule-based and concerned with compliance and accountability. But recent analysts prefer to take an inter-disciplinary view of regulatory governance. Minogue and Carino (2006) further state that regulatory reforms is emerging in developing countries alongside privatization, quite unlike the case of developed countries where it emerged post- privatization. The slow or incomplete progress of privatization in developing countries has resulted in regulatory reforms lacking sequencing and coordination. Powerful aid donors such as the World Bank have regarded poor governance as one of the critical problem of economic reforms. Hence regulatory governance, which provides the context in which policies succeed or fail, has acquired importance.

Regulators have oversight over regulatory functions and the degree of independence they should have vis a vis government is much debated, particularly on the issue of regulatory capture. Independent regulators are often prescribed for developing countries but its merit is contested. Many scholars argue that transplanting regulatory systems from the developed country to the developing is not an effective policy (Minogue, 2006). The modeling of regulation, as developed through the understanding of historical process in the developed countries, can prove inadequate to the needs of developing countries, given completely different context. A matter of concern is that many international convergence of regulation is occurring through a process driven by developed countries in which the developing countries are not represented. The efforts by many aid organizations at transplanting an idealized regulatory system, supposedly independent, may not work in developing nations where economic governance cannot be insulated from critical political considerations.

2.2.5 Empirical evidence of regulations and market efficiency:

Not many empirical research measuring impact of institutions and regulations on water markets are available. A recent one deals with water market in California. Brewer, Fleishman, Glenon, Ker & Libecap (2008) have analyzed through the perspectives of New Institutional Economics water trading in California from 1987 to 2005 and how definition of water rights and regulation of water transfers has affected market activities such as volume of water traded, the nature of contracts (short or long term lease or sales), etc. The NIE perspective differs from the neo classical in that perfect information is not

assumed nor transaction cost of exchange considered as zero. Institutions such as contracts, laws, constitutions and even unwritten norms and codes of behavior can be devised to reduce information uncertainty and transaction cost.

Brewer, Fleishman et al., (2008) prepared a list of legal factors that strengthen property rights and lower transaction cost of trading as also list of factors that weaken property rights and increase transaction cost. In all, there are 21 variables or factors - 14 that strengthen property rights and 7 that weaken. Their analysis systematically explores legal, administrative and judicial pronouncements in California between 1987 and 2005 which are associated with change in any of these factors. Using this data, the authors have conducted econometric analysis with number of water transfers as the dependent variable and regulations as one of the independent variables. The finding is that, apart from population and precipitation of the preceding year, the regulations in the years 1989, 1991 and 2000 had statistically significant impact on water transfers. The analysis is repeated with volume of water transfer as the dependent variable. The regulations in 1989 and judicial rulings of 2003 were found to be statistically significant.

Saleth and Dinar (2008) have undertaken institutional analysis of the water sector using an innovative approach. Unlike most studies on institutions which are based on a monolithic relationship between institutions and performance, Saleth and Dinar (2008) unbundle institutions into their elements, developing models based on linkages, which are constituted by structural and functional relations among the elements. The model is tested for performance using perception based inputs from 127 water experts (economists,

engineers and lawyers) in 43 countries. An econometric test is conducted using OLS and 3-SLS method on data sets for 21 institutional variables (derived from law, policy and organization) and 5 performance variables. Out of 21 institutional variables, 5 are dependent variables (highlighted in bold in Table 2.4 below) but also enter as independent in other equations. The performance variables are all dependent variables.

The explanatory power is higher for the equations showing linkages between institutional elements in comparison to equation treating institution as a monolithic whole. The analysis shows that water institutions have significant impact on water sector performance. Laws and organizations have more impact than policy. Three elements that have most significant effect on sector performance are cost recovery commitment, fiscal health and information status. Other institutional elements that have direct or indirect impact on water sector performance are effective conflict resolution mechanism, clear water rights, user participation, functional specialization, independent pricing body and technology application in management.

Table 2.4: Institutional Elements and Performance variables

Legal Variable	**Policy Variable**	**Administrative or Organizational variable**	**Performance variables**
Treatment of surface and subsurface water	Project Selection criteria	Organizational basis of water administration	Overall effectiveness of water law
Format of surface water rights	**Level of cost recovery**	Balance in functional specialization	Overall effectiveness of water policy
Effectiveness of conflict resolution provisions	**Effectiveness of water transfer policy**	Existence of independent water pricing body	Overall effectiveness of water administration

Effectiveness of accountability provision	Impact of private sector participation policy	**Seriousness of budget constraint**	Overall Water Institution performance
Degree of integration within water law	Impact of user participation policy	Effectiveness of administrative accountability	Overall Water Sector performance
Tendency of centralization in water law	Impact of other policies on water policy	Adequacy of information	
Scope of privatization in water law	Overall linkage between law and policy	Extent of Science and technology application	

The advantage of institutional analysis by Saleth and Dinar (2008) is in designing institutional reforms program because it identifies the channels of impact transmission and underlying chains of variables. It can also be useful in prioritizing, sequencing and packaging institutional elements in reforms program. It can spot weak and strong links in the impact transmission process and help in exploiting the path dependency properties of institutions.

There are, however, limitations too. The model is based on a particular conceptualization of inter-relationship between elements. The theoretical basis of this inter-relationship is not clear. Second, the analysis is based on perceptions of water sector experts alone. But institutions must take into account the larger convergence of concepts. Eventually, the concepts of water sector experts will interact in the real world with concepts of politicians and policy makers. In the absence of politicians and policy makers from the survey, the analysis is incomplete, statistically summarizing the perceptions of water experts.

2.2.6 Functions of regulatory mechanisms:

The purpose of regulation is to subject the operator to competitive pressure, gather information about the operator and the market and apply incentive regulation (Jamison, Berg, et al, 2004). Competition is useful because it induces the operator to meet customer demand for service at the lowest costs. In other words, the operator interest is aligned with customer interest through competition. Information asymmetry is removed, and greater the competitive pressure more is operator forced to reveal his true cost. Competition could be "in the market" or "for the market". Competition in the market is achieved by removing legal and technical barriers to entry, monitoring and restructuring the sector to segregate the competitive part of business from the non-competitive. Structural separation is also called unbundling. Competition for the market is achieved by auctioning off the right to be a monopoly to private operator. The goal of the auction is to provide potential operators the incentive to reveal their private information with regard to their ability to serve customers the best. Transparency of procedures and contract design are important aspects of competition for the market.

Another purpose of regulation is to gather information from the operator with a view to reduce information asymmetry and base regulatory decisions on facts. In this context, regulator ask private operator to supply financial information such as balance sheet, income statement, cash flows and operating statistics. In pure price cap regulations, information about cost is not essential, as pricing is independent of cost. However, the regulator tries to reduce information asymmetry as much as possible. But reducing

information asymmetry is not entirely based on gathering information. Incentives are provided by regulation for inducing operator to reveal information.

Incentive regulation is, therefore, also one of the means of controlling market power and reducing the impact of information asymmetry. Such regulation can be used in several context and one common use is with respect to prices. It can take four different forms: rate of return regulation, price cap regulation, revenue cap regulation and benchmarking (or, yardstick) regulation. A common reason why regulator looks into cost and price structure of utilities is because of claims by operator that it is receiving returns lower than the cost of capital or because of complains by the consumers that they are paying price which is far in excess of cost of capital. The objective of regulator in rate of return regulation is to align price to cost of capital. Usually, the regulator provides incentive by way of regulatory lag, allowing the operator to keep excess above cost of capital until the next price revision. The risk for the regulator is mis-estimation of cost of capital, resulting in wrong pricing. Also, assured rate of return can result in operator over-investing in infrastructure, which is called Averch-Johnson effect or gold plating, and is a common criticism of rate of return regulation (Jamison, Berg, et al, 2004).

In price cap regulation, operator is allowed to change price level in accordance with an index which comprises of inflation measure, RPI or I, and a productivity offset, called X-factor. By definition, input prices for the average firm in the economy change at the rate of inflation and its productivity also changes at the average rate for the economy resulting in retail price changing as per RPI or I and firm continuing to earn returns equal to its

cost of capital. Over time efficiency of the operation is expected to improve because of technical changes or managerial efficiency. The price cap regulation is commonly represented as RPI-X in which retail price index is RPI, (alternatively, general rate of inflation for the economy, I, is used in place of RPI) while X-factor captures the predicted difference between the operator and the average firm in the economy with respect to inflation in input prices and changes in productivity. The price cap at the time of revision will become RPI-X. A firm can improve efficiency with X1>X, resulting in profits over and above the cost of capital until next date of price cap revision (Jamison, Berg, et al, 2004).

Revenue cap regulation is conceptually similar to price cap excepting that the cap is applied to the revenue. It is more appropriate when cost does not vary much with unit of sales

In benchmark competition, the performance of an operator is compared to its competitors. The efficient operators are rewarded for their performance with extra profits while the inefficient ones are penalized. Data Envelopment Analysis and regression analysis are two common tools used for benchmarking. In recent years, virtual company approach has also been tried by some countries in which analysts construct a simulation model of the operator and estimate cost level of efficient operator, but this approach is limited by strategic behavior of the analyst. In any benchmarking exercise, the differences between operators outside their control, such as variations of geography, demographics, macro-economic conditions and history, should be taken into account.

Tariff design is an important regulatory function in which both the government and operators have great interest. But their objectives differ. Operator is interested in maximizing profits while government is interested in maximizing welfare and providing affordable service to the poor. Both government and the operator have interest in maintaining stable political environment. In a perfectly competitive environment, pricing can be done at marginal cost for both the government and the operator to achieve their objectives. But when operator has market power, the profit maximizing prices will exceed the marginal cost. The government will want to fix price at marginal cost but operator may not find that attractive because of scale economies and fixed costs. If operator does not want decline in the purchase quantity, Ramsey pricing or inverse elasticity pricing is suitable mechanism. It raises individual price above marginal cost in accordance to each service's price elasticity of demand. Mark ups above marginal cost are lower for services with more elastic demand, and conversely mark ups are greater for services with more inelastic demand. Ramsey pricing can maximize welfare and is, therefore, acceptable to government too. However, it is considered unfair by some, being a form of price discrimination.

Another form of pricing is multi-part pricing in which operators charge different prices for different element of services. As for example, in two part tariff for electricity the customers pay a monthly fee for access and a usage fee for consumption. In water, non linear pricing is more common which vary depending on the amount consumed by the

customer. Peak load pricing is useful if marginal cost vary depending on when the service is used. This is not feasible option in case of water supply.

An important concern for the government in regard to tariff design is prices facing the poor. The issues of concern are access and affordability. High connection fee can preclude poor from service connectivity. This problem can be overcome by creating option to pay over time. Secondly, the pricing for the low income category customers may be too high for them to afford services. Subsidies is one of the means by which government can resolve this problem but past experience has shown subsidy often benefits the middle class. New subsidy designs, such as Output Based Aid (OBA), attempts to better target subsidies. In OBA, the operator is provided targets for connecting poor households and subsidies against the targets paid to the operator after confirming that connections are completed. The subsidies are, therefore, based on output with respect to the target set (The World Bank, 2006).

In many water utilities of developing countries, the regulations on tariff, service standards and equity are often weakly enforced or completely neglected. The regulatory agency is an integral part of government, located within a government department, rendering it vulnerable to political opportunism. Being proximate to government - in particular, proximity to the department which manages water utilities – also results in conflict of interest and lack of incentives for efficient functioning. Regulatory designs for water utility reforms should aim to overcome these limitations (Rouse, 2007).

Therefore, an important objective of regulatory reforms in developing countries is to control opportunistic behavior of the government. The economic characteristics of water services make it vulnerable to quasi-rent exploitation, which manifests as low tariff levels. Hence, primary economic concern of efficient regulation is tariff rationalization, balancing economic and non-economic factors that influence water services quality. Savedoff and Spiller (1999) believe that government opportunism is responsible for 'low-level equilibrium' of water supply services in developing countries. A 'low-level equilibrium' is characterized by low pricing of water and deteriorating utility infrastructure, with progressively declining service standards. The low levels of service standard results in public dissatisfaction and distrust, manifesting as lack of public support for subsequent reform initiatives. This 'low level equilibrium', thus, turns into a vicious cycle.

There are three characteristics which makes water supply services different from other utilities, enabling government to behave opportunistically. The sunk cost is very large, utilities have economies of density and scale and their service is massively consumed. The operating cost to total cost for water supply services is very low. In US, the ratio is only 10% for an efficient water supply firm as against 32% for gas utilities and 57% for electric utilities. The technology is suitable for economies of density and scale. Massive consumption creates opportunity for politicians to behave strategically, utilizing price as an issue for political mobilization. Even a small, vocal group of consumers, with explicit or tacit political support, can obstruct reforms (Jamison, Berg, et al, 2004).

Politically, it may be advantageous to expropriate sunk cost if direct costs are small, direct benefits are high and indirect costs are small. The direct costs are small if technology is not changing too frequently, only a few companies are in the business and the investment needs are limited. All these are true in the case of water utilities. Direct benefits are high if elections are periodic and highly contested. Democratic countries with diverse constituencies are more likely to face this problem. Indirect institutional costs are small when regulatory policy is highly centralized and the judicial system is weak.

'Low level equilibrium' has had social costs in developing countries which include (i) health impact to the society, (ii) loss of competitiveness of the private firms in the region because they are forced to develop captive water supply systems, adding to total production costs and (iii) failure to supply water to those with willingness-to-pay. Although efforts were made by many developing countries to escape 'low-level equilibrium', most were not successful. Price increase for water services was ineffective as the increase were usually modest, quickly eroded by inflation. Performance contracts, in which pubic utility entered into agreement with government to deliver certain basic level of services, did not work because the discretionary powers of the government remained unchanged and the information asymmetry were not removed. The utility managers expropriated profits through redistribution of cash to office expenses and to employment rather than investing for sustainable efficiency (Savedoff and Spiller, 1999).

Efficient institutions are designed to provide good incentive to economic agents. In neo-classical economics, the individuals or firms were conceived as rational entities, each

aiming to maximize profits, and because of perfectly competitive environment the need for incentive did not arise. However, incentives assume importance when delegation of a task to an agent with private information is taken into consideration. The objective of the agent may not fully cohere with that of the principal and the agent has the advantage of private information. While the agent can observe his cost, the principal cannot, and, therefore, the principal cannot offer a contract that induces the agent to behave as he would have in a perfectly competitive market. Private information with the agent can be of two types; (i) adverse selection or hidden knowledge, in which the agent has private information about his cost and valuation but the same is not known to the principal, (ii) moral hazard or hidden action, in which the action of the agent is unobserved by the principal. Further, information problem can also arise because of non-verifiability, in which the principal and agent share the same information ex-post but no third party, particularly no court of law, can observe the same information (Laffont and Martimort, 2002).

The implication of incentive theory is that the principal has to pay information rent to agent because of information asymmetry, and design contract such as to attract the best agent. Unfortunately, first best allocative efficiency is not attainable, but the second best is. In case of water utilities, therefore, private participation is likely to result in payment of high information rent, as information asymmetry in water supply systems are high because of buried assets and long life term of assets. This, in itself, is not an issue to worry though, if private sector involvement results in operational efficiency; the payment of information rent may me well worth it, as long as the net social benefits are high. The

challenge is to design contracts which attracts the best agent, results in improvement of operations, reduces information rent and leads to net social benefits.

Regulatory incentives are important for efficient management of water supply utilities. The incentive levels are low when water supply systems are managed by public operators (Savedoff and Spiller, 1999). The outcomes are low coverage, limited investments in infrastructure and poor quality of service. Public operators depend on government budgets and most often their investment needs are not evaluated against profitable social returns but against competing uses of funds for various purposes in the national/sub-national budget. The public operators, therefore, do not receive adequate budgetary support to expand, rehabilitate or improve services. Cash poor public sector utilities are subjected to closer scrutiny by the government, like any other government agency which is financed from the budget, risking loss of independence regarding personnel management, input allocation and expansion plans. On the other hand, cash rich public utilities tend to hide cash. As public utility managers do not reap any direct benefits from government asset ownership, they are likely to dissipate returns through excessive employment and other forms of wasteful resource utilization (Savedoff and Spiller, 1999). The authors believe that private sector participation is the right way forward in managing water utilities. “Government ownership…….represents neither the best way to promote public interest nor the most efficient method to provide services, but simply the failure to develop institutions that limit temptation for opportunistic behavior”(Savedoff and Spiller, 1999, p. 13).

In recent years, international organizations such as the World Bank have been promoting price cap regulations in developing countries arguing that it promotes efficiency. However, experiences in the developed countries such as the US and UK where the method has been used for sometime show that it has flaws and requires considerable regulatory skills to understand and implement. Kirkpatrick, Parker and Zhang (2004) argue that price cap is being over promoted in developing countries, and is not the best regulatory mechanism for price setting of utilities in developing country context. They conducted a survey covering 36 developing countries with inputs from 60 respondents (senior staff members of regulatory agencies or government ministry). About 44% said that they did not understand fully the difference between price cap and rate of return regulation. Kirkpatrick, Parker and Zhang (2004, p. 10) comment that lack of "training seems to be at the heart of problem".

In the survey, information asymmetry was reported to be the most serious problem in both price cap and rate of return regulation. In the former, however, more respondents reported information asymmetry as a serious problem. So, while information asymmetry is a problem in both cases, it appears to be more pronounced in case of price cap regulations. The survey also found that price cap was more associated with under-investments, resulting in customer complaints about quality of service.

The authors argue that rate of return is more appropriate for developing countries compared to price cap regulation because it is easier for common people to comprehend, is a continuation of the practice that government followed prior to public private

partnerships or privatization and guarantees a steady stream of revenue. Also, price cap regulation is difficult to implement because the efficiency factor, X, has to be computed on the basis of a benchmark and it is difficult to have one in the case of developing countries. Moreover, the regulatory skills required from experts in managing price cap regulation is complex and of high order, which is difficult to find in many developing countries. This argument appears genuine but governments or regulators can resolve it by hiring international experts in regulatory bodies. The authors, in fact, found that in case of water utilities price cap and rate of return regulations were being followed by equal number of respondents. The real problem appears to be information asymmetry than the method of regulation itself. In the case of water supply systems, the information asymmetry could be higher because of buried assets and longer life-span of infrastructure components.

The institutional view of Spiller and Tommasi (2008) emphasizes the impact of political opportunism, and differs from incentive theory of regulation on two important aspects. Firstly, they argue that institutional environment controls the type of regulatory institutions possible in a country and, therefore, the feasible set of incentive regulations. They argue that regulation should not be considered a "black box", requiring no investigation. Instead, the factors that impact the nature of regulatory institutions should be explicated. Secondly, while incentive theory considers government to be benevolent, willing to design regulations that provide appropriate incentives to the private sector investors, the approach of Spiller and Tommasi (2008) assumes government to be opportunistic.

Public utilities provide strong incentives to politicians to act opportunistically. One of the challenges for regulator is to limit government opportunism in case of PPP. Politicians can act opportunistically even after private operators are placed in charge of utility management. Once private investments in infrastructure up-gradation are completed, politicians can potentially expropriate quasi-rents through their opportunistic behavior for short-term private gains. As the investments in utilities are sunk costs, the investor is likely to continue operations even after such expropriation as long as operation revenue exceeds operation costs. The politicians are induced to behave opportunistically because they realize expropriation of quasi rent will not shut down utility as long as operational revenue exceeds operational costs. The direct cost to the politician from such opportunism is reputational loss and lack of future investments in the utilities. The indirect cost is disregard for judicial and administrative processes. If short-term gain is perceived greater than the sum of direct and indirect long-term costs, the politician has incentives to behave opportunistically (Spiller and Tommasi, 2008).

Minogue and Carino (2006) express concern that with State concentrating more on market forces and efficiency through regulatory mechanism, the traditional role of public sector to protect the interest of the poor may also be left to the market. Such a situation, they argue, may result in denial of "substantive freedom" advocated by Sen (2000) which is the ability of the people to live the life they choose. While new technology should enable government or the private sector to provide the poor with better capabilities, this may not occur because of traditional socio-economic and cultural barriers unless

regulatory bodies are tasked specifically to address such concerns; else, the market may simply forget the poor.

2.2.7 Regulatory attributes and design issues:

Ehrhard, et al., (2007) state that good regulatory mechanisms possess five attributes: Coherence, Predictability, Credibility, Legitimacy and Accountability. Coherence is defined as the ability of a regulatory system to select the right combination of tariffs and service standards, such that providers can recover costs and people receive the services they are willing to pay for. Predictability results from regulatory decisions that are time consistent and made on clear precedents and rules. Credibility is the existence of credible protection against political opportunism which could prevent recovery of cost. It also implies ability to protect from market power of private operator. Legitimacy is the existence of decisions that are clear, widely accepted and publicly accessed. Accountability to the public and transparency in decision making are also important attributes

Regulatory design should be country specific and there is no singular model that could be universally applied (Ehrhardt, et al., 2007; Savedoff and Spiller, 1999). Ehrhardt et al., (2007) analyze regulation of water utilities in several developing countries and offer design approaches that can help improve regulatory performance. These are;

1. working within existing organization framework.
2. taking account of politics in design features

3. limiting discretion of regulator in decision making
4. preferring simplicity to sophistication.

Unfortunately, limiting discretion and preferring simplicity are often tradeoffs; an increase in one will result in decrease of the other. Limiting discretion often requires lengthy rules, trying to specify actions in detail against future eventualities. But increase in rules result in sophistication. The balance between the two will depend on the context of the country and will be a subjective determination. Ehrhardt et al., (2007) suggest that in developing countries with limited institutional capacity, regulator should initially have low discretion. This implies setting up detailed rules and procedures which the regulator will follow in setting up prices or service standards.

Another issue to consider is that discretion is not necessarily bad if quality of manpower in the regulatory agency is good. For example, in case of developed countries such as England where Water Services Regulation Authority (OFWAT) is the utility regulator, discretion is fairly high. OFWAT can determine tariff without consulting the government. But regulation is not adversely impacted because the organization is manned by credible experts. Level of discretion, therefore, is again context specific, with higher levels feasible when regulatory agency have adequate sector expertise.

Whether a legal instrument is appropriate for a given context depends on two conditions. If legal instrument limits discretion of the regulator, it is appropriate (Ehrhardt, et al, 2007). Such a choice positively impacts predictability and transparency. Secondly, if the

legal instrument is simple to comprehend, it is appropriate. Such a choice positively impacts predictability, credibility and transparency. Furthermore, whether the organization is an appropriate choice for reinforcing behavioral changes in a given context also depends on two conditions. If new organizational structure is rooted in existing organizational structure, the choice is appropriate (Ehrhardt, et al., 2007). Such a choice positively impacts credibility and legitimacy. If new organizational structure provides for politics to play out in a formal manner, the choice is appropriate (Ehrhardt, et al., 2007). Such a choice positively impacts predictability and accountability.

Table 2.5: Design parameters and attributes they promote

Design Parameters / Attributes	Governance embedded in existing structure	Space for formal role of politics	Low level of Discretion	Simple rules and Processes	Balance between service quality and tariff
Coherence					√
Predictability		√	√	√	
Credibility	√			√	
Legitimacy	√			√	
Transparency			√		
Accountability		√			

Minogue and Carino (2006) suggest the following as important for efficient regulatory governance; (i) regulators should have both technical capacity and independence (ii) the independence should imply relative insulation from both government and the private pressures (iii) the importance of regulator in the country is revealed by its hierarchical position and its functions.

Savedoff and Spiller (1999) argue that regulatory design have to consider the tradeoff between flexibility and credibility. A flexible design has the advantage of adapting to

changes as new information arrives or new technology is developed. It implies higher level of discretion. On the other hand, credible designs demand rigidity and predictability. A credible regulatory framework implies stipulation by government or regulator of policies and procedures for price setting, conflict resolution, consumer rights protection, quality standard enforcement and investment returns. A good design embodies a mix of flexibility and credibility, their relative weight dependent on other institutional features of the country such as Parliament, courts and independence of regulatory agency.

Credibility of regulatory framework is important for attracting and sustaining private sector interest in water utility (Savedoff and Spiller, 1999). Lacking credibility, private operators will spend as little as possible in system maintenance, leading to high water loss. The private operators are also likely to demand high, up front prices for investments, which will render reforms politically difficult to manage. The operator may transfer the cost of investment to the customers through high connection fees, again a politically difficult issue.

Minogue and Carino (2006) emphasize interaction between impersonal legal / administrative systems and the political processes. Comparing normal policy formulation processes in which politics is an integral part with regulatory governance processes, they are concerned that excessive delegation to regulatory agencies will weaken accountability. They strongly advocate accommodating political processes in regulatory governance processes for realizing predictable and accountable policy outcomes. The purpose of the regulation, the authors argue, should not be confined to correcting market

failure but should also extend to social issues such as management of risk in society and achievement of social justice.

As discussed before, Savedoff and Spiller (1999) argue that governments in developing countries act opportunistically in respect of water utility management, resulting in 'low level equilibrium'. The manner in which political process could be balanced, preventing opportunism while enhancing predictability and accountability, is best understood from the works of Spiller and Tommasi (2008). They analyze institutional determinants having impact on regulatory governance. They state that the challenge for government is to design regulatory governance mechanisms in such a way as to limit its own ability to behave opportunistically.

Thus, an important purpose of regulatory institutions is to limit future political behavior. As all contracts are inherently incomplete, there is cost ramification to imposing such limits. In the absence of political inputs, policy cannot be adjusted to political and economic shocks. Adjustments to shocks are desirable if political cooperation is easily forthcoming. If cooperation is easily achievable, regulatory policies should be adaptive, improving with experience over time, and it may not matter if there aren't too many safeguards. On the other hand, inflexible policies are more predictable, encouraging investors to undertake long-term investments. Also, when institutional environment does not inspire confidence about political cooperation, and cost of safeguards is low, the regulatory policies should be rigidly implemented. However, an issue of concern is that if cost of safeguard is high and political cooperation unlikely, the

regulatory policy will respond with shock and the system will become unstable. It is essential to identify critical regulatory policy issue that could cause shocks if not well designed at the outset. At the start of utility reforms, the shocks on account of regulatory policies on equity issue are more likely to occur than technological shocks (Spiller and Tommasi, 2008).

Spiller and Tommasi (2008) found that the determinants of political cooperation are;

(i) number of key political actors – political cooperation more likely if the number of political actors are small.

(ii) inter-temporal linkage of political actors – political cooperation more likely if inter-temporal linkage of political actors are strong, i.e., all decision makers are not out of office together.

(iii) transparency of policy and political actions – political cooperation is more likely if transparency is high.

(iv) enforcement technologies - political cooperation is more likely if bureaucracy is efficient and courts are independent.

(v) arena for political exchanges – political cooperation is more likely if there are political arenas, such as committees and other formal political organizations, where give and take exchanges are legitimately possible.

(vi) comparative attractiveness of long term pay-off from cooperation with respect to short run payoff from non cooperation.

Political cooperation leading to stable and flexible regulatory policy is more likely if number of political actors are small, inter-temporal linkage of political actors are strong, transparency of actions is high, enforcement mechanism such as competent bureaucracy and independent courts are present, give-and-take exchanges are possible through an existing democratic forum and short run payoff from non-cooperation is not too high.

While institutional determinant of regulatory governance serve as the backdrop against which regulatory functions occur, Savedoff and Spiller (1999) suggest regulatory constrains that can help utilities escape from 'low level equilibrium'. The key is to develop processes that limits government discretion is price setting. The process will work if the operators have financial and managerial autonomy, the restraints on government discretion are embedded in a regulatory framework, the polity cannot change the framework frequently and enforcement of restraints is plausible.

Savedoff and Spiller (1999) state that regulatory commitment is achievable by three methods;

1. Legislation
2. "hard wiring" or detailed decision making process
3. license terms (contracts)

The credibility of commitment inspired by each depends on whether the political system is decentralized or centralized. In case of fragmented and decentralized decision making structure such as that of the US, 'hard wiring' works well. Legislation is difficult as the

interest of many political entities, at different levels of decision making, is hard to converge. License terms have also worked in the US, because of a robust judicial systems and accountable public service (Savedoff and Spiller, 1999).

But in nations with highly centralized decision-making process, legislation and 'hard-wiring' may lack credibility as government can easily amend them. License terms, supported by independent courts, may be more credible.

Savedoff and Spiller (1999) argue that high level equilibrium is inherently unstable unless adequate institutional restraints against government opportunism have been established. One method is to increase the number of interest groups supporting high level equilibrium. This can be achieved by fragmentation – by sub-dividing the geographic service area or subdividing the sector (production, transmission and distribution). In fact, fragmentation of utilities can also be achieved by "selling shares to the public or directly distributing shares in public enterprises to citizens" (Savedoff and Spiller, 1999p. 25).

The advantages of fragmentation are development of multiple sources of political support, lower information asymmetry because of competition and enhanced difficulty to firms aiming to 'capture' the regulator. Exclusive franchises, on the other hand, limit competition and are prone to re-negotiations, tilting balance towards efficient negotiator than efficient operator (Savedoff and Spiller, 1999). In case licensing is chosen, the

number of decision makers for licensing should be limited and any modifications to the agreement should be vetted by the agency which was not part of the original decision.

2.3 Public Private Partnerships:

This section first briefly discusses the property rights theory and agency theory which are commonly cited to justify public private partnerships in public service delivery, such as water supply. Next PPP experience in water supply is discussed, comparing literature on performance of public utility with private. The conclusion drawn from the literature survey is that there is no definite superiority of one form of service delivery over another. Depending on the context, both public and private can perform well. Then, the section discusses problems relating to PPP, and the conditions which institutions should promote if these are to be remedied. Each of these conditions is discussed in some details, drawing information from literature about options, potential and limitations.

2.3.1 General Theory

Classical economics emphasizes the centrality of clearly defined property rights for well functioning markets. The concept of property rights has its origin in the doctrine of natural rights which recognize humans as self-interested, rational and individualistic. Hume has attributed three distinguishing characteristics to property rights (i) “the stability of possession” (ii) “the transference of property by consent” and (iii) “the performance of promises”(Furubotn et al, 1997, p. 70). Thus, property rights are assigned to individuals in the context of the classical liberal state following the principle of private

ownership, and "ownership rights are transferable in accordance with principle of freedom of contract" (Furubotn et al, 1997, p. 71). The third characteristics concerning performance of promises results in "relative property rights" when time elapses between a promise and its actual execution. Contractual obligations are, therefore, relative property rights.

Property rights are useful for understanding social dynamics and adopting economically efficient practices. Furubotn and Richer hold that "the prevailing structure of property rights in a society can be understood as the set of economic and social relations defining the position of each individual with respect to the utilization of resources" "(Furubotn et al, 1997, p. 72) . They also posit that allocation and use of resources patterns are predictable from the content of property rights and that the property-rights assignment has systematic relationship with economic choices.

The concept of property rights has broadened over time. Many scholars believe that property rights are also created from less obvious sources such as personal relationships, customer relationships, political associations, etc., which are recognized as legitimate properties from the perspective of economics as they advance individual welfare – the ultimate objective of economics. Writing about trust, loyalty and honesty Arrow says:

"*They are goods, they are commodities; they have real, practical, economic value; they increase the efficiency of the system, enable you to produce more goods or more of whatever value you hold in high esteem. But they are not commodities for which trade on the open market is technically possible or even meaningful* (Arrow, 1974, p. 23)."

Thus, from the perspective of economics, every right may be interpreted as property rights to the extent they enhance social welfare, but not all property rights be traded in the market (Furubotn et al, 1997, p. 78).

Security of property rights is important for market efficiency and creates the environment in which private sector is active. In organizing institutions and their functions, there is a choice for the community on the extent of role government should have compared to non-government institutions. Usually, both the government and the private have important role to play in society.

Public Private Partnerships (PPP) is defined as:

"any engagement between government and the private sector in which partially or traditionally public activities is performed by the private sector" (Savas, 2000).

Ouyahia (2006) defines PPP as "a contractual agreement between public sector agency and for-profit private sector firm to share resources and risks for delivering a public service or developing public infrastructure".

National Council for Public-Private Partnerships, USA, defines PPP as:

"*a contractual agreement between a public agency (federal, state or local) and a private sector entity. Through this agreement, the skills and assets of each sector (public and private) are shared in delivering a service or facility for the use of the general public. In*

addition to the sharing of resources, each party shares in the risks and rewards potential in the delivery of the service and/or facility[5] *".*

Savas (2000) argues that distinction between 'private' and 'public' is not very sharp. The term 'public' can mean government ownership, widespread ownerships (as in the case of equity of a private company) and open access (as in the case of public restaurant, which all can access). The implication is that government ownership is not essential for benefit to be spread widely among the people; private ownerships dispersed widely among people can as well serve the same purpose. However, this is not how PPP is commonly perceived.

Wettenhall (2003) expresses concern that public private partnership is poorly defined term which could result in potentially risky transactions by governments. First, he states that private involvement in dominantly public activity is not anything new. He argues that the term was result of political process in which those opposing the contracting out principles under New Public Management preferred Public Private Partnership as a moderate middle path. He cites the example of political ideology in UK where the conservative government started involving private sector in public activities through Public Finance Initiative in early 1990s. In late 1990s, when the labor returned to power, they chose to use the term Public Private Partnerships.

[5] http://www.ncppp.org/howpart/index.shtml#define accessed on 10 Jan 2009)

Wettenhall (2003) emphasizes the need to clearly classifying, using the experience of last many years, the different types of mixes and hybrids in PPPs, and their relative differences, as well as identifying conditions which make them safer instruments for economic and social development. He argues that better understanding of PPP can come by distinguishing five different roles involvement in the management of public affairs: producer, owner, provider, regulator and facilitator.

The arguments of Wettenhall (2003) deserve respect. The classification of PPP in water has been attempted based on degree of investments made and distribution of risks, etc., but complex arrangements are often found which do not adhere to current classifications, obfuscating risk-rewards distribution.

Although PPP is not privatization, the theory of privatization can help appreciate potential for PPP in various infrastructure sectors. Theory of Privatization argues that some types of business are more amenable to market based competition than others (Savas, 2000). The effectiveness of competition depends on how feasible it is to exclude others from using the good or services, and whether consumption is individual or joint. In other words, markets function well when property rights can be well defined. In general, the government should stay away from goods and services in which market based competition can occur. Although markets do not operate well in the case of collective goods or services that have monopolistic characteristics, government can regulate to make competition possible in many such cases. For example, toll goods are easier to

privatize with competitive pricing despite their monopolistic character. Piped water supply systems are also toll goods and, hence, privatization is a distinct possibility.

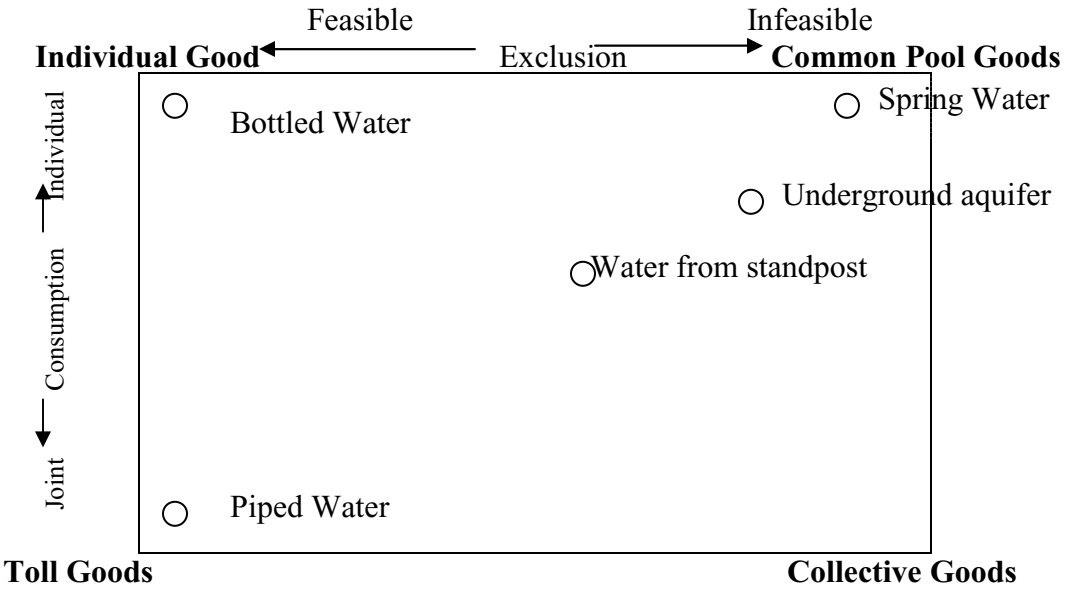


Fig 2.3: Characteristic of Drinking Water (adapted from Savas, 2000)

Fig 2.3 above indicate the characteristics of water as common pool resource and how technological innovation has enabled exclusion so that drinking water is reverted to goods that are individually consumed (as in the case of bottled water) or jointly consumed (as in the case of piped water). Market functions best when goods are fully excludable and can be individually consumed. But, market can also function well for toll goods, such as piped water supply, with appropriate regulations that support market mechanism.

Traditionally, roads, water supply, power and other infrastructure were financed, owned, maintained and operated by public agencies because of the importance of these sector and the belief that private sector did not have capital for such massive investments (Savas,

2000). The need for infrastructure has, however, steadily increased and public fund is no longer sufficient. Innovative public private partnerships are taking place in water supply, wastewater treatment plants, transportation facilities, electricity generation and distribution, etc., relying more on private than government to satisfy the needs of people. As these infrastructures have the characteristics of toll goods, it is possible for users to pay according to the usage. Other reasons why PPP are commonly adopted are the lack of expertise in government, lower operating cost and expectation of consumers of better service standards.

Savas (2000) mentions several ways in which PPP helps government address infrastructure needs. PPP enables identification, development, innovative designing and financing of profit making facilities at prices people can afford. Involving private sector can ensure in-depth review by experts. Private capital can substitute scarce government resources. The construction can be faster and more cost effective. The facilities are often operated more efficiently, as private sector is held accountable to higher standards. New performance benchmarks are set, which induces public agencies elsewhere to improve their performance. The private managers also pay taxes and for every dollar invested, the return by way of taxes brings twice as much (Savas, 2000). New technologies are introduced and risks usually borne by the government is transferred to the private sector.

Savas (2000) appears to be too optimistic about PPP. Experience does not bear witness to all his observations. Accountability is a serious problem when private sector is involved (Guttman, 2000). Principal Agent problem results in private sector not performing to the

standards they are capable of (Laffont and Martimort, 2002). Private operator can exploit monopoly rents unless they are regulated. Monitoring private operator requires skills which government may lack.

Sclar (2000) argues that there are many limitations to privatization of public services, and advises improving public management techniques. In public services such as water supply where contracts govern relationships, competition is inherently limited. Often there are only a few private companies bidding for the services. Once they are awarded contract, it is costly to change them. In case of incomplete contracts, which usually happen in water supply contracts, information asymmetry leads to three types of problems – principal agent problem, adverse selection and moral hazard.

PPP in water supply systems exhibit principal-agent problems. The government agency responsible for supervising contracts (i.e., regulator) function as the principal while the private operators behave as agent. The regulator can be of different types, with Ministries assuming this role in some countries and fully autonomous set up in others. The operators have private information which they utilize for maximizing profits. The effectiveness of regulation determines how well information asymmetry is reduced in a contractual relationship.

One of the central issues in economics has been designing of institutions that provide good incentive to economic agents. In neo-classical economics, the individuals or firms were conceived as rational entities, each aiming to maximize profits, and because of

perfectly competitive environment the need for incentive did not arise. However, incentives assume importance when delegation of a task to an agent with private information is taken into consideration. The objective of the agent may not fully cohere with that of the principal and the agent has the advantage of private information. While the agent can observe his cost, the principal cannot, and, therefore, the principal cannot offer a contract that induces the agent to behave as he would have in a perfectly competitive market (Laffont and Martimort, 2002).

Private information with the agent can be of two types, as discussed before also; (i) adverse selection or hidden knowledge, in which the agent has private information about his cost and valuation but the is not known to the principal, (ii) moral hazard or hidden action, in which the action of the agent is unobserved by the principal. Further, information problem can also arise because of non-verifiability, in which the principal and agent share the same information ex-post but no third party, particularly no court of law, can observe the same information (Sclar, 2000).

In adverse selection, the principal delegates task to an agent for various reasons, including inability to perform. This is usually the reason for governments, the principal, to delegate water supply management to private operators, the agent. By the mere fact of delegation, the agent gets the information that principal lacks, such as the opportunity cost of the task, precise technology and how good is the match between the agent's intrinsic ability and this technology. These are the private information of the agent, and are not available to principal. This is the case of adverse selection.

If information is symmetric, the principal can design a contract that is allocatively efficient, conditional on incentive compatibility and participation constraints. However, if information is asymmetric, the efficient agent will mimic the inefficient, capitalizing on its informational advantage. The marginal cost of the efficient agent is known to him alone, and by mimicking the inefficient one, the efficient agent stands to make lager profit. The principal, in trying to optimize his gains, faces a tradeoff between allocative efficiency and information rent. Eventually, the principal can only achieve the second best efficiency level because he will have to pay information rent to the agent to ensure that it performs to its highest ability (Laffont and Martimort, 2002).

Moral Hazard is the case when the principal cannot observe the efforts put in by the agent to achieve the goals. Technically, principal could monitor agent closely and account for each of his action. But, the process of monitoring is costly. Eventually, principal finds it more efficient to design incentives for the agent to increase his efforts than make expenses in closely monitoring.

Sclar (2000) argues that these problems can be overcome if relational contract arrangements with bilateral governance structures such as joint ventures are formed between government agency and the private operator. He visualizes a relational contract in which government employees are allowed to bid for the contract too. His assumption is that in most public services, they are likely to bid the lowest. Once awarded the work, he suggests a relational contract will develop between the government and public

employees. In other words, he finds lack of incentives really the problem in performance and not lack of ability or low competition.

Relational contracting with employees is, however, a doubtful solution for developing countries where labor unions are generally very militant. Often, these unions are in collusion with politicians in extracting rents, and incentives may not be sufficient for them to ignore the benefits from such rent-seeking.

2.3.2 PPP Experiences in Water Supply:

The argument that private sector will outperform public sector in water supply management is based on several theoretical perspectives, two important ones being principal agent problem (or agency theory) and property rights theory. The inference from Agency theory is that the effort of public managers is hard to monitor and private operators can provide incentives to managers to keep cost down and increase productivity. The inference from property rights theory is that private operators, as residual owner, have clearly defined incentives to push managers for efficient performance. Politicians and public servants who have oversight on public utilities do not have residual ownership or any personal incentives to ensure efficient performance of managers (Renzetti and Dupont, 2004).

Comparing Public and Private Water Utilities:

Incentive problems associated with public provision of water services are on account of several reasons. First, there is a tradition of under-pricing water services for populist ends. Strong lobby groups influence politicians to keep prices low. The electoral cycles induces politicians to respond to popular sentiments, particularly when poor are affected. Second, there is a conflict of interest as the public enterprise is both the owner and regulator and, therefore, cannot credibly enforce performance contracts. Third, there is perverse organizational incentive in public sector on account of non-credible threat to bankruptcy, weak competition and performance measurement problems (Savedoff and Spiller, 1999; Spiller and Tommassi, 2008).

Many scholars contest the argument that incentives cannot be aligned in case public sector managed utilities. Araral (2008), in his study of public utilities in Phnom Phen, Cambodia, observes that prices can be got right by adopting cost recovery pricing and incorporating pricing into the budget. He believes public entrepreneurship and leadership can play a significant role in pricing reforms. He adds that governance can be got right by ensuring autonomy of the public corporation, operating utility on the basis of commercial principles and implementing performance measurement and management systems. He does not, however, explain what could be the underlying motivation for such reforms in publicly managed utilities. While these conditions were achieved in Phnom Phen, it may not be possible in other developing countries where politicians may be more opportunistic.

Araral (2008) clearly favors public provision of water service against private. He does not give reasons why private participation is not the right way, excepting stating that weak regulatory regimes are responsible for failure of private sector participation in the sector in several developing countries. The implication is that if regulatory regime were robust, private participation could be an alternative. There are several other weaknesses in his argument that public provision is the right way for water supply. First, he cites the example of Phnom Phen in Cambodia as to why public provision is superior. However, it is noteworthy that water utilities in many south-east Asian countries, including Cambodia, were traditionally managed through water districts which were autonomous and mandated to run services on commercial principles. Hence, pricing and governance structure were already in place, and all that was needed was further refinement to adhere to modern practices, particularly with New Public Management paradigms.

Secondly, the level of autonomy granted to Phnom Penh Water Supply Authority (PPWSA) makes it almost equal to a private entity with good corporate governance structure. It can hire and fire employees, pay its managers much higher than civil servants, reward performance to technicians as much as 25 times their salary (Araral, 2008). Top management is known to have high level of integrity, possibly because of better salary and reward structure. All these factors have contributed to the success of PPWSA. There is, however, no guarantee of continued protection of the utility from opportunism of politicians in long-term. Politicians are likely to show keenness in controlling the utility and expropriating profits as utility performance improves and fund

accumulation increases (Baietti & Curiel, 2005). In other words, government opportunism could sooner diminish property rights of PPWSA than it could for a private entity of similar competence.

It may not make a difference whether water services are private or public in case government opportunism is completely absent from a country and regulatory capacity is strongly developed. The path the country will take will likely depend on its historical experience. Unfortunately, the presence of political opportunism is endemic in developing countries. On the other hand, many developing countries have human resources and technical competence for developing regulatory capacity, with support from international donors. Private participation could then be considered an important alternative means of management in case government is confident about regulatory capacity.

Renzetti and Dupont (2004) also hold from their analysis of water utilities in the US, UK and France that empirical evidences are lacking to conclusively support the theoretical proposition that performance of privately-owned utilities are superior to publicly-owned utilities. They authors give four explanations for this variation in theory and empirical evidence. First, they argue that regulatory environment is more important than ownership in case of water utilities. Araral (2008) also believes that private provisions in many countries have failed because of weak regulatory regimes. Second, data on operations were not good enough, resulting in contested empirical outcomes.

Third, there could be other factors which influence performance such as size, geographical location, source of bulk water, etc. Finally, competition is limited in water supply. Technologically water supply systems are different from other infrastructures where private participation is usually accompanied by deregulation, resulting in more firms entering into market and increased competition. Economies of scale are critical in water and technology does not allow more than one operator in an area; two pipelines competing for water supply in the same locality is a costly option and not found anywhere in the world. If more firms are encouraged to participate in anticipation of competition, they would have to operate in smaller areas, resulting in costlier operations.

There are problems in the analysis of Renzetti and Dupont (2004). In comparing private and public utilities, they concentrate on evidence relating to operational (cost) performance and productivity performance. In fact, operational performance is more of a financial analysis than economic, because positive externalities are not accounted for. Moreover, cost efficiency analysis is, at best, partial, being based on operational cost than the sum of capital cost and operating cost. In water supply systems, operating cost is only 10% of capital cost. Ignoring capital cost can result in misleading conclusion about efficiency in resource use.

The performance with respect to profitability may not be relevant for comparison, as the aims of private and public undeniably differ sharply on this account. However, performance with respect to quality is an important comparison that Renzetti and Dupont (2004) should not have ignored. As quality is directly related to customer expectations, it

is important to understand if private sector delivers better quality than public. Also, higher cost in improvement of quality for privately operated utilities may be acceptable, if there is overall gain in social welfare (Morande and Dona, 1999) and there were low expectations of quality improvement under public provision.

Barlow and Clarke (2002) analyze at the macro-level conditions behind private sector participation in water and warn that democracy is being compromised through PPP. Ideological factors are driving the privatization process which started with Washington Consensus and has resulted in ever expanding economic globalization, backed by international organizations such as the World Bank and the International Monetary Fund. Transnational companies are the main beneficiaries of this trend and they have become increasingly powerful. The sales revenue of top 200 transnational companies exceeded the economies of 182 out of 191 countries in the world. In 2002, Vivendi and Suez had between them controlling interest in water companies in 130 countries spread over all five continents, distributing services to more than 100 million people.

Barlow and Clarke (2002) express concern that voice of the people, especially the poor, is being ignored and there is an increasing trend towards commodification of nature. The World Water Forum in 2000, under the influence of transnational corporations, declared water as a "need" while it should have rightfully been perceived as "rights". Scarcity and pollution is now making water an issue of life and death for millions of inhabitants, with the poor much worse that the rich. The equations for growth takes labor and capital into account but ignores natural resources as an endowment which has tremendous impact on

growth. With increasing depletion of natural resources, growth is bound to slow down all over the world.

Barlow and Clarke (2002) are also concerned that contracts for water are often being re-negotiated, indicating the market power which private sector attains through privatization. The re-bidding is an expensive and time taking process, resulting in weak potential for competition once the bid is awarded Even if private sector is found to be abusing its monopolistic powers after award of bid, the government has few options for controlling the private sector. In general, there is lack of transparency in the functioning of most of the private operator who are reluctant to disclose information citing corporate confidentiality clauses. Hence, private operators are subject to lower accountability. There is also a lingering fear that as water becomes more profitable it is likely to attract financial speculators in the capital market with all its attendant problems.

Estache and Rossi (2002) studied water companies in 19 countries in Asia to explore the effect of ownership on utility performance. They used cross sectional data. Out of 50 companies, 22 had some form of private sector participation. The authors had controls for different types of ownerships, hoping to measure relative impact of each, but they found that ownership variables had no significant effect on utility performance. But in another study, Estache and Kouassi (2002) found for 21 water utilities in 16 sub-Sahara African countries that private operators were more efficient than public operators. However, neither of these two studies control for institutional, economic and physical environment which affect both enterprise performance and public private partnerships.

Bitran and Valenzuela (2003) have undertaken a comparative analysis of public and private water supply companies in Chile and found that private companies made more investment than public and kept prices lower. But the lower prices was probably because government retained utilities in dry regions of the country where costs where high anyway. Garn, Isham and Kahkonen (2002) undertook a comparative analysis of public and private water utilities in Cambodia, in respect of technical and financial performance, as well as, consumer satisfaction, and found that private utilities far out performed the public. However, there could be bias in the study because the private operators had approached the government to manage select city utilities. Hence, there is an inherent selection bias in this study. Also, both these studies do not control for institutional, economic and physical environment which may have impacted performance. As for example, the level of monitoring, accountability and enforcement increases when a utility is transferred to private management from public.

Clarke, Kosec and Wallsten (2002) analyzed if private sector participation improved water supply and sewerage coverage to households in Argentina, Brazil and Bolivia. They found that coverage in the cities having private sector participation was same as that found in control group (cities without any private sector participation). An important insight from their study is that private sector participation did not result in adverse impact to the poor compared to cities managed by public entities. The analysis, however, fails to reveal anything about efficiency because it does not measure improvements in

Unaccounted-for-Water or labor productivity. The authors admit that it is not possible to conclude about welfare changes from their research.

Harris (2003) studied water supply contracts in Latin America and Caribbean and found that comparatively large numbers of contracts were cancelled and almost 55% of concessions were renegotiated. Even if renegotiation is an effective mechanism to deal with new information, it can undermine the value of bidding for the market. Also, if winning bidders believe they can renegotiate, they can bid strategically, with prior intention of renegotiating at a later time.

Renzetti and Dupont (2004) highlight three factors that influence performance. The first is scale of operations which imply that larger utilities can operate more efficiently than smaller. This only relates to technical efficiency and not allocative. Second determinant of performance is the physical environment. Utilities relying on bulk production from groundwater are likely to have greater cost than those depending on surface source. Contamination, population density, customer mix (residential and industrial) and topography are other important environmental factors. Third factor influencing performance is regulation and government policies, which include tax rules, accounting and pricing requirements, health and safety requirements, etc. These requirements vary across jurisdictions and may differ in their application to private and public utilities within same jurisdiction, making comparison difficult.

Shirley (2006) emphasizes economic principles in urban water reforms, arguing that urban water supply should be treated as private good and priced to recover cost. Operation of utilities should be regulated for price, access and quality. Services to the poor should be subsidized. Private sector participation in operation should be encouraged because it is more efficient. Competition should be encouraged for economic efficiency. These principles are likely to result in efficient water supply systems only if institutions and regulations are robust. Savedoff and Spiller (1999) argue that private sector is essential for drawing out water utilities in developing countries from "low level equilibrium". Rouse (2007) argues that private or public ownership does not matter as long as long as regulation and delivery are separate and transparency is high. Sidenstat, Nadol and Hakim (2000) argue that but private and public utilities can function efficiently and it is the regulatory environment which matters.

In summary, empirical evidence do not appear to conclusively establish the theoretical expectations that private sector is more efficient in utility management than public. However, it does not indicate otherwise either and both private and public utilities can function efficiently depending on the regulatory environment. As such, PPP is a valuable reform options for developing countries, although regulations have to be well designed for it to succeed.

2.3.3 Institutional problems affecting PPP:

There are several reasons why countries with weak institutions may find it difficult to attract and sustain private sector participation. First, water is essential to life. As such, if private participation is to be encouraged it is necessary that there be mechanisms by which voters can hold politicians accountable, prevent abuse of monopoly power, enforce contracts and subsidize water to the poor (Spiller and Savedoff, 1999). Setting up credible and competent regulatory body could be a helpful step in this regard (Shirley, 2006). Second, water is local, implying the need to balance national and local interests and mediate conflicts between stakeholders by reasonably allocating costs and benefits. Third, water is "dull", implying that rate of return is low, making it necessary for government to give credible commitment to investors of a reasonable rate of return(Shirley, 2006). Finally, water is "mysterious", implying that it is difficult for consumers to confirm if the water they are drinking is contaminated or not (Shirley, 2006). Also, the information of assets buried underground and their conditions is hard to find, discouraging private sector participation.

Shirley and Menard (2002) analyzed success of public private partnership in water supply management of six cities in Latina America and Africa with respect to regulatory contracts and governance institutions. They define regulatory contract as "the explicit and implicit agreements that define the relation between a government and regulated monopoly, and the institutions that govern this relationship"(Shirley and Menard, 2002).

The authors state that, holding governance institutions constant, a regulatory contract is more likely to achieve its goals if three necessary conditions are met;

(i) Information asymmetry between regulator and operator is reduced. This is usually achieved through product market competition, competition for market, yardstick competition and monitoring.

(ii) Incentives are provided to the operator to comply with contract goals. This is achieved through tariff policy, penalties for failure to achieve targets and risk and reward assignments.

(iii) Both parties provide credible signal of their commitment. This is achieved by having in place enforcement mechanism and dispute resolution mechanism.

Also, holding regulatory contract constant, the stronger and more supporting are the governance institutions – regulator, judicial system, political system and international constraints – the more likely contract will achieve its goals. Further, regulatory contract and governance institutions may work smoothly and yet fail to deliver if contract goals were, in the first place, not aligned to community needs for efficiency and economic and social welfare.

2.3.4 Regulating Public Private Partnerships in Water Supply

PPP is not a panacea for public sector deficiency in management of water supply systems. It is merely one of the options for reforms, with its own set of limitations. As PPP is often resorted to because government agencies are found lacking in capacity for

management, it is paradoxical that the government is expected to possess the capacity to regulate a new entity which is expected to be smarter. The development of regulatory capacity, therefore, is critical for PPP to succeed. Private sector partnership is not a retreat of the state, but rather a redefinition of its role as a regulator in a market-oriented economy (Fauconnier, 2003; Ouyahia, 2006).

Accountability is a serious issue in PPP, more so in the case of water supply which is among the basic human needs. Gutman (2000, 2004) scrutinizes the issue of accountability in PPP from general perspective, drawing from experience of the United States. He argues that accountability is being seriously compromised in many PPP contracts. While many services are being privatized, including those which were once considered 'inherently governmental', the rules that control private sector are not as effective as those that kept bureaucracy in check. Private sector involvement has been encouraged to overcome the slothfulness of bureaucracy, but not holding private sector accountable to the same standards as the public sector undermines privatization objective. Gutman (2000, 2004) is particularly critical of the term "Governance", which he considers as an elitist artifact for facilitating third party control of traditionally government functions without the same level of accountability to which government officials were always obligated. He believes that the term has blurred the boundary between private and public, and circumvented the accountability issue.

Posner (2002) also finds accountability a major issue when private sector is involved. He discusses principal agent problems, the resulting information asymmetry and potential for

opportunistic behavior. However, Posner argues that accountability issue can be addressed by proper design of incentives, sanctions and rules. Selection of right provider, administrative oversight and tracking of performance through outcome measures are important in this context.

Gutman (2000, 2004) and Posner's (2002) concern for accountability in general is also an important issue in PPP for water supply in developing countries, although the underlying reasons is not necessarily the laxity in holding private sector accountable to the same standards as public, as Gutman (2000, 2004) alleges in the context of US. In fact, in case of water supply in developing countries, regulations are either absent or weakly enforced when ownership and management is under public sector control (Jamison, Berg, et al., 2004). The issue of regulation assumes importance only when reforms result in private sector control. This reflects lack of professionalism and poor checks and balances within government.

Externalities are a critical issue in water supply management. Galiani, Gertler, Schargrodsky (2005) study the externality associated with water supply and found that public health is positively impacted by private water supply management. In their study of Argentina, they found that child mortality fell by 8% in regions that privatized their water systems and the effect was largest (26%) in poorest areas. However, this implies that Argentina possessed the capacity to regulate private sector utilities. PPP is unlikely to internalize externalities unless competent regulatory mechanism is in place and enforcement is possible.

Regulator of water supply systems in developing countries is usually weak. The regulatory institutions should have the capacity to collect and monitor information and apply penalties. Shirley and Menard (2002) argue that important issues in regulatory design are (i) if regulatory agency is a separate agency, (ii) if regulatory agency is autonomous and insulated from political influence, (iii) if regulatory agency is powerful and has discretion, and (iv) if regulatory agency has staff with skills. Ehrhardt, et al., (2007) are, however, cautious and do not recommend absolute independence of regulator or its complete insulation from politics. They subscribe to the view that regulatory type should be dependent on the context of a country.

Independent regulator are proposed by some experts because it can help insulate regulation from political influence, ensure policy continuity and focus attention on controversial issue, helping to enrich public debates (Ouyahia, 2006). There can be several independent regulators, such as in England, where water quality is regulated by Drinking Water Inspectorate (DWI), wastewater discharges by National Rivers Authority (NRA) and economic regulation by OFWAT. All three are at the national level and when the same regulatory framework is applied to all utilities, it is possible to have comparison in the sector. Guasch, Laffont and Straub (2006) found in their study that renegotiation is less likely to occur when regulator are present while existence of price caps is more likely to lead to renegotiations. The implication is that renegotiations are less likely when rules are stable and coherent.

The choice of right model for PPP is a complex and time consuming exercise, to be based on thorough assessment of costs and benefits. The underlying institutional framework should be credible and coherent. Past experience show that when institutional framework is lacking, too complex or incoherent, the quality and reliability of water services may be at risk and public private partnership could fail (Ouyahia, 2006). The private sector has to be assured of a fair return to investments. The customers have to be assured that private sector cannot abuse its monopoly power. Usually the administrative structure and judicial systems in developing country lack human resource and financial capacities. These have to be developed before PPP.

Many developing countries have weak judicial and political institutions. Judicial institutions are important from the perspective of support to incentives and providing credible commitment. It is particularly important with regard to (i) property rights and (ii) neutrality when government is also a party to dispute. Political institutions are important because it can control opportunism through checks and balances. Electoral laws or legislative rules can make it difficult for opponents of reforms to overturn water contracts once the deal is finalized. Technocratic and apolitical pricing regulation established by law could help assuage public grievances on tariff increase. The extent to which political class or operator are sensitive to international opinion also matters, and international institutions could substitute weak domestic institutions in come cases (Shirley and Menard, 2002). Open trade and capital flows can make governments concerned of their reputation effect. However, presence of international institutions can also become a liability for PPP oriented reforms, as past experience indicates.

Decentralizing regulatory responsibility to municipal level is proposed by many experts because customers influence increases (Ouyahia, 2006). But municipalities may lack ability to deal with private sector, resulting in less interest among private sector. Other experts propose allocating responsibilities among various levels of government. But there can be uncertainties in the allocation of responsibilities among levels of government, complicating PPP. In France, municipalities regulate the PPP through contracts but are supported by regional and national authorities which regulate some aspects of water. Expecting the same level of coordination in developing countries, however, would be unrealistic

Information asymmetry, lack of incentives and lack of credible commitment are the greatest challenge to water supply management. Regulatory contract for PPP have to be designed to reduce information asymmetry, create incentives and develop mechanisms for credible commitment for the purpose of achieving contract goals, consistent with community expectations on operational efficiency and socio-economic welfare. Further, the contract requires to be supported by suitable regulatory institutions, judicial institutions and political institutions for reducing information asymmetry, motivating parties and making credible commitments.

2.3.5 Competition

Competition is an important factor for privatization to succeed. Information asymmetry is reduced through competition. Higher the level of competition, greater is the incentive for operator to divulge all private information. When competition is lacking, whether in private monopoly or public, services deteriorate, customers do not have alternative choices and they are at the mercy of an unresponsive service provider. It is possible to induce competition through appropriate institutional arrangements.

Although competition is important, opportunities for competition is lacking in water sector as compared to other infrastructure sector such as telecommunication and electricity. Limited competition has meant that private sector participation in water is often controversial. Unless regulations are effective, private monopoly will replace public monopoly, with none or modest improvements in performance standards. On the other hand, tight regulation could hinder market forces. The difficulty of inducing competition in water supply has led some scholars to posit that "there is no consensus on how to promote competition, the roles of public and private sectors, and the institutional arrangements for regulation"(Ouyahia, 2006, p.5). Yet, experiences show that competition is a distinct possibility, even if limited in scale, and regulatory designs can help strengthen its outcome.

Three types of competition are possible - product market competition, competition for market and yardstick competition. The product market competition is low in water

compared to other infrastructure because nearly 66% of the costs are accounted by networks which are inherently monopolistic. Others, such as storage or treatment, can be competitive, at least in theory, provided there are several reservoirs or treatment plants catering to a city. But in reality, product market competition is very low in water supply systems.

Usually direct competition for market occurs between piped water supply and private vendors, which is not sufficient to overcome information asymmetry problems. Indirect competition for market occurs through periodic auction of the right to operate a supply system. These can take several forms such as management contract, lease and concessions. The limitations are that the period between bidding is usually quite long, resulting in low threat to entry for current operator. Also, there are very few private companies which participate in water supply related auctions.

There are many possible arrangements in Public Private Partnership spectrum, varying in the level of competition they invite and degree of autonomy from the government. "Public Authority" or "Public Corporations" are at one end of spectrum, with some autonomy from the government while "Build-Own-Operate-Transfer" arrangements or "Concessions" are significantly private. While many combinations and arrangements are possible, the common types of PPP arrangements in water sectors are as follows:

1. In Management Contract, the government as owner undertakes major capital investments while the private operator operates the supply system. The performance level

to be achieved by the private operator is specified in the contract, including water quality, the reliability of service, etc. A fixed monthly fee is paid to the private operator and sometimes a variable component too which is dependant on the achievement of contracted parameters during the period.

2. In lease, the private operator runs the business, retains revenue from customer tariffs, and pays a fixed lease fee to the contracting authority. The private operator does not finance investments in infrastructure assets. Lease differs from management contract in that a fixed fee is paid by private operator to the contracting authority, retaining the balance as its revenue. The risk to the operator is significant.

3. In concessions, the private operator runs the business and finances investments, but does not own the infrastructure assets. All revenues are retained by the private operator and it pays a concession fee to the government. Concessions differ from the pervious three in that all investments are undertaken by private operator. The risk to the operator is major. The asset is returned to the government at the end of concession contract.

4. In Divestiture: The private operator runs the business, finances investment, and owns the infrastructure. Divestitures differ from concessions in that the private operators undertake investment as well as own the assets. The risk to the operator is major.

Table 2.6: Types of PPP arrangement and their characteristics

Type of PPP	Revenue	Period	Capital Investment	Ownership
Management Contract	Fixed Fees	3 – 5 years	By government	Government
Lease	Revenue – fixed fee	3- 5 years	By government	Government
Concession	Revenue – concession fee	25- 30 years	By private operator	Government
Divestiture	Full revenue		By private operator	Private

Although periodic auction ensure limited competition, preparing the bid has been found to be very expensive proposition for both the government and private sector. Small firms are deterred to participate on this account. Cases of corrupt practices to influence bids have been recorded in both developed and developing countries. There are only a few water companies in the world which dominate the business and, in many cases, they are in partnership. This further limits competition

Competition for market often takes the form of concessions which are auctioned for a period of 25 – 30 years. There are no competitive pressures to the firm during the lifetime of the contract once bid is awarded. The regulation of contracts, therefore, assumes great importance for both parties – private and government – to safeguard their interest. Business in water supply involves idiosyncratic investments and is best managed through relational contracting. But concessions contracts between a public entity and a private one cannot be relational as might be possible in contracts between a private with another private. Spiller (2008) states that inefficiencies of public contracting (public entity in contract with a private entity) compared to private (private entity in contract with another

private) are because of inherent hazards specific to public sector. Hence, this inefficiency should be seen its proper context of adaption and is not remediable.

As contracts are not complete, risks increase when transactions are complex and parties have sunk investment costs. If two private parties are involved, relational contracting is the governance structure they would prefer in such circumstances. As new facts emerge, outside that covered by contract, they will adapt to new information as long as efficient to do so. Spiller (2008) argues that when public sector is involved, relational contracting is not a possibility. This is because governments are worried about third party opportunism. The third party could be political opponents, NGOs or interest groups who would benefit by accusing the government of corruption or favoritism. The governments, therefore, will not prefer negotiation, excepting to the extent already specified in the contract, and would rather choose early termination.

Spiller (2008) adds that in case of water concessions, contracts are detailed and elaborate for controlling government opportunism. If economic shocks or other causes lead to differences between government and private operator, the government is unwilling to negotiate fearing public criticism. This is the case even if government understands and believes that it is economically efficient to negotiate. This inefficiency in public contracts is, therefore, an equilibrium response for political reasons and is not remediable.

The views of Spiller (2008) are correct about the limitations of public contracting from the perspective of formal rules, but institutions are more than that. Informal rules, norms and beliefs are institutional elements which also guide relationships.

Apart from periodic bidding, yardstick (or benchmark) competition is also one of the means to improve performance and overcome information asymmetry, utilizing industry average or best practices as the standard (Kwoka, 2006; Anwandter and Ozuna, 2002). However, this is inherently subjective. The data collection and analysis can be quite demanding, outside the competence of regulators in many developing countries.

Yardstick competition is achieved through comparing performance of supply systems using common yardsticks or performance indicators. This form of competition is not fully effective because there are exogenous factors which influence supply systems making comparison very difficult. The climate, rainfall, soil characteristics, soil chemistry, etc., can vastly differ between regions, making comparison of common indicators an imperfect measure of competitiveness. There should be diversity in ownership of water supply systems within the same country, making comparison possible and meaningful. Unfortunately, diversity of ownership is rare because market for water supply is thin.

Some scholars believe that merger of utilities of any country on economies of scale argument should not be permitted because it limits the potential for yardstick competition (De Witte, 2008). One way to overcome this problem is to include international data for developing benchmarks. Inset appointment and common carriage are other competitive

methods attempted in developed countries but they have failed in water sector. The inset appointment method proposes giving license for service to a private party within the service area of another private party. As such, potential competitors can supply to part of the area in each other's territory. In case of common carriage, the same distribution system could be used by more than one supplier with the customer having freedom to choose his service provider. But the problem is in fixing responsibility for quality. Both these models have not performed very well in England and Wales where they have been attempted (Ouyahia, 2006).

Kwoka (2006) found that in the case of natural monopoly, yardstick competition is effective in reducing cost. Thus, unlike direct competition which is focused on price, yardstick competition reduces costs, which should eventually reflect in price too. He also found that yardstick competition, in the case of electric utilities in the US, reduced costs in the case of private utilities more than the public. In fact, the public utilities were already low priced. The implication is that the inefficiency on account of regulation may be higher than inefficiencies on account of public ownership of natural monopoly. In other words, PPP which is accompanied by regulation can result in more expensive services.

There are several limitations to above arguments. First, Kwoka (2006) does not explain how private and public compare with respect to quality of service. The importance of quality to the consumers should not be under-estimated. Secondly, high price in private

could be linked to high asset life potential because of superior maintenance. Unless lifetime costing is done, pricing cannot be a good comparator.

2.3.6 Monitoring

Monitoring is essential because it reduces information asymmetry. Although an expensive option, it is important in case of PPP in water because the potential for competition, another means of reducing information asymmetry, is limited. Moreover, water service is politically sensitive which necessitates close monitoring.

In PPP, the operator is contractually obliged to share pre-specified information with the regulator, with fines for failure to do so. Transaction costs are associated with monitoring and information can have substantial cost. In fact, monitoring is more expensive than competition for reducing information asymmetry.

Even after PPP, the government remains responsible for utility performance. PPP does not necessarily result in lower government spending because cost is incurred in creating and maintaining infrastructure for regulation and monitoring (Ouyahia, 2006). Even if government spending is not reduced, there may still be a case for private sector participation because of net welfare gains (Morande and Dona, 1999). The externalities from ill-managed and poorly regulated public utilities are often large, and private sector participation can help reduce them significantly, using new technology and superior management methods. Newly established regulatory mechanisms to control private

operator can lead to improvement in water quality, with improvements in quality of life. In such cases, social cost benefit analysis of PPP based reforms is likely to show positive NPV because negative externalities are greatly reduced, justifying the new arrangements.

For monitoring of PPP to be effective, the contracts should clearly define objectives and specify performance targets. Some of the regulatory tasks are listed below. The regulatory institution should have the capacity for undertaking these tasks. The degree to which each task will be important is dependent on the type of contract. As for example, "ensure development of infrastructure" is not an important task in management contract because it is not the responsibility of the private sector.

Table 2.7: Regulatory tasks to be monitored by regulator.

Regulatory Tasks	Management Contract	Lease	Concession
Price Control	-	Y	Y
Promotion of operating efficiency	-	Y	Y
Service standard specification and monitoring	Y	Y	Y
Control of externalities	Y	Y	Y
Maintenance of Public good functions	Y	Y	Y
Ensure asset serviceability over time	-	Y	Y
Controls over unfair trading practices	Y	Y	Y
Health and Safety regulations	Y	Y	Y
Promote water use efficiency	Y	Y	Y
Ensure responsiveness to final customer needs	Y	Y	Y

Adapted from Ouyahia (2006)

2.3.7 Incentives and Tariff:

Incentives change the behavior of operator as well as consumers. It induces the operator to reveal private information, preventing operator from acting opportunistically.

Depending on how incentives are structured, the operator strives to increase operating efficiency, expand coverage, prevent waste, address equity concerns, maintain system and share information with the operator. Incentive structure determines consumer motivation to connect with the supply system and curb waste. The three policy instruments related to incentives are (i) setting targets and associated penalties (ii) distributing risk and reward assignment and (iii) tariff.

Assignment of risk and responsibilities influence the operator behavior. If operator does not bear the risk of investments, it will prefer expanding capacity to conserving water through reduction of UFW. Also, large government subsidies for investment encourage capacity expansion at the cost resource conservation (Shirley and Menard, 2002).

Tariff has incentive effect on both operator and consumer. In the case of operator, tariff policy can help improve efficiency, expand access and reduce waste. Tariff based on cost can be subjected to manipulation and distortion, as cost is a private information of the operator. As for example, tariff set on rate-of-return result in over-investments. Hence, tariff decoupled from utility's cost, such as in price caps, are more likely to motivate efficiency improvements (Shirley and Menard, 2002). The tradeoff is that price caps are more complex to regulate and attracts higher capital costs because of risks. The frequency with which tariff are changed also determines motivation, because operators have preference to benefit over longer duration through efficiency gains they might have achieved. Frequent changes to tariff, in such a circumstance, are not in their interests. OFWAT rebases price every 5 years. Price-caps are, thus, changed over time but the

process often relies on information collected from the operator. Consequently, some level of information asymmetry occurs in price cap regulations too.

Kirkpatrick, Parker and Zhang (2004) believe that international donors are over-promoting price cap regulation in developing and transition countries compared to rate of return regulation. The conducted a survey of regulatory professionals in developing countries, and found from the response of 60 individuals from 36 countries that they did not fully understand the price cap regulation and were not trained for it. Interestingly, the respondents observed that in both price cap and rate of return regulation, the biggest problem was information asymmetry.

The authors believe that price cap regulations are problematic for developing countries, particularly when uncertainty is high. In case of water services, uncertainty is usually high. Also, price cap regulation results in lower private sector interest in investments and the cost of capital is higher. The volatility of profit in water sector due to price cap regulation can attract unfavorable attention from the government, particularly if a period of high profit is utilized by interest groups or NGOs to rally against private sector participation.

The greatest advantage of rate of return regulation is that it is easy to understand and does not exacerbate the information asymmetry problem which seriously impedes water sector reforms. There is a guaranteed profit stream. One of its disadvantages is that the private operator over-invests in infrastructure. But this may not be a negative feature in case of

many developing countries with low level of infrastructure, urgently in need of expansion and rehabilitation.

If tariff covers marginal cost and there is reasonable rate of return to capital, the operator has incentive for expanding coverage. Metering also works as incentive for coverage and reducing waste. If the consumptions are not metered, operators increase number of users as that is their main tool of increasing revenue. But when metered, the operator aims to improve service such as reduction in interruption of services and reduction in leakages to the extent returns are greater than maintenance cost.

There is incentive effect of tariff on customers too. Optimal pricing give consumer incentive to avoid waste and pollution. Consumers should ideally pay at least the marginal cost; if the usage price is too low, metering may not make sense. Consumers may also be opposed to paying marginal price because of cross-subsidies. The subsidized consumers have no incentive to save water while those paying too high may prefer to set up their own bore holes.

Explicit targets in the contract, with penalties for non realization, motivate operators to achieve them. The targets should be aligned to the problems. As for example, if opportunity cost of usage is high in a city, the target must cover UFW. If connection rates are low and related health problems high, the target should address coverage. If contamination is high, target should address pollution.

2.3.8 Dispute Resolution

Credible commitment mechanisms are critical for contracts to perform. Effective dispute resolution mechanisms enhance the credibility of contracting arrangements. Disputes are resolved through mutual discussions, autonomous regulator, judicial courts, international arbitrage or arbitration panel. There is also private ordering of disputes when both parties attach value to ongoing relationship.

The interests of the stakeholders are divergent – the private, the government and the customers – which along with the incomplete information about future creates potential for friction and conflicts. The government and regulator must have the skill to manage conflicts over the life of partnership. Bargaining and negotiations will be part of their relationship.

Risk allocation is undertaken through a bargaining process and is not necessarily distributed by the principle of optimal risk allocation, i.e., the part best in position to manage the risk, should be responsible. In fact, government usually has to bear higher level of risks, which evolves over time in a complex negotiation process (Ouyahia, 2006)

The World Bank (2006, p.129) suggests using existing institutions with good reputation for resolving disputes. It also emphasizes the need for transparency in resolving disputes, as well as keeping legal documents relating to contract in public domain.

2.3.9 Consumer confidence

Consumer confidence is critical to the success of PPP arrangements. Ouyahia (2006) argues that customers should be involved right from the decision making process in PPPs. Rouse (2007) highly values transparency and public participation for good governance and regulation of water services. The World Bank (2006) also emphasizes public participation and the importance of transparency in PPP deals. The impact on the poor is one of the most serious public concerns. There is also potential for corruption in PPP arrangement which can undermine credibility of the process. Regulation can be effective in addressing these concerns.

Tremolet and Halpern (2006) suggest regulatory mechanisms for protecting the interest of the poor. They identify four aspects which regulator should be attentive for. First, the rules for expanding coverage should be unambiguous, sufficiently detailed and also enforceable. Issues such as land rights should not become a reason for denial. Second, tariff level should be structured in a manner that takes into account the paying capacity of the poor. The incremental block tariff is a good system to adopt.

Third, the quality of service should be flexible enough that utility operator can experiment with low-quality service levels, as long as health is not at risk. In particular, the quality standards prevailing in developed countries should not be prescribed for all customers in developing countries. Regulator should calibrate local needs, while paying attention that no adverse health impacts occur. Finally, the regulation of alternative

service provider should not be neglected. In many countries small scale service providers contribute significantly to water services for the poor, delivering water in tanks, albeit at a much higher price. The regulator should try licensing them and formalizing their services.

The problem with suggestion of Tremolet and Halpern (2006) is with respect to the last issue of formalizing the services of the alternative service providers. While there are benefits of such an action, the disadvantage could be steady proliferation of such vendors and systematic vandalizing of water supply systems, particularly in case of public ownership. Also, proliferation of small scale service providers could become powerful alliance against future reforms initiative. Hence, decision to regularize informal water supply and its extent should be linked to long-term plans and strategies for water supply services.

Asthana (2008) argues that decentralization of water service, which is one of the reforms being attempted in many countries to improve service quality, results in increase in corruption. He uses empirical data from utilities in India to substantiate his claim. The level of participation does not increase from decentralization, as expected, and the decision making power is captured by the local elite. He does not, however, agree that private sector participation could be one of the alternative forms of reforms which could be tried. He gives no reason for his rejection of private sector participation. The insight from his research is that accountability is a serious problem in water services, and consumer participation is important in this context.

CHAPTER 3: RESEARCH FRAMEWORK & METHODOLOGY

Public Private Partnerships in water supply are contractual agreements between private operator and the government for the operation and management of a utility (Davis, 2005). The experience of PPP in water supply has been mixed (Renzetti and Dupont, 2004). While many question the very concept of PPP in water supply (Arraral, 2008; Barlow and Clarke, 2002), others believe that public sector management of water supply in developing country is trapped in a "low equilibrium" which demands PPP initiatives to escape out of it (Savedoff and Spiller, 1999). One of the important drivers of PPP in water supply is the need for finance (Davis, 2005). With many governments in developing countries facing fiscal crisis, and the private sector increasingly capable of financing infrastructure, the need for PPP in water supply will exist. Information asymmetry, incentives and credible commitments are three main problems in respect to PPP in water supply (Shirley & Menard, 2002; Spiller & Tommassi, 2008; Savedoff & Spiller, 1999).

Institutional choices impact economic outcomes (Eggertson, 1996). Changes in the "rules of the game" can lead to improved economic outcomes depending on how incentives are structured (North, 1993). Transaction costs characterize economic exchanges but the type of governance structure chosen for managing exchange can reduce transaction costs (Williamson, 1979). Secure property rights through laws and enforcement mechanisms strengthen market forces and encourage technological innovations (Furubotn, et al, 1997; Ruttan, 2006). Collective intentionality accompanied by "status function" assigned to a

regulatory institution can result in credible signals for reform initiatives (Searle, 2005). The reform path is dependent on historical experience and occurs by institutional refinement (Greif, 2006). It is not possible to transplant institutions from developed country to the developing ones, without understanding the context (Greif, 2006; Minogue, 2006). Good institutional arrangements have the attributes of coherence, credibility (includes predictability) and legitimacy, including accountability and transparency (Ehrhardt, et. al, 2007).

While past empirical and theoretical studies indicate problems with PPP in water supply systems, current trends reveal that demand for PPP will persist. As institutions impact economic outcomes, insights from institutional analysis bears the potential of resolving problems associated with PPP in water supply. This expectation has led to the framing of main research questions for this dissertation which are centered on designing institutions in case of PPP in water supply systems. There are two main questions. The first is to understand the impact of country-wide (but not water supply specific) institutional environment on efficiency of water supply systems. The second is specifically about designing institutions for PPP in water supply systems. These questions, the purpose behind them and auxiliary questions they lead to are discussed below in greater details.

3.1 Research Questions:

Question 1: What is the impact of country-wide institutional environment on the efficiency of water utilities?

The purpose of this question is to appreciate whether country wide institutional environment has significant effect on the efficiency of water utility. In case it is found that they do not have significant impact, the design of regulatory institutions for PPP in water supply will need greater caution. Three institutional variables are proposed to be analyzed - Property rights security, Business Freedom and Ownership of utility (public or private). Quantitative method is used for answering this question. Cost efficiency is the criteria for measurement. The following are the hypothesis for these variables:

Hypothesis 1: Secure Property Rights should result in improved cost efficiency.
Hypothesis 2: Greater Business Freedom should result in improved cost efficiency
Hypothesis 3: Privately managed water utility should be more cost efficient than publicly managed utility.

Only one prior study was found for hypothesis 1 and 2 (Kirkpatrick, Parker & Zhang, 2006). This study uses another set of database to analyze the same issues. In regard to the last hypothesis, there have been several studies in the past but the findings from these are ambiguous. While some have shown significant positive relationship between private ownership and efficiency, others have found the relationship to be

insignificant. The research here is a contribution to the ongoing debate, analyzing the relationship using a new set of database.

Question 2: How to design institutions in case of Public Private Partnerships in water supply systems?

The focus of the research is how property rights, regulation and contracts reduce the problems of information asymmetry, incentives and credible commitments, which have been found to constrain PPP in water utilities. The question, therefore, concentrates on level 3 and 4 of Williamson's (2000) characterization of institutions, although it draws information relating to level 1 and 2 also, because they must be in harmony for being effective.

3.2 Research Framework:

The research framework is presented in the figure 3.1 below. Regulatory governance structure and regulatory incentive structure are the independent variables while dependent variables are the attributes of good regulatory design – legitimacy, coherence and credibility. Two auxiliary questions emerge out of this.

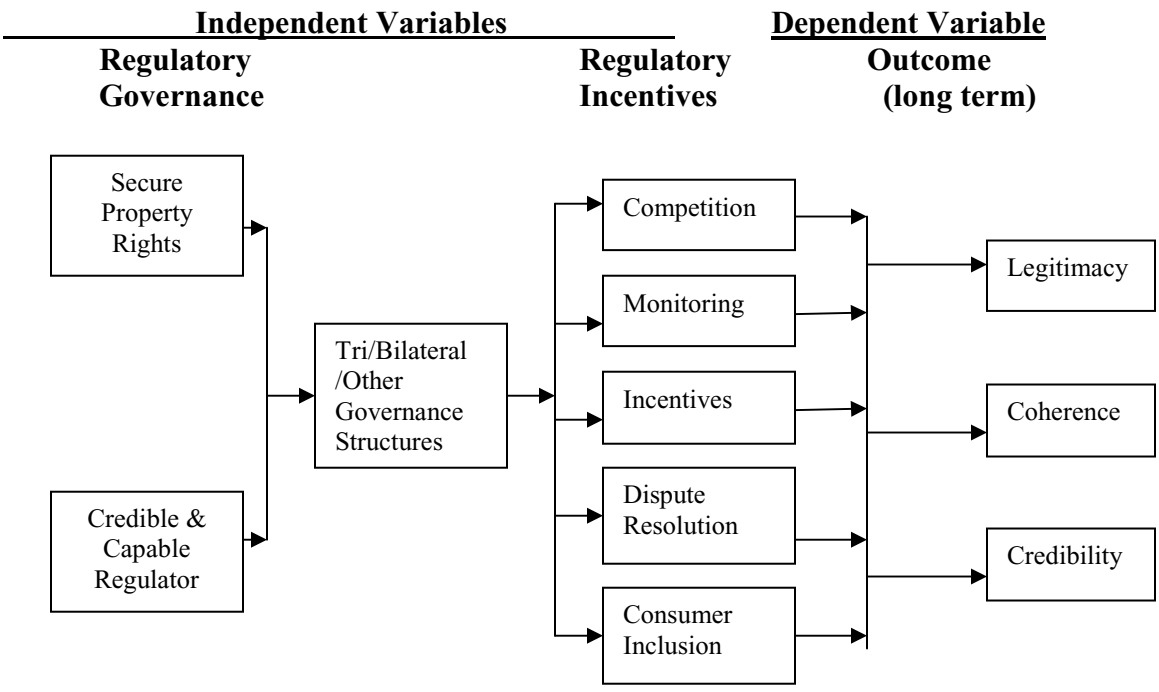


Figure 3.1: Framework for understanding the impact of Regulatory Governance

Auxiliary Question 1: How to design regulatory governance structure in case of public private partnerships in water supply systems?

Regulatory governance structure is composed of property rights structure, regulator and contract governance structure. PPP contracts create property rights. Security of property rights is fundamental to attracting private sector investments, and inducing competition. Further, creation of property rights must be complemented by a credible and competent regulator to enforce contract clauses impartially and control opportunistic behavior by either party. The contract governance structure should aim to

minimize transaction costs. This auxiliary question is further broken down into three sub-questions:

How to design property rights structure in case of PPP in water utilities?

This question is related to the potential for quasi rent expropriation by the government. In an ideal situation, private sector will show interest in a market only if property rights appear secured. The government making commitment of secure property rights should feel assured that private sector will function at its highest efficiency level.

How to ensure effectiveness of regulatory office in case of PPP in water utilities?

This question relates to appointment process of regulators, tenure, sources of funding, powers under law and competency of personnel. In an ideal condition, regulator should be perceived as independent and neutral, contributing to credibility and legitimacy of the entire governance mechanism. An effective regulatory office should have control over market to ensure that private operator does not manipulate its monopoly powers. In addition, the regulatory effectiveness should result in high quality of service delivery and low level of negative externalities to the society.

How to design contract governance structure in case of PPP in water utilities?

There are different choices for contract governance structure, following Williamson's model (1979). The selection is dependent on frequency of transaction, specificity of asset and level of uncertainty. The overall goal should be to lower transaction costs of exchange.

***Auxiliary Question 2**:* How to design regulatory incentive structure in case of public private partnerships in water supply systems?

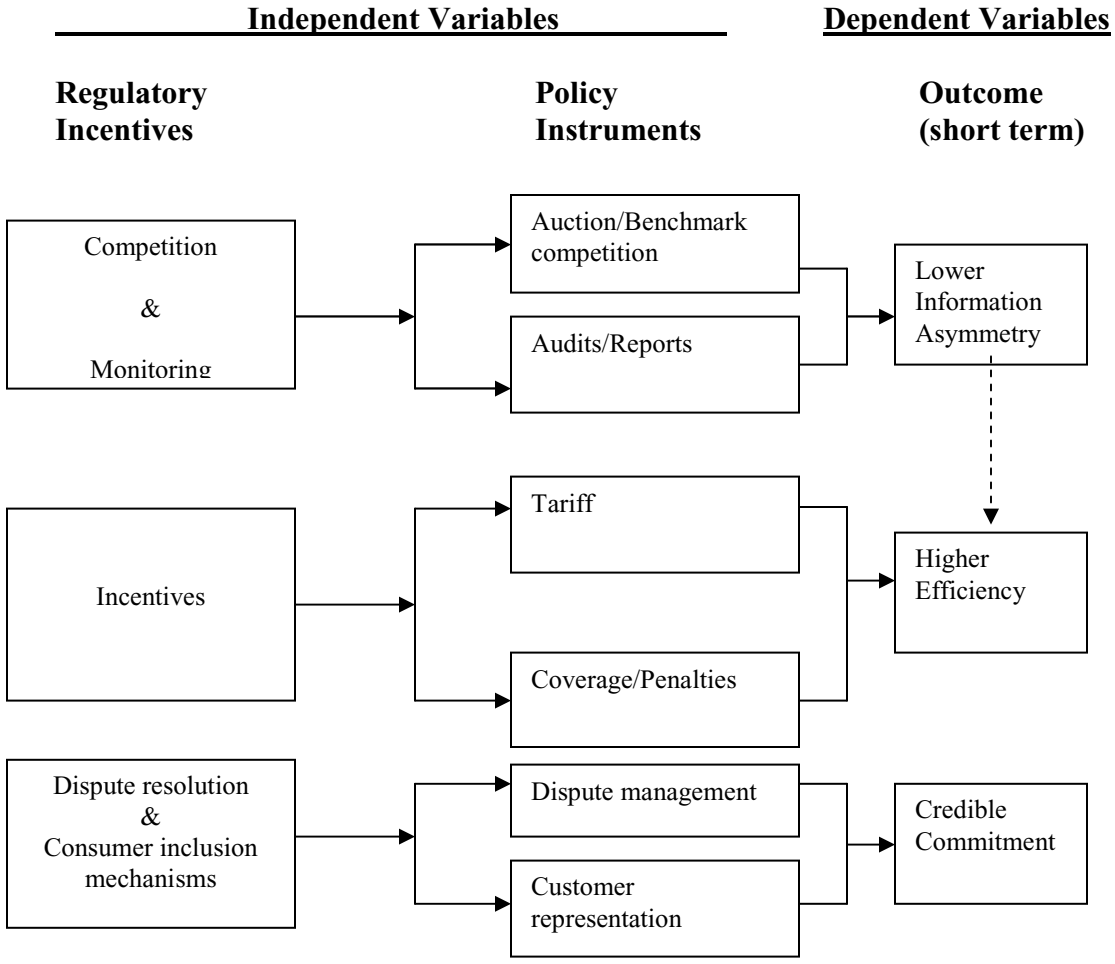


Figure 3.2: Framework for understanding the Impact of Regulatory Incentives

The regulatory incentive structure can be characterized as the "rewards of the game". It consists of details of the contract. Regulatory incentive is at Level 4 in Williamson's (2000) categorization of institutions, and is dependant on all preceding layers for performance. It can economize on transaction cost by decreasing information asymmetry, creating incentives and making credible commitments.

Figure 3.2 above gives the research framework for auxiliary question 2. It is an expansion of the earlier framework, and represents the part between application of regulatory incentives and achievement of long-term regulatory attribute conditions. This framework shows the policy instruments for regulatory incentive application and the short-term outcomes whose sustenance would lead to the long-term regulatory attributes.

The clauses of contracts are meant to align interests of both parties. The conditions by which interest alignments frequently take place are inducement of competition, effective monitoring, incentives distribution, dispute resolution and consumer inclusion.

There are three stakeholders – government, private operator and consumers. The government acts as the agent of the consumer and draws up a contract which, in ideal condition, reflects the best interest of consumer. A regulator is established for enforcing the contract. In an ideal condition, the regulator pursues the interest of consumers as articulated in the contract. The interest of the regulator, therefore, is not different from the interest of the government or the consumers in the ideal state (Anwandter and Ozuna, 2002). This theoretical assumption guides the analysis in this research.

Regulatory incentives are most effective when regulatory governance, as discussed in auxiliary question 2, are appropriately set. In figure 3.2 above, the dotted lines linking outcome box "lower information Asymmetry" with "Higher Efficiency" box indicates that reduction in information asymmetry will contribute to efficiency. The following sub questions emerge from the auxiliary questions 2;

How to design competition in water supply system contracts?

Competition is essential for reducing information asymmetry, learning and innovation. Some aspects of water supply systems can be subjected to competition but not others. The question seeks to understand institutional arrangements that enhance competitive pressure in case of PPP.

How to design effective monitoring of water supply contracts?

The purpose of monitoring is to reduce information asymmetry. However, monitoring is a costly option. Also, the regulator should have the technical competence and skills to conduct effective monitoring. In case of PPP, public sector is often believed to lack competence found in private sector. This raises questions about its ability to effectively monitor private operator. This question seeks to understand institutional arrangement that can make monitoring effective. Monitoring is to be undertaken with respect to benchmark indicators as stated or implied in the contract as well as key provisions of the contract.

How to design incentives?

Incentives are meant to align interests of contracting parties towards efficient outcomes. In case of water supply systems, tariff and coverage of the poor are important issues for the government. On the other hand, governments are known to act opportunistically for political reason and extract quasi-rents from tariff structure. This question seeks to understand institutional arrangement that can create incentives for private operator to pursue government's objectives for tariff and coverage of poor and for governments to act responsibly in respect to tariff.

How to design disputes resolution mechanism between government and operator?

The purpose of dispute resolution mechanism is to underline the commitment of the government for reforms. As contracts are incomplete, there is potential for differences between the private operator and government agency. Regulator, when independent and credible, could moderate differences. Other mechanisms include arbitration and approaching local courts. The framework which helps resolve disputes through formal or informal mechanism is an important design consideration.

How to design mechanisms for consumer inclusion?

Consumer inclusion creates transparency and lends credibility to the entire process of PPP.

3.3 Methodology

The methodology for Question 1, which is answered using quantitative techniques, is described in Chapter 4. This section only discusses the methodology followed in answering Question 2.

Research Design: The research intends to utilize multiple, embedded case study design. The proposed research questions are more amenable to analysis through case study. First, institutional issues are complex and contextual, making case studies ideal method of approaching the analysis (Yin, 1994). Secondly, data for PPP in water utility is very limited, which is one of the reason why not many empirical works have been undertaken for this class of infrastructure (Davis, 2005). The case studies are purported to be explanatory.

The unit of analysis is city water utility with PPP arrangement. The cities proposed to be analyzed are Manila, Delhi and Tirupur water supply systems. The theoretical proposition is that institutional design is important for PPP in water supply to take place and sustain. The rival proposition is that PPP in water supply can occur and sustain without specific institutional design.

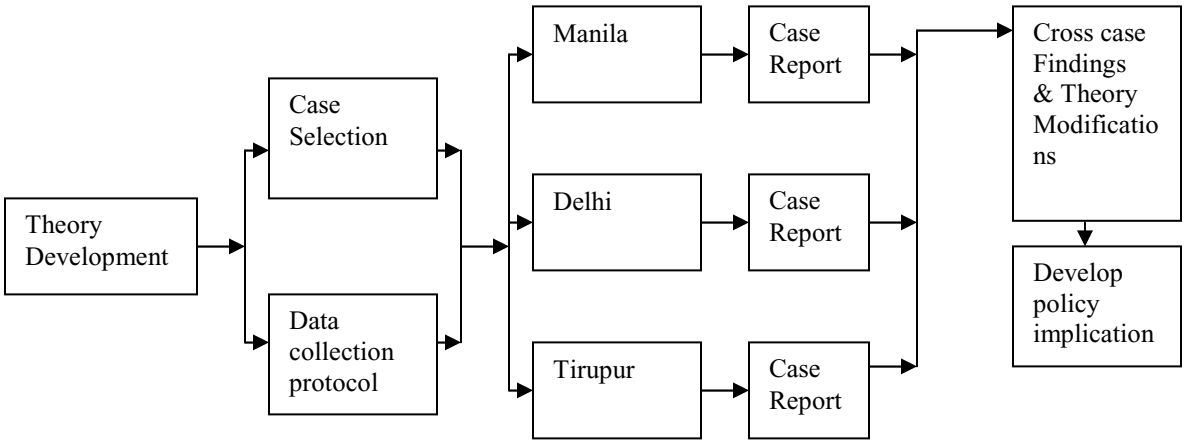


Figure 3.3: Case Study Research Design

The criteria for selecting the cities were that at least two should be located in India and one in any other middle income developing countries in Asia, that they should have experienced PPP in water supply within at least last 12 years from present and that the population they serve should be greater than 500,000. The reason for selecting two from India was that one of the objectives of the research was to develop generalizable recommendations applicable to India.

Delhi was chosen because it is a case of failure in adopting PPP. Thus, it will help in theoretical replication of the proposition. However, it needs to be emphasized that Delhi is not a failure of PPP in the literal sense. Delhi is a failure in the sense that it did not adopt PPP. If institutional design is important for PPP to take place and sustain, the issue is - was there a problem with institutional design with reference to other two cities that PPP could not take place? In addition, Delhi is a counterfactual to other two cities because it is operating under government management currently. Therefore, the research

can compare institutional design differences under government management and private management or patterns that are common to private but not found in government. Tirupur was chosen because it is the most successful example of PPP in India, which would assist the research through literal replication of research proposition. Manila was chosen because it is in a middle income country comparable to India. The Manila PPP experience is also believed to be one of the most comprehensive in Asia.

Data Collection: The data for the case studies was collected from interviews, official documents, archival records and websites of the three utilities. In all, 27 officials were interviewed, 9 for each city. Three represented the government or the regulator, three the private operator and the balance three other interested parties involved with the reforms or having considerable knowledge about it. These interested parties were mostly Non Governmental Organizations (NGOs), World Bank officials and Asian Development Bank officials.

The interviews were conducted in New Delhi, Tirupur and Manila. The sample was selected following snowball methodology. Each person interviewed was apprised of the confidentiality clause. Excepting some, most were not comfortable with recording of their interview. Therefore, interview notes were taken by hand on the spot and entered in the computer at the earliest. A database of interview was maintained. Summary from the database are provided in case study analysis.

There were 9 interview questions (see annex 1 to 3). The interviews were mostly semi-structured. Although the anticipated interview time was 45 minutes, in many instances it exceeded this limit. Participants sometimes did not answer some of the questions or simply said they do not know enough about it, advising to ask the next person about the issue. There were two local field trips. The first was in Manila for visiting several locations which included water treatment plant, wastewater treatment plant and slums areas served by Manila Waters. The other was to visit treatment plant in Tirupur.

Data Analysis

Data analysis follows pattern recognition from all three case studies. The purpose is largely exploratory while also undertaking explanatory analysis in some instances. Thus, the analytical method is dominantly inductive, while also relying on deductive analytics where relevant.

The chain of evidence was maintained during data collection by asking the respondent, and understanding in respect to each question, what was going on before the reforms, what was intended through the reforms and what is the status now. While asking these questions, the focus was on laws and rules, organization, roles and responsibilities, incentive and management culture, as might have been relevant for that question.

As for example, in trying to understand about regulatory structure of water utility management in Manila, the chain of evidence was maintained by asking:

(i) what were the rules and regulations in this regard before the reforms, which organization was earlier responsible for governance, what were the incentives to that organization and what was the management culture like?

(ii) what change had been planned?

(iii) What is the current status?

3.4 Limitations of this Study:

There are potential limitations in respect of measurement validity, reliability, internal validity and external validity in the study. Each of these limitations were carefully considered in research design and efforts made to reduce their impact on the research findings.

Measurement validity arises on account of the difficulty in directly measuring or observing information asymmetry and all range of incentives. Instead, competition, monitoring practice and impact on tariff, coverage and efficiency are analyzed. The case study protocol was designed to focus the analysis on information asymmetry and incentive problems.

The reliability of data is also a limitation. Every person interviewed had vested interest in making data look favorable to the organization he represented. As for example, the manager of a poorly managed private utility would rather blame the regulator for his

woes. On the other hand, the regulatory officials may lack such basic capacity as data collection. They may, instead, take data provided by the private operators and present them, without verification, as official data. This problem of reliability was partially addressed by interviewing three persons in each category, thus helping to cross check the data. Further verification was obtained through interviews with independent stakeholders such as the World Bank, UNICEF, Asian Development Bank officials, NGOs, etc.

There are also threats to internal validity. Exogenous events, such as macro-economic shocks or global currency crisis, may have contributed to the exacerbation of regulatory problems, with adverse impact on tariff, coverage and efficiency. In such cases, the institutional mechanism of the country could not have sufficiently dealt with the issue. A global mechanism would have been needed. Also, the number of people interviewed to test the theoretical propositions of the research is low. These problems are sought to be resolved by carefully studying any global or regional crisis, financial or otherwise, which was not remediable by the institutions of the country. Also, the experts to be interviewed are from different categories, increasing representativeness and decreasing possible bias.

There are threats to external validity because cultural context can vary considerably. Although the analysis attempts to internalize the cultural factor as far as practical, the experience of a utility is not exactly transferable to a utility in another country with completely different set of cultural beliefs. This problem is sought to be remedied by recognizing the cultural context in the analysis.

CHAPTER 4: STOCHASTIC COST FRONTIER ANALYSIS

4.1 Introduction:

This chapter analyzes, using empirical method, the impact of public private partnerships and institutions on the cost efficiency of water supply systems. The analysis is undertaken using two data sets. The first is cross-sectional data of utilities from fifteen States of India. The second is cross-sectional data of utilities from four Asian countries (India, Malaysia, Philippines and Vietnam). The questions proposed to be answered and the underlying hypotheses are;

What are the impacts of country wide institutional environment on the cost efficiency of urban water utilities?

Hypothesis 1: Secure Property Rights should result in improved cost efficiency.
Hypothesis 2: Greater Business Freedom should result in improved cost efficiency

What is the impact of private sector ownership on cost efficiency of urban water utilities?

Hypothesis 3: Privately managed water utility should be more cost efficient than publicly managed utility.

In regard to the first question, the institutional environment elements taken for analysis are property rights security and level of business freedom. If high value of these support cost efficiency, the implication will be that contracts are easy to enforce even if they do

not account for all eventuality. Anything missing in the contract with respect to property rights or business freedom related issues will be eventually smoothened by larger country wide institutions, in a manner which is considered fair by all stakeholders. On the other hand, if these do not positively support cost efficiency or, in extreme case, have negative impact, it is necessary to design contract with greater caution, incorporating remedial measures.

4.1.1 Ownership and Institutions:

Past literature on the impact of ownership over cost efficiency of water utilities provide weak and uncertain evidence. The normal meaning of ownership is the entity which has legal rights over assets. However, in literature relating to water utilities, the term ownership is used in a different sense. It implies Public Private Partnership (PPP) such as concessions, lease and management contracts. In none of these cases the private operator is full owner of the assets. In fact, full privately owned utilities are rare in developing countries. Public Private Partnerships are, at best, temporary transfer of ownership such as in the case of concessions, but may not even include temporary transfer of ownership in case of lease and management contracts. In the case of concessions also, government remains the owner, although the responsibility to invest, manage and profit is transferred to private sector for specified period of time.

The term "ownership" should, therefore, be understood in its wider context. In this thesis, consistent with prior research on the topic, ownership means utilities fully operated

through PPP models such as concessions, lease and management contract. It excludes contracts for small components of utility operations, such as management contracts for billing, collection, etc., or service contracts. This chapter uses econometric techniques to analyze if ownership can explain cost efficiency.

Institutions consist of laws, rules, regulations, norms, expectations and organizations that shape economic exchanges. They are characterized by transaction costs and bounded rationality. They differ from one context to another. They can be varied within the constraints imposed by past experiences. Time available for effecting the change is also a constraint.

4.1.2 Literature Review:

The econometric analysis presented in this chapter is based on methodology followed in prior research on ownership and institutions. Some of the studies have already been discussed in preceding chapter. A few are discussed here in greater details, explaining how this research builds on the earlier ones and in what ways it differs.

Bhattacharya, Harris, Narayanan & Raffiee (1995) compared cost efficiency of private water utilities in US as compared to public utilities. They used stochastic cost frontier technique and translog functional form. They used secondary cross sectional data of 1992 for 221 utilities of which 31 were private. The dependent variable was cost while the independent variables were energy expenditure, labor wage, capital, production, system

loss, source of water, ownership, length of distribution pipes, etc. They found that when operations were small, private utilities were efficient but when scale of operations were large, public utilities were efficient.

Some of the limitations of the study are that translog functional form reduces degree of freedom and as the sample size is not large, this could have affected the result. Further, there is potential for inherent bias because of the fact that most private utilities in the US are small (Sidenstat, et al, 2000).

Estache and Rossi (2002) used stochastic cost frontier estimation technique and Cobb Douglas functional form to analyze secondary cross sectional 1995 data of 50 Asian utilities of which 22 were private. The dependent variable was cost while independent variables were salary, number of clients, daily production, number of connections, population density, percentage water from surface sources, number of hours water available on tap each day, percentage of metered connection, dummy for chlorination, dummy for desalination and 3 dummies for public private partnerships. The three types of dummies for PPP are for: (i) concessions, (ii) privately managed billing, collection, leak repair and meter reading and (iii) any other types of participation, such as source development, production and pumping.

They found that efficiency is not significantly different in private and public companies. They argue that competition matters more than ownership. They suggest regulatory

incentives for cost reduction and for ensuring that benefits of such reduction pass on to consumers.

Faria, Souza and Moreira (2005) use stochastic production frontier estimation technique with Cobb Douglas functional form to analyze cross sectional 2002 data for 148 utilities in Brazil of which 13 are private. The dependent variable is production and independent variables are length of piped network (proxy for capital) and number of employees (proxy for labor). They found that private companies are only marginally better.

A serious limitation of their analysis is that production frontier is not the best estimation technique for water supply systems. In most cities, water supply services are supply driven and the production level cannot be varied for cost minimization.

Kirkpatrick, Parker & Zhang (2006) use stochastic cost frontier estimation technique with Cobb Douglas functional form assumption to analyze cross sectional data for 76 utilities in Africa of which 9 are private. The dependent variable is cost while the independent variables were water distributed per year, number of hours water available each day, manpower cost per employee, water resource per capita, population served per connection, GDP per capita, Freedom Index, ownership dummy, sector specific regulation dummy. They found that there were no significant differences in cost efficiency between private and state owned water utilities in Africa. They also found that Freedom Index did not have significant impact on cost efficiency either.

The study of Kirkpatrick, Parker & Zhang (2006) on water utilities differs from others in that they have tried to capture the impact of institutions in cost efficiency. While there have been some studies on impact of institutions on water sector (Brewer, Fleishman, et al., 2007; Saleth and Dinar, 2008) there are no others specifically analyzing water supply systems.

4.1.3 Utility analysis for India:

In India, utilities are owned and managed by the government. In some cities, particularly the larger ones, utilities are managed by Authorities or Boards. These are manned by government officials and, although technically autonomous, usually lack the power to hire and fire staff. Moreover, they are dependent on the government for their annual budget, which further limits their managerial autonomy. Most small and medium sized utilities are managed by local municipalities, government owned statutory bodies or directly by government department. All of them are highly dependent for their finances on the State governments.

As nearly all utilities in India are run by government, the empirical analysis of Indian utility cannot address the effect of private ownership on efficiency. The analysis in respect to India, therefore, concentrates on institutional impacts, analyzing how varying economic freedom among the States affect cost efficiency. The name of the States, number of utilities in each, the score of the state in respect to Economic Freedom Index (EFI) is given in Table 4.1 below.

Table 4.1: Number of State utilities and corresponding institutional index

	Name of State	Number of utilities in database	EFI (Property Rights)	EFI (Business, credit and Labor)
1	Andhra Pradesh	19	0.451	0.262
2	Assam	1	0.140	0.245
3	Delhi	1	0.476*	0.279*
4	Gujarat	11	0.389	0.367
5	Haryana	6	0.476	0.279
6	Karnataka	10	0.344	0.228
7	Kerala	4	0.486	0.348
8	Madhya Pradesh	15	0.543	0.134
9	Maharashtra	17	0.257	0.498
10	Orissa	4	0.354	0.420
11	Punjab	8	0.374	0.200
12	Rajasthan	9	0.454	0.326
13	Tamil Nadu	18	0.545	0.223
14	Uttar Pradesh	19	0.274	0.353
15	West Bengal	9	0.169	0.371
16	Union Territories (UT)	2	**	**
	Total	153		

* No EFI value for Delhi; Hence, EFI values of the proximate State, Haryana, assigned to Delhi. They are culturally identical.
** No EFI value for Union Territories, which are small autonomous regions. EFI values of the proximate State have been assigned for cities in UT. Thus, Chandigarh city has values for Haryana and Pondicherry the value for Tamil Nadu. They are culturally identical.

4.1.4 Utility Analysis for Asian Countries:

Using secondary data of utilities from four developing countries in Asia, the research analyzes the impact of private ownership on the efficiency of utility. As discussed earlier in the chapter, past studies relating to the effect of ownership on efficiency have reached mixed conclusions. This research will contribute to the on going debate by taking data from four Asian countries. If ownership by private operator is found to contribute to utility efficiency, it will affirm the belief that profit motive is powerful for guiding utility towards efficiency. If not found true, there are likely other factors more critical than

ownership which contributes to utility efficiency. These factors then need to be identified and supported to ensure efficiency gains, irrespective of ownerships status.

In addition, this chapter analyzes if national level institutions and regulations enhancing economic freedom also explain utility efficiency. As in earlier research, property rights and business freedom are the two institutional aspects that are analyzed. As there have been only few empirical studies so far analyzing the impact of institutions on cost efficiency of water utilities, the analysis in this chapter will be a new and important contribution to existing stock of knowledge. The list of Asian countries, their pre-capita income, number of utilities, ownership status and economic freedom index for property rights and business freedom is summarized in Table 4.2 below.

Table 4.2: Number of Utilities in Asian Countries and their EFI

	Name of the country	Per capita GDP (US$) PPP-2008	Number of utilities	Number of PPP	EFI (property rights)	EFI (Business)
1	India	2,460	19	1	50	70
2	Malaysia	12,160	5	1	30	55
3	Philippines	3,430	8	1	50	70
4	Vietnam	2,310	15	2	10	40
	Total		**47**	**5**		

Details of 5 PPP utilities in the sample and how they compare to public utilities are discussed in section 4.2.4

4.2 Estimation Techniques and Model Specification:

The purpose of the analysis is to estimate the cost efficiency of water utilities. Several estimation techniques were considered for the analysis including OLS and Stochastic Frontier Analysis (SFA). Stochastic frontier estimation technique was found most

suitable for reasons described in next paragraph. Cobb-Douglas functional form was assumed on the basis of past research. The independent variables selected are consistent with past research. New independent variables that control for institutional differences have been included to test how significant is their impact on cost efficiency.

4.2.1 Discussion of statistical techniques:

OLS and Frontier Analysis are commonly applied techniques for estimating cost efficiency (IBNET, The World Bank[6]). OLS is simple in application, revealing information about cost structures and distinguishing how different independent variables affect the cost. Large data set is required for reliable results. This is always a problem in the case of water utilities, particularly in respect of developing countries. The regression results are sensitive to functional form. Explaining the error term is difficult, particularly differentiating noise (resulting from idiosyncratic events) and omitted variables. Corrected OLS (COLS) can be used to develop a frontier by shifting the slope towards the best performing utility. However, outliers can significantly affect the results.

Two types of Frontier Analysis are possible – Data Envelope Analysis (DEA) and Stochastic Frontier Analysis (SFA). The former is a non-parametric method which uses mathematical optimization models to develop a frontier. The inefficiency of a firm is measured by its distance from this frontier. The latter, in contrast, is parametric and assumes a particular functional form for the frontier. Depending on the nature of sector being analyzed, either production or cost frontier is constructed. The advantage of SFA is that it decomposes error term into two parts – random or stochastic terms and inefficiency

[6] http://www.ib-net.org/ accessed on 3rd Nov, 2008

terms. Hence, the measure of inefficiency is more accurate, as long as the choice of functional form is accurate.

4.2.2 Stochastic Cost Frontier and Model Specification:

Water supply utilities are supply driven and do not have control over production. They cannot vary level of production as part of their business plan. Controlling cost is their best option and, therefore, cost frontier analysis is more relevant in their case. The utilities will try reducing cost given input variable constraints. The true cost for a utility is difficult to quantify as the cost on account of capital stock is usually not known because of poor record keeping. The cost function used here is ad-hoc estimation with labor wage as one of the inputs besides proxies for capital stock.

The analytical foundation of Stochastic Cost Frontier lies in production economics and is derived from the concept of productive efficiency, defined as the degree of success producers achieve in allocating the inputs at their disposal and outputs they produce, towards meeting some objective. The measurement of productive efficiency, therefore, requires specifying producer's objective and quantifying degree of success with respect to the objective.

There could be four different objectives. The first is the objective of waste avoidance from which is derived the concept of technical efficiency. In this, the producer seeks to maximize output given inputs, or seeks to minimize inputs for achieving a given output.

The physical structure of production technology is determined solely by the quantities of inputs and outputs utilized for production, defining a boundary which is the feasible set of inputs and outputs. Using distance function, the distance by which a firm falls short of the feasible production boundary is measured to determine its technical efficiency. In theory, a firm that is perfectly technically efficient will lie exactly on the boundary, while the inefficient ones will lie beneath.

Cost, Revenue and Profit are the remaining three objectives of productive efficiency. While the previous measure of productive efficiency was constrained only by technological parameters, the remaining three imposes behavioral constraints on producers and conceptually measures economic efficiency. Cost efficiency imposes behavioral constraint of producing a given output at minimum cost (i.e., cost minimization). Revenue efficiency aims at utilization of given inputs to maximize revenue (i.e., revenue maximization). Profit efficiency is concerned with allocation of inputs and outputs for maximizing profits (i.e., profit maximization). In all these three, both price and quantity information are used for developing the frontier against which efficiency is measured using distance function.

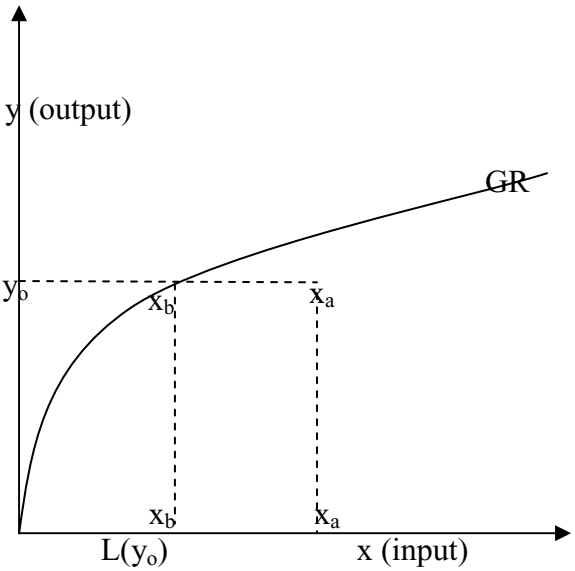


Fig4.1: Input/Output sets of Production Tech. (Single Input-Single Output)

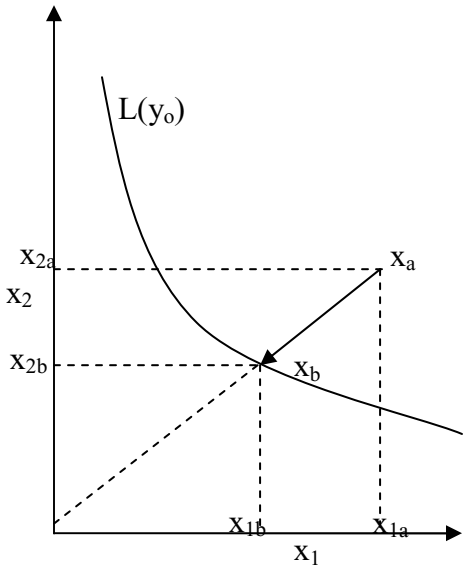


Fig4.2: Input Sets of Production Tech (Iso-quant of Two Inputs)

The concept of efficiency is illustrated using a production frontier first, and then extending the logic to cost frontier. Figure 4.1 represents the production technology. GR is the production frontier, and all firms produce either exactly on this line or beneath this. For a given production technology, $L(y_o)$, the minimum input required is x_b for producing y_o. If input is increased to x_a, the output will still be y_o. Thus, x_a is inefficient compared to x_b, given production technology, $L(y_o)$.

If the above argument is extended to two inputs combination, as in Fig 4.2, then iso-quant $L(y_o)$ represents their feasible set of combination for producing output y_o if x and y axis represent inputs x_1 and x_2, respectively In case a firm is using x_a combination of inputs, it

is far from the production frontier, and therefore, inefficient. The distance it has to radially contract from point x_a so as to reach the input combination point, x_b, which lies on the iso-quant as indicated in Fig 4.2, represents the magnitude of inefficiency of the firm.

Fig 4.3 below illustrates the cost frontier for output, y, and input price, w. E represents the point on cost frontier at which combination of inputs is least expensive for a given output level. All points over the cost frontier are inefficient combinations of inputs. Fig 4.4 below shows the input iso-quants, assuming two inputs (x_1 and x_2), for output y_a and input price, w_t. In general, the objective of the producer is to minimize the cost, w_x, they incur in producing the output, y. Cost efficiency is the ratio of minimum cost to observed cost.

In fig 4.4, the cost faced by a firm is $w_t x_a$ for output y_a. It is possible to radially contract the inputs combination to achieve cost $w_t \theta x_a$ which lies on the input iso-quant for output y_a. While this is technologically the best combination of inputs for cost efficiency, it is possible to further reduce cost because of the difference in relative prices of inputs, x_1 and x_2. The input allocation represented by slope $w_t x_e$, which passes through x_e and x_b, and is tangent to the concave iso-quant, is the minimum cost. Thus, cost efficiency is the ratio $w_t x_e / w_t x_a$. It has two parts – technical efficiency and allocation efficiency. The decomposition of these two parts requires detailed information about the inputs, and has not been attempted in this thesis.

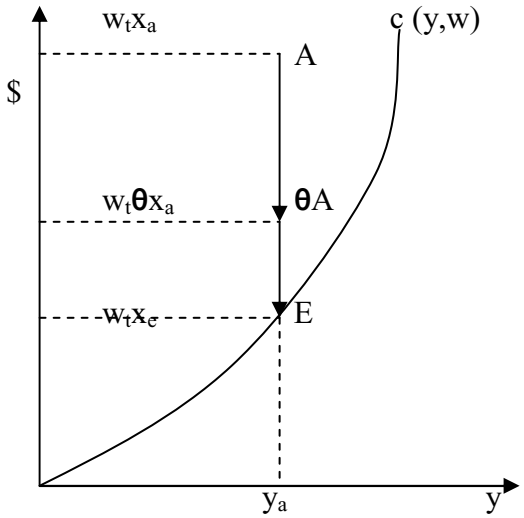


Fig 4.3: Cost Frontier

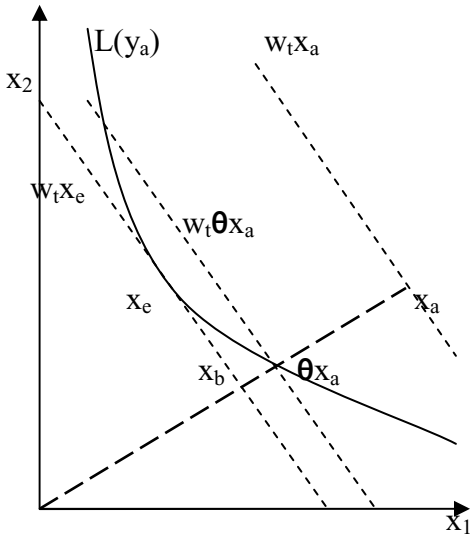


Fig 4.4: Input Iso-quant

Cost efficiency (CE) of the ith firm is measured by the following;

$$CEi = c\ (y_i,w_i)/\ E_i \qquad (1)$$

where c(y,w) is the cost efficiency frontier for all the firms, y_i and w_i are on this frontier and E_i is the observed expenditure of the ith firm. In this equation, the entire excess of observed expenditure over the minimum feasible is attributed to inefficiency. Random shocks not under the control of the producers and equally impacting all the firms are ignored. The equation can be improved modifying to include a stochastic component in the cost efficiency frontier.

$$CE_i = c\ (y_i,w_i).\exp\ (v_i)/E_i \qquad (2)$$

This numerator of the equation has two parts – the first part is deterministic, common to all firms and the second, exp (v_i), is stochastic and is firm specific. It is assumed that stochastic error term is normally distributed and independent of the regressors, iid N (0, σ_v). This should be the observed expenditure if there were no firm specific inefficiency. But the observed expenditure, which is the denominator of this equation, also includes firm specific inefficiency.

To account for firm specific inefficiency, a value u_i will have to be added to the error term such that the right side of the equation below explains the observed expenditure;

Thus, $Ei = c(y,w) \exp \varepsilon_i = c(y,w) \exp (v_i + u_i)$ (3)

Substituting (3) in the previous equation (2), we have

$CEi = \exp \{-u_i\}$. (4)

If u_i is present in the sample, its distribution should be positively skewed because u_i can only assume zero or positive values, the former implying it is on the frontier and the latter implying it is away from the frontier. (Pl see SFA details in Annex 4).

The inefficiency term, u_i, could assume half normal, truncated normal or exponential distribution. In this thesis, it is assumed that u_i is half normally distributed, iid N^+ (0, σ_u). This distributional assumption is unlikely to have significantly impact on the findings of the thesis (Kumbhakar and Lovell, 2000, p. 90). As u_i is not observed, the expected value of u_i given error term, ε_i, is derived using econometric techniques and then equation (4) above used to compute firm specific cost efficiency.

There are several econometric techniques for deriving the expected value of u_i and one of them is the method proposed by Battese and Coelli (1988) based on the following formula;

$$E[\exp(-u_i) \mid \varepsilon_i] = \{[1-\Phi(\sigma_A-\gamma\varepsilon_i/\sigma_A)]/[1-\Phi(-\gamma\varepsilon_i/\sigma_A)]\}*\exp(-\gamma\varepsilon_{i+}\sigma_A/2) \quad (5)$$

In this, Φ is the distribution function of normal random variable. Further, following the parameterization proposed by Battese and Corra (1977), $\sigma^2 = \sigma_v^2 + \sigma_u^2$, $\gamma = \sigma_u^2/(\sigma_v^2 + \sigma_u^2)$ and $\sigma_A = [\gamma(1-\gamma)\sigma^2]^{1/2}$. The parameter γ should lie between 0 and 1, with 0 indicating that deviation from frontier is entirely because of stochastic noise and 1 indicating that the deviation is entirely due to inefficiency. This permits the testing of hypothesis that there is no inefficiency effect in the model, Ho: $\gamma = 0$, as against alternative that Ha: $\gamma = 1$.

In Model specification for this analysis a Cobb-Douglas functional form is assumed, consistent with past research on cost efficiency of water utilities. Translog functional form is not considered because it will considerably reduce the degree of freedom which is not desirable because sample size is small. The model is specified as follows:

$$\ln COST = \alpha + \beta \ln SALAR + \omega_1 \ln POPSERV + \omega_2 \ln CONE + \omega_3 \ln PROD + \pi_1 \ln DENS + \pi_2 PSURF + \pi_3 DUFW + \pi_4 DFRDPR + \pi_5 DFRDBU + \pi_6 ONS \quad (6)$$

where the dependent variable is COST which is the Operational Cost, in thousands of US dollars, and includes expenditures for personnel, power, parts, chemicals, materials and bulk purchase. The independent variables include proxy for input prices, proxies for

outputs, environmental variables, institutional dummies and ownership dummies. These are explained below;

Proxy for Input prices:

SALAR= ratio of total salary cost to the number of workers. It is expected to be positively related to the dependent variable.

Proxies for outputs:

POPSERV= number of people served, in thousands.

CONE= number of connections, in thousands.

PROD = daily production, in million liters per day (MLD).

All the three are expected to be positively related to dependent variable.

Environmental variables/dummies:

DENS= population density in area served, in persons per square kilometers. The expected relation to the dependent variable is negative, as it is cheaper to service densely populated areas.

PSURF= Percentage of water from surface source. The expected relation to the dependent variable is positive as surface water is more expensive to treat than underground.

DUFW= Dummy, which is 1 if Unaccounted For Water is ≥ 20% and 0 otherwise.

Institutional Dummies:

DFRDPR = Dummy, which is 1 if Legal Structure and Security of Property Rights component of Economic Freedom Index (EFI) is high, else 0. The definition of Economic Freedom Index and when it is considered high is discussed separately.

DFRDBU = Dummy, which is 1 if Regulation of Business, Credit and Labor component of EFI is high, else 0. The definition of Economic Freedom Index and when it is considered high is discussed separately. The institutional dummies are for understanding the impact of economic freedom on the cost efficiency of utilities. Institutions and regulations contributing to economic freedom index can be considered as well designed for efficiency if cost is low. Thus, a negative relationship between economic freedom index and cost is expected.

Ownership Dummy:

PPP1 = Dummy, which is 1 when ownership is private (concessions/BOTs/Management Contract for entire operations) and 0 otherwise.

The model includes Economic Freedom Index (EFI) for the States in India developed by Rajiv Gandhi Institute for Contemporary Studies (RGICS), New Delhi. Economic freedom is defined by Heritage Foundation as the absence of government coercion or constraint on the production, distribution, or consumption of goods and services. RGICS improves on this definition by adding that besides not interfering in the working of markets, the government should "fulfill its duty of protecting life and property, and enforcing legal contracts and law (Debroy & Bhandari, 2005)."

EFI by RGICS gives a value between 0 and 1 to each State in India to indicate how the States compare in respect to economic freedom. Higher score imply greater economic freedom. EFI computation is derived from three distinct indexes and for each the States are assigned numerical value between 0 and 1. These three indexes are for;

- size of the government measuring expenditures, taxes and enterprises
- legal structures and security of property rights.
- Regulation of credit, labor and business.

The analysis here includes only the second two components – (i) legal structures and security of property rights and (ii) regulation of credit, labor and business. It should be noted that although the institutional factors are not specifically directed towards utilities, they create the environment within which utilities operate. The null hypothesis for the econometric analysis is that country-wide institutions do not impact cost efficiency.

As EFI is an ordinal number, it is difficult to comprehend what exactly a unit change in this index implies. The value of EFI for a State of themselves does not mean anything, but are useful for comparing with another State. In this research, EFI is used as a dummy with States ranking top 2 given the value of 1 (high) and the rest 0 (low). The changes required to transition from low to high can be understood through factors utilized in rank formulation and comparing on which factors is a low ranking State lagging with respect to the top two. The details of factors that went into rank composition can be found in the report of RGICS.

Two SFA models have been used to verify if ownership and institutions have significant impact on cost efficiency. The null hypothesis is that they do not have any impact and the econometric analysis will test if null can be rejected. The two models by which the test is proposed to be undertaken are Error Component (EC) Model and Technical Efficiency Effect (TEE) Model.

EC Model is based on Battese and Coelli (1992) specifications. It decomposes error term into stochastic and inefficiency component, computing for all independent variables in the specified equation.

$$\text{Thus, } ci = f(y_i,w_i) \exp(\varepsilon_i) = f(y_i,w_i) \exp(v_i+u_i) \qquad (7)$$

where c_i is the log of cost of production of the ith firm.
y_i is the vector of output of the ith firm
w_i is the vector of price faced by the ith firm
v_i is the random variable which is assumed to be iid N $(0, \sigma_v)$.
u_i is non-negative random variable on account of inefficiency in production, which is half normally distributed, iid $N^+ (m_i, \sigma_u)$

If u_i were to be 0, EC model will be transformed into OLS. Allocative efficiency condition is imposed. The inefficiency is estimated using equation (5); betas are estimated following a three stage process. First, OLS estimates of the functions are obtained. Second, two phase grid search of γ is conducted using beta parameters set to OLS values except intercept. Both α and σ are adjusted as per corrected OLS formula is Coelli (1992). All other parameters are set to zero. Finally, the values of γ selected in grid search are taken as starting values of an iterative procedure to obtain the final MLE.

TEE is based on Battese and Coelli (1995) specifications. The technique is inspired by prior empirical studies which estimated stochastic cost frontiers, predicted firm level inefficiency using the estimated functions and then regressed predicted inefficiency on firm-specific variables such as managerial experience, ownership characteristics, etc. Further, the two stage process has been integrated into single stage by Battese and Coelli (1995), expressing inefficiency, u_i, as an explicit function of a vector of firm specific variables and random error. Once again, allocative efficiency condition is imposed.

Thus, cost is regressed to the independent variables other than dummies and the resulting error term decomposed into stochastic, iid N $(0, \sigma_v)$ and inefficiency component, iid N^+ (m_i, σ_u). The inefficiency component is then regressed to dummies which are vectors of variables that are believed to influence the efficiency of a firm.

Thus, $m_i = z_i\delta$

where z_i is the vector of variables which may influence the efficiency of a firm. In this chapter, z_i implies ownership and institutional dummies and δ is the vector of parameters to be estimated.

4.2.3 Data Description and Estimation- Indian utilities:

The analysis is based on secondary data from 153 utilities of large and medium sized cities of India. Formally published in 2005, the data pertains to 1999, and was collected by Central Public Health and Environmental Engineering Organization (CPHEEO) which

functions under Ministry of Urban Development, Government of India. Only cities with population more than 100,000 were taken into account for this analysis. There were 186 such cities in 1999. Out of these, data for only 153 were complete for enabling statistical analysis[7].

CPHEEO collected data on many variables related to water supply services. Only relevant data points were taken for this research which include (i) operational and maintenance expenditure, (ii) expenditure on salary, (iii) number of employees, (iv) population served, (v) number of connections, (vi) production, (vii) density of area served, (viii) percent of water supplied from surface sources and (ix) percent of water lost, i.e., Unaccounted for Water (UFW).

An average utility produced 125 million liters per day. About 66% of water produced were drawn from surface sources and balance from underground aquifers. The cost of treating and supplying water was US$ 2.8 million per annum. In average, 736,000 people were served by a city utility through 54,000 connections. Tenali served just 34,000 people, which constituted only 20% of its population, while Delhi served 12 million. The cities were dense with average of 8,827 persons per square km. The data is summarized in Table 4.3 below.

[7] Data for three cities in respect to their area were missing in the report and have been taken from their websites. These are Mandya from http://www.mandyacity.gov.in/, Solapur from http://www.solapurcorporation.com/ch_gat.asp and Bhubhaneshwar from http://orissa.gov.in/ourbmc/

Table 4.3 : Average Water Supply Variables

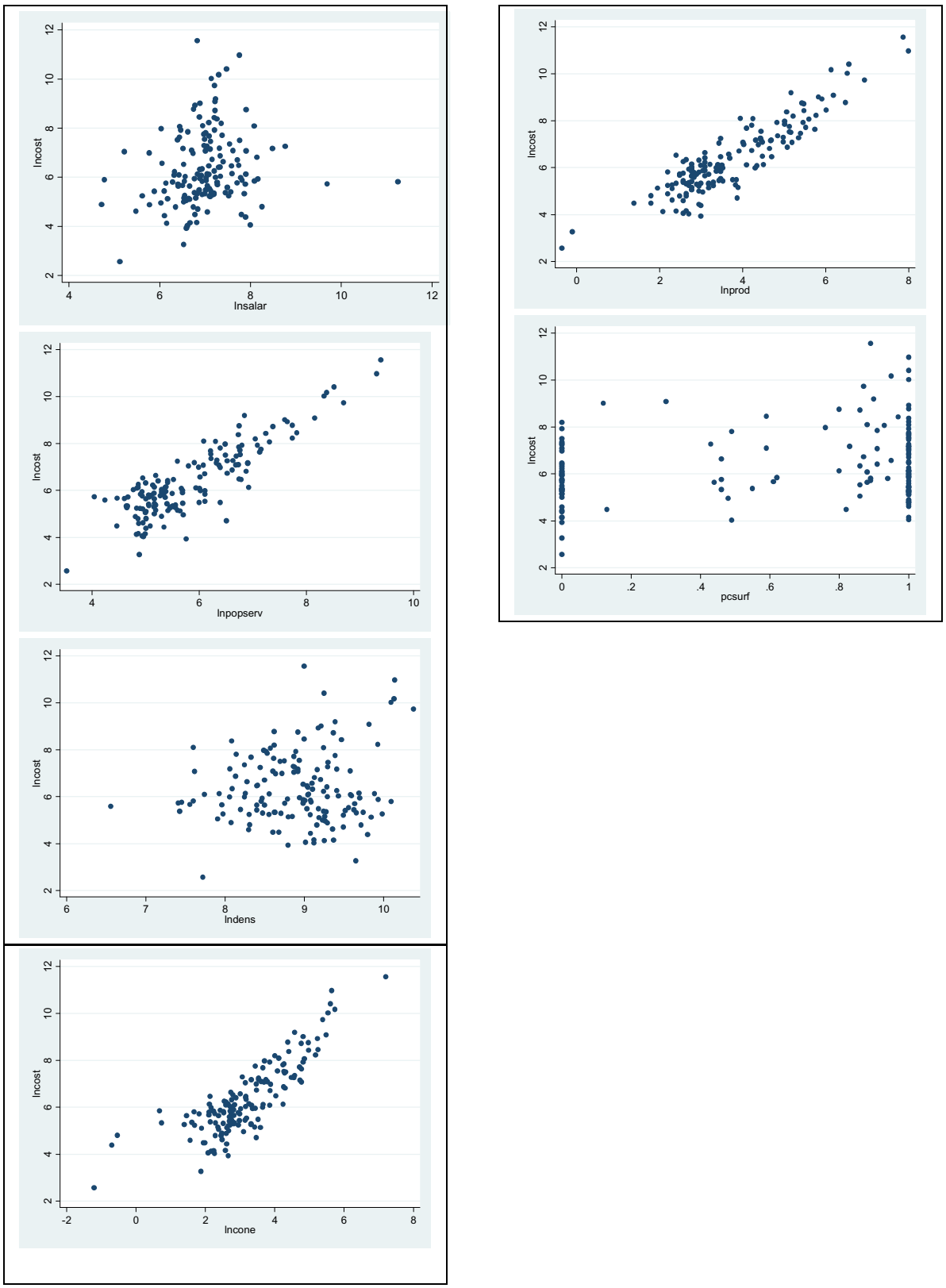
Variable	Obs	Mean	Std. Dev.	Min	Max
annual cost	153	2791.745	10343.77	13	104064
salary/emp	153	1885.523	6266.765	112	76667
pop. served	153	735.6961	1531.967	34	12000
connections	153	53.98473	120.8711	.299	1350
production	153	125.3961	342.7017	.7	2978
density	153	8827.745	5518.366	703	32029
quality	153	4.996732	3.930103	.5	24
% surface	153	65.75163	42.77393	0	100

Units: Annual Cost in '000 US$; salary/employee in US$; Population Served in '000; Connections in '000; Production in million liters per day; density in persons/sq km; Quality in hours of running tap.

The relationship of the log of cost to the log of all these variables is given in the scatter plot below. At least three scatter plot support Cobb Douglas functional specification (lncost vs lncon, lnpopserv and lnprod). One of them has opposite slope (lncost vs lndens). The other two graphs also skew towards right.

Skew test gave a positive value, indicating the presence of inefficiency term in the sample.

Figure 4.5: Scatter Plot of lncost with independent variables



The Error Component (EC) Model was first computed, following both OLS and MLE methods. The MLE estimates represent the cost frontier outputs. Both outputs are summarized in Table 4.4 below. The dependent variable is the natural log of cost.

Table 4.4: Error Component Model for estimating effect on Cost

Dependent Variable: LnCost (natural log of Cost)

Independent Variables	**OLS**	**MLE**
Lnsalar	0.17 (0.06)***	0.17(0.06)***
Lnpopserv	0.31 (0.14)***	0.31 (0.14) ***
Lncone	0.30 (0.08)***	0.30 (0.08)***
Lnprod	0.53 (0.12)***	0.53 (0.11)***
Lndens	- 0.20 (0.08)***	-0.20 (0.08)***
Pcsurf	0.12 (0.13)	0.12 (0.12)
Dufw	0.01 (0.11)	0.01 (0.11)
Dfrdpr	-0.06 (0.13)	-0.06 (0.12)
Dfrdbu	0.43 (0.16)***	0.43 (0.16)***
Constant	2.02 (0.86)	2.02 (5.51)
R adjusted	0.84	
Wald Chi Square		892.58
Lambda		0.002 (6.84)

*** Significant at 5% level; ** Significant at 10% level.

The coefficients of five independent variables are significant at 5% level and their signs are in line with expectations, positive for salary, population served, number of connections, daily production and negative for population density. The coefficient for water source is positive but is not significant. Both the OLS and MLE methods give nearly the same coefficients. The adjusted R square for OLS is quite high.

The dummies, however, are difficult to interpret. UFW dummy has positive sign against expectation of negative but the coefficient is not significant. In case of EFI for property rights, the coefficient has a negative sign as expected but, once again, it is not significant.

EFI for business regulation is positive, against an expectation of negative, and is significant at 5% level. This means that cost of utilities in top two ranking States (Maharashtra and Orissa) is 43% higher compared to remaining States because of business freedom, holding all others constant. The implication is the possibility that higher business freedom, while good for overall economy, may not have positive impact on water utility efficiency[8].

The result of TEE is summarized in Table 4.5 below. FRONTIER 4.1 was used to compute both OLS and MLE estimations (STATA was also used to cross-check some of the outputs, particularly to check OLS regressions as well as for MLE computations in case of EC Model). The computation process of the inefficiency term follows the methodology prescribed by Battese and Coelli (1995). The coefficients of the independent variables and their signs are consistent with EC Model and in line with expectations. Also, in respect to sign and significance of dummy for institutions, the results from TEE Model are similar to EC Model and in both one of the dummy does not have expected sign.

The dummy on property rights has negative sign in line with expectations. The estimate show that increase in property rights protection by a State to a level equal to that of top 2 States in India will result in 49% decline in cost. However, the coefficient is not statistically significant.

[8] The regression was also run with dummies for States. Some of the States were dropped by STATA because of collinearity; dummy for business freedom was no longer significant but sign remained unchanged.

The coefficient for institutional variable relating to credit, labor and business has a positive sign, implying, that in comparison to other States, the top two ranking States incur 49% more cost, holding all other variables constant. The result is significant at 5% level. Both EC and TEE models show that an increase in this variable contributes negatively to cost efficiency.

Table 4.5: Technical Efficiency Effects Model for estimating impacts on Cost

Dependent Variable: LnCost (natural log of Cost)

Independent Variables	**OLS**	**MLE (Method 1) FRONTIER 4.1**
Lnsalar	0.12 (0.06)**	0.16(0.71)***
Lnpopserv	0.27 (0.14)**	0.31 (0.35)
Lncone	0.26 (0.07)***	0.30 (0.07)***
Lnprod	0.61 (0.11)***	0.54 (0.28)**
Lndens	- 0.20 (0.08)***	-0.22 (0.14)
Pcsurf	0.18 (0.12)	0.12 (0.16)
Dufw		-0.03 (0.40)
Dfrdpr		-0.49 (0.42)
Dfrdbu		0.49 (0.20)***
Constant	2.47 (5.09)	2.30 (1.04)
Log Likelihood	-137.81	-131.43
Wald Chi Square	831.90	
LR Test		12.75***

*** Significant at 5% level; ** Significant at 10% level.

Likelihood ratio test gave a value of 12.75 which was significant at 5% level, indicating presence of inefficiency term and technical efficiency effects.

4.2.4 Data Description and Estimation – Asian Utilities:

This part of the analysis is based on secondary, cross-sectional data from 47 utilities belonging to four different Asian countries. The data is for 2005, and was compiled by Asian Development Bank (ADB). While database of ADB includes many variables, the ones utilized for this analysis are: (i) annual operation and maintenance cost, (ii)

percentage expenditure on personnel (iii) number of staff, (iv) number of connections, (iv) population served, (v) production, (vi) area served and (vii) percent of water for which no revenue could be collected, i.e. Non-Revenue Water (NRW)[9] and (viii) ownership status.

In average, a utility served 1.5 million people, the lowest serving only 80,000. The average daily production was 301 million liters per day, distributed through 136,000 connections. A city had 7492 people in average per square kilometer and they received water for 15 hours daily. The cost of supplying water was US$ 13 million per annum. The summary is at Table 4.6 below.

Table 4.6: Average Water Supply Variables – Asian Cities

Variable	Obs	Mean	Std. Dev.	Min	Max
Annual cost (m US$)	47	13.168	24.08702	.579	106.449
Salary/empl(US$/year)	47	2705	2245.942	482	9516
Pop. Served (000)	47	1493.149	2242.574	80	13000
Connections (000)	47	135.8085	170.5266	11	812
Production(m lit/d)	47	301.6596	530.3123	6	3200
Density (per/sqkm)	47	7492.957	8363.262	19	29613
Quality (hrs)	47	15.19149	9.547253	.25	24
UFW (%age)	47	.2965745	.1179953	.128	.595

The utilities in the database having PPP are listed below. They are either concessions or BOTs. In case of Metro Cebu private operation is limited to bulk water supply management. In average, utilities having PPP serve 1.2 million people, the lowest serving 400,000. The average daily production is 396 milion litres per day which is distributed through 209,000 connections. The average density on PPP managed cities is 3058 persons per sq km which is less than half that of the total sample. It implies that PPP is

[9] NRW is different from UFW, although they are related. NRW includes UFW (water lost due to technical loss, such as leakages in the pipes) plus water which was supplied but for which bill could not be collected (for reasons such as free supply to government, non-payment of bills, etc).

more common in cities that are less densely populated in as far as this sample is concerned. The average cost of supplying water is US$ 26 million. This is twice that of the total sample.

Table 4.7: Utilities with PPP in the Asian City Sample

Utility	Country	Cost 000$	salar $/y	popserv '000	cone '000	prod m lit/d	dens p/skm	quali hrs	pufw %age
Binh Thuan	Vietnam	1974	1042	399	33	31	1156	23	.263
Tien Giang	Vietnam	1746	1310	800	55	68	1826	24	.484
Johor	Malaysia	106449	6317	3069	812	1366	163	24	.374
Metro Cebu+	Philipp	14057	9150	1639	106	145	2185	20	.274
Jamshedpur*	India	7461	7530	488	39	370	9959	6	.128

+ PPP limited to bulk supply
*This utility in India supplies to industrial township as well as local neighborhoods. It has been run by private operator for more than 50 years.
(Data Source: Databook of South East Asian Water Utilities 2005, Asian Dev Bank)

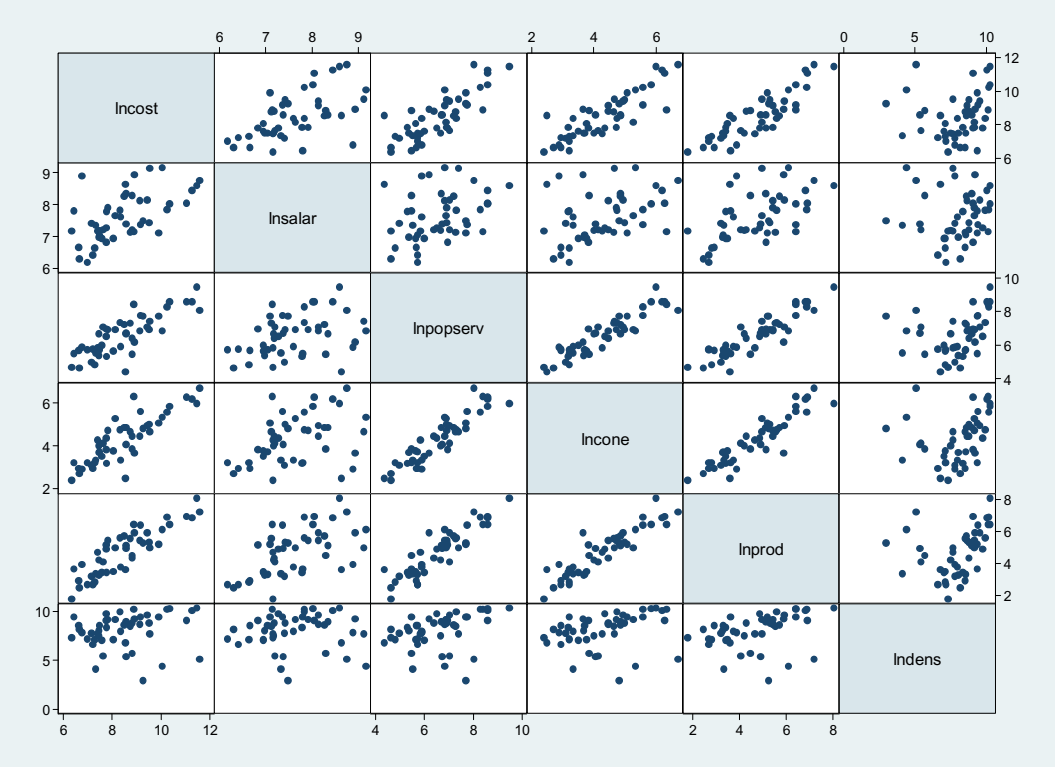
Table 4.8: Average Water Supply Variables – Asian Cities with PPP.

Variable	Obs	Mean	Std. Dev.	Min	Max
Annual cost (m US$)	5	26.33	45.06	1.74	106.449
Salary/empl (US$/year)	5	5069.8	3695.111	1042	9150
Pop. Served ('000)	5	1279	1113.914	399	3069
Connections ('000)	5	209	338.3083	33	812
Production (m lit/day)	5	396	557.9843	31	1366
Density (per/sq km)	5	3057.8	3933.903	163	9959
Quality (hrs/day)	5	19.4	7.668116	6	24
UFW (in %age)	5	.3046	.1330932	.128	.484

The scatter plot matrix below gives the relationship of log of cost to the log of other variables for the case of total sample in Asian cities. The use of log has considerable reduced heteroskedasticity. ADB database had some missing points and outliers that were found to be errors. Corrective actions were taken as explained. Three cities – Binh Doung, Sarawak and Metro Cebu - did not have data to support computing the personnel cost per annum. The data from IBNET of The World Bank, was used for computing average personnel salary for these three utilities. Also, ADB data did not have figures for

UFW in case of Bhopal and Indore while figures for staff in case of Bhopal and Jabalpur were clear outliers, and evident errors. These figures were verified from concerned utilities of Bhopal, Indore and Jabalpur through a senior official in Government of Madhya Pradesh. The corrected figures provided by the three utilities have been used in the analysis.

Figure 4.6: Scatter Plot Matrix of lncost with independent variables



The Economic Freedom Index used in the analysis is from Heritage Foundation, USA, and concerns the level of business freedom and security of property rights (refer section 4.1.3). The index used is for 2005 and they take value from 1 to 100. The Business Freedom Index measures the freedom entrepreneurs have in starting business, obtaining licenses and closing businesses. The Index on Property Rights measure how secure is

property rights. Both these are not directly comparable to EFI developed by the RGICS, India, but deal with similar issues. The index are again used as dummy, with score of 50 and above counted as 1 (High) and lower values as 0 (Low).

The effect of Public Private Partnerships on cost efficiency has been analyzed using a dummy. BOT , Concessions and management contract for entire utility management are given the value of 1 and other forms of management are treated as government managed and given value of 0. There were several utilities in this database which have service contracts with private sector, or even management contracts for a small component of their job, such as bill collections. However, these types of private sector involvements were ignored as they do not constitute major managerial control impacting cost related decisions.

The result of the Error Component Model is summarized in Table 4.9. In both the OLS and MLE methods, salary, population served and number of connections are not found significant for cost. However, production is significant at 5% level, with one percent increase in production contributing to 0.60%-0.70% increase in cost. Density is also found significant at 10% level, a more densely populated area contributing to decline in cost. The impact of Non-revenue water (NRW) on cost efficiency is not found to be significant. But once again the institutional variables show strong and significant impact on cost efficiency. High property rights index is associated with downward pressure on cost (increase in cost efficiency). In contrast, higher business freedom index show an upward pressure (decrease in cost efficiency). The effect of PPP is found different in

OLS and MLE methods. While OLS show a negative sign for PPP, suggesting lower costs, the coefficient is not significant. On the other hand, MLE shows a positive sign for PPP, suggesting cost increase. The coefficient is significant at 1% level.

Table 4.9: Error Component Model for estimating effect on Cost

Dependent Variable: LnCost (natural log of Cost)

Independent Variables	**OLS**	**MLE**
Lnsalar	0.25 (0.19)	0.08(0.06)
Lnpopserv	0.01 (0.23)	0.09 (0.26)
Lncone	0.41 (0.26)	0.15 (0.33)
Lnprod	0.58 (0.25)***	0.69 (0.19)****
Lndens	- 0.11 (0.59)**	- 0.22 (0.12)**
Dufw	0.02 (0.22)	- 0.10 (0.36)
Dfrdpr	- 0.73 (0.32)***	- 1.15 (0.19)****
Dfrdbu	0.60 (0.27)***	1.27 (0.21)****
ppp1	- 0.04 (0.30)	0.33 (0.02)****
Constant	2.84 (1.16)**	4.02 (0.69)**
Log Likelihood	-38.83	-33.72
LR test		6.21***

**** Significant at 1% level; *** Significant at 5% level; **Significant at 10% level.

The result of TEE model is summarized in Table 4.10 below. Increase in salary is found to increase cost with coefficients significant at 1% level. Population served has expected sign but continues to be statistically insignificant. Number of connections has expected positive sign with coefficient significant at 10% level. Daily production and population density also show expected sign and both coefficients are significant. The coefficient for NRW continues to be insignificant. The coefficients for institutional variables, however, are strongly significant at 1% level. Again, higher index of property rights is associated with reduction in cost but higher business freedom index is associated with higher cost. The dummy for Public Private Partnership show a negative sign implying a reduction in

cost due to such partnerships, but the coefficient is statistically insignificant. But LR test is not significant at 10% level, implying relatively weak support to above observations.

Table 4.10 Technical Efficiency Effects Model for estimating impacts on Cost

Dependent Variable: LnCost (natural log of Cost)

Independent Variables	**OLS**	**MLE (Method 1) FRONTIER 4.1**
Lnsalar	0.33 (0.18)***	0.29(1.10)****
Lnpopserv	0.10 (0.22)	0.06 (0.17)
Lncone	0.48 (0.25)***	0.44 (0.27)**
Lnprod	0.33 (0.23)	0.48 (0.17)****
Lndens	- 0.89 (0.57)**	- 0.10 (0.05)***
Dufw		- 0.02 (0.01)
Dfrdpr		- 0.66 (0.20)****
Dfrdbu		0.57 (0.22)****
ppp1		- 0.56 (0.27)
Constant	2.35 (1.62)	2.41 (0.81)
Log Likelihood	-40.66	-36.80
Wald Chi Square	206.66	
LR Test		7.72

**** Significant at 1% level; *** Significant at 5% level; ** Significant at 10% level.

4.3 Analysis of the empirical findings:

There are several findings related to institutions and ownership relevant for this dissertation. The first concerns effect of institutional variables on cost efficiency, their significance and possible reasons. The second is the effect of public private partnerships.

4.3.1 Institutional Variables:

The higher index of property rights appears to be associated with lower cost in both cases – Indian and Asian utilities. The coefficient is not significant in case of India, but significant at 5% level in case of Asian utilities. Protection of property rights implies

effective and quick dispute resolution mechanisms and capacity of government and judiciary to enforce laws protecting property rights. A country with better property rights protection mechanism is likely to have lower transaction costs associated with coping. As for example, in countries with lower property rights index, the utilities may require more security guards. Also, disputes with private suppliers or private parties will likely be delayed. Both these add to cost.

An important insight is that the degree of property rights protection a country ensures, reflected by its rank in corresponding index, positively impacts cost efficiency of water utilities. Therefore, regulatory governance mechanisms and regulatory incentives should strengthen property rights, irrespective of ownership status, for improving cost efficiency of utilities.

The higher business freedom index, in contrast, appears to be associated with higher cost in both Indian and Asian utilities. The coefficient is strongly significant in both. The business freedom index implies ability of entrepreneurs to quickly set up businesses, get licenses easily and close business as and when they desire. In case of India, the index also includes access to credit and employee layoffs without hindrances. Although the evidence is limited by small sample size, the positive and statistically significant coefficient for business freedom index in both Indian and Asian utilities underline the need to seriously scrutinize underlying causes. There could be several reasons behind this finding. First, higher business index is resulting in a more vibrant private sector, drawing away talented

managers from utilities. With lower managerial capacity, the utilities may be turning less and less efficient.

Second, higher business freedom implies that concerned State government or country are cash surplus. They might be budgeting more for the public utilities. The managers are likely to utilize excess cash for unproductive office uses first (Savedoff and Spiller, 1999) rather than efficient operations.

In summary, the important insight is that increasing business freedom for the economy as a whole does not result in cost efficiency for water utilities, whatever be the underlying reasons. In fact, it could even have negative impact. Laws and regulations enacted for business freedom at the country level, while benefiting the general economy, can impact water utilities negatively unless counteracting measures are taken. This makes it imperative that regulatory governance structure and regulatory incentives specific to water supply business be considered. The important components of regulatory designs in this respect are discussed later in the dissertation, using case study methodology

4.3.2 Public Private Partnerships:

Empirical evidences do not show consistent outcome for public private partnerships (PPP) in respect of cost efficiency. Separating inefficiency terms from random noise show that PPP decreases inefficiency but the coefficient is not significant. Hence, no conclusion can be drawn. It appears that, in conformity with prior research on this

subject, PPP itself is not as important to cost efficiency as the underlying regulatory environment in which the utility operates.

Existing theories appear to point towards importance of competition and monitoring. As per Williamson's (1979) categorization of transactions discussed in Chapter 2, governance structure can differ widely. While non-specific goods with high frequency of transaction and low level of uncertainty are best governed through traditional free-market mechanism, complex governance arrangements are required for idiosyncratic goods where frequency of contracting is low, such as the case of water supply services. At one end, therefore, is the free market and at the other relational contracting and vertical integration. High business freedom for country-wide economy enhances efficiency of free-market mechanism but will not affect bilateral governance structures or vertically integrated structures. To ensure water utilities are efficient, regulatory governance and incentive arrangements should try introducing, as far as practical, competitive pressures similar to that observed in free markets.

4.4 Limitations:

The sample size is small. While data on India covers only 153 cities, only 47 cities in four countries are covered for Asia. Lack of data on water utilities of developing countries has been observed to be a serious limitation for undertaking empirical analysis (Davis, 2005; Estache and Rossi, 2002). The data used is cross sectional and not longitudinal. A limitation of cross sectional data is that it does not reflect cost efficiency

over long term. This is particularly important for water utilities because the life-time of water supply infrastructure is very long. The cost of capital stock is not included. The analysis is based on operation and maintenance cost as a proxy of total cost, in line with prior research on the subject (Estache and Rossi, 2002). This is because data on capital stock is not available for water utilities in developing countries. Consequently, even if cost appears low in many cases, this could be misleading as depreciation of capital stock is excluded. Moreover, the total cost should also include the cost of tax collection through which utilities are financed by the government. While the cost to capital for private sector is likely fully reflected, this is not the case with government. Finally, the sample size for water utility with PPP is small.

Another limitation of the study is the possibility of omitted variables causing the betas of dummy variables in TEE to appear very significant. Analysis based on panel data can help ascertain if the significance is truly on account of the dummies or are bias resulting from omitted variables.

CHAPTER 5: CASE STUDIES OF MANILA, TIRUPUR AND DELHI

The dissertation undertakes case studies of three cities – Manila, Tirupur and Delhi. The purpose is to discover common pattern of institutional structures which contributed to establishment and continuation of Public Private Partnerships (PPP). As Delhi is an example of failure in adopting PPP, the expectation is that the pattern contributing to establishment should be absent in its case. Further, the pattern contributing to continuation of PPP in Manila and Tirupur should differ from publicly managed utility in Delhi. This chapter first gives the background of the two countries to which these cities belong, including a brief account of their history. Thereafter, case studies of three cities are presented.

5.1 Background:

Philippines and India are both developing countries in Asia with democratic form of governance. They have a colonial past, followed a policy of centralization after independence and eventually embraced principles of market-based economy. Reforms resulted in rapid economic growth. Basic statistics relating to the two countries are in Table 5.1 below.

Table 5.1 : Philippines and India – Basic Data, 2007

	Philippines	**India**
Population (million)	83 million	1,094 million
Population growth rate (%age)	1.8%	1.6%
Area (in sq km)	300,000 sq km	3,287,000
GDP in billion US$ (2006)	US$ 100 billion	US$ 690 billion
GDP Growth rate	5.4%	9.2%
GDP per capita (PPP-2008)	US$ 3,430	US$ 2,460
Per capita water resource (m3)	5,767	1,733
Agriculture use (%age)	74%	86%
Industrial use (%age)	9%	5%
Domestic use (%age)	17%	8%
Water Service coverage	14%	36%

Source: Global Water Intelligence, 2007/World Bank

The islands of Philippines were discovered by Ferdinand Magellan in 1521 AD and soon the country, dominated by population of Malaya origin, was colonized by Spain. A notable feature of the Spanish rule was conversion of majority population to Christianity. In 1898, a popular uprising supported by the United States ended the Spanish rule. Political power passed on to the United States, the new colonial ruler of Philippines. In 1941, during the 2nd World War, Japanese invaded Philippines leading to a brutal occupation. The country was liberated by United States army in 1945, and granted full independence in 1946.

The country inherited a democratic governance structure, similar to the United States, with a strong President and independent congress. But democracy suffered a set back between 1972 and 1986 when President Marcos seized absolute power and ruled as a dictator. During this period, all major economic activities were nationalized and government ownership of large businesses was strongly favored. In 1986, the government of President Aquino came to power. She reversed earlier policies, limiting the role of government in commercial activities. New laws and rules were enacted in support of

privatization. In 1992, President Ramos became the President and he continued pursuing policies of President Aquino. Soon after he assumed power, Manila witnessed acute electricity crisis. President Ramos rapidly privatized the sector. By 1994, to the surprise of everyone, private sector was supplying uninterrupted electricity to Manila city. This rapid turnaround created confidence among the people about effectiveness of privatization policy and legitimized privatization as a solution to infrastructure woes of the country (Dumol, 2000).

India is an ancient civilization which has witnessed many ups and downs over last 4000 years. Ruled by the Buddhist and Hindu kings until the 11th century AD, its area and culture, at one time, dominated much of South Asia and Malaya peninsula regions. The rising Muslim kingdoms of the Arabian Peninsula in the 11th century soon made inroads into India, attracted by its wealth and prosperity. The next 700 years of Indian history was politically dominated by Muslim rulers, most of whom espoused liberal religious policies. Thus, the traditional social and cultural norms and beliefs of the country continued to persist in rural India, with minor changes.

The British arrived in India as traders during the 16th century. Attracted by wealth and splendor of the courts, and aware of its military weaknesses, British East India Company soon conquered much of India. But it chose not to rule the country directly, re-appointing the defeated rulers on conditions that they would be obedient to East India Company and promote its interests. The agenda of East India Company was purely commercial and political power was a means towards that end. The British under East India Company

avoided any cultural clashes with local population, aware this could negatively impact their commercial objectives. The social and cultural norms of the country remained unchanged, but economic condition of common people steadily declined. In 1857, after a brief but violent uprising against East India Company, the British Crown intervened and took over the reins of power from East India Company, becoming the new ruler of India.

Under the non-violent leadership of Mahatma Gandhi, India achieved freedom from British Crown in 1947. However, the British decision to bifurcate the country into a Hindu India and Muslim Pakistan resulted in deaths and displacement of millions of people. Rejecting the British policy of divide and rule, India chose to be secular, accepting the unique contribution to its culture and traditions by various religious groups in different periods of history. The experience under East India Company and British Crown led to citizens of post independence India holding commonly the belief that large businesses entities and foreigners should not be trusted.

India inherited British style democracy, with Parliament as legislative branch and Council of Ministers led by Prime Minister as executive branch. Nehru, as India's first Prime Minister, began the tradition of heavy government investments in key economic sector. During 1970s, the government of Indira Gandhi nationalized many commercial activities, including the Banks. For a brief period in 1977-78, she assumed absolute powers of a dictator, but she suffered a resounding defeat in the elections of 1978 and relinquished power In 1991, with the cold war over, and global economic trend unequivocally tilting towards liberalism, India embraced new economic policies and began encouraging

private sector initiatives. The software boom of late 1990s spurred adoption of further liberal economic policies, strengthening popular beliefs on efficacy of market principles.

5.2 Case Study of Manila Water Supply:

5.2.1 Introduction:

Manila households experienced running tap water as early as 1878 when Manila Waterworks Authority was established by Governor Domingo Moriones with funds bequeathed a century earlier by Don Francisco Carriedo y Peredo, a public spirited Spaniard who migrated to Philippines in early 18th century and undertook many infrastructure works. When Carriedo died in 1743 he left behind money in his will for construction of Manila waterworks. Spanish colonialists attached great value to water services. Historian Nick Joaquin noted that among the Spanish "no casa was grande that did not have its own fountain and no first-rate pueblo that didn't have sufficiency of public pozos"[10].

In 1971, Marcos administration transformed Manila Waterworks Authority into Metropolitan Waterworks and Sewerage Authority (MWSS). The responsibility for water supply was delegated to local government, but with infrastructure in poor conditions, local governments found the task challenging. In 1973, a new management model was conceptualized to help local government overcome financing problem. They were

[10] http://traveleronfoot.wordpress.com/2008/03/04/the-carriedo-legacy-and-the-twin-fountains/ accessed on 3 April 2009.

encouraged to constitute water districts and these districts were granted certain degree of autonomy in managing their finances. Over next two decades, several new organizations were set up to coordinate actions in the water sector. Aquino administration in mid 1980s tried to streamline overlapping responsibilities. The decentralization and autonomous functioning of water utilities continued to receive encouragement.

5.2.2 Public Private Partnership:

Ramos Administration in 1990s accelerated the process of Public Private Partnerships in infrastructure. After successful private sector participation in power sector reforms, President Ramos wanted private sector involvement in water sector reforms too. Some of the strongest reasons for reforming water sector were complexity of government procurement processes, increasing fiscal demand on government for water utility operations under MWSS and public demands for improving operational performance (Dumol, 2000). By early 1990s, private operators were beginning to show commercial interest in MWSS. In 1994, a Malaysian firm and Biwater, a British firm, jointly approached the Philippines government for direct purchase of MWSS. In 1994, Biwater again approached the government while a third effort was made by a consortium of local and foreign firm in 1995.

National Water Crisis Act was enacted in 1995, clearly articulating government's intention of improving water supply services through any means, including private participation. The law clearly defined property rights in water, with clauses for

imprisonment of those found guilty of water theft. Section 8 of the act addressed pilferage and read as follows;

"It is hereby declared unlawful for any person to:

a)

b)

..

..

(f) use or receive the direct benefit of water service with knowledge that diversion, tampering, or illegal connection existed at the time of that use, or that the use or receipt was otherwise without the authorization of water utility;

(g) steal or pilfer water meters, main lines, pipes and related or ancillary facilities

(h) steal water for profit or resale

..

.."

Section 9 clarified what constituted evidence and against whom. Section 11 set the process of awarding punishment to offenders, with punishments ranging from disconnection of supply to jail time. The law was undoubtedly hard and amply demonstrated the commitment of the government for reforms. Further, the government increased tariff by 38% in August 1996 before inviting private bids for concessions.

MWSS area of operation was divided into two parts – East Zone and West Zone, and concessions granted for these areas separately, following a transparent and competitive bidding process. The bidding was for price and the lowest bidder was found to have bid below the existing tariff. Although Manila Water had bid the lowest for both Zones, the bid rules did not allow for same concessionaire running operations in both zones. Hence, Manila Waters was asked to choose and they selected East Zone. Maynilad Water Service, Inc., was awarded the West Zone.

The terms and conditions of the bid required the concessionaire to absorb operational manpower of the MWSS, pay concession fee to MWSS and assume responsibility of re-paying MWSS debts. Prior to bidding, the government of Philippines had extended a handsome voluntary retirement scheme to the employees of MWSS and nearly 30% employees had taken advantage of it. Although the remaining employees were not very keen about private sector participation, they had understood its inevitability because of the strong will demonstrated by government and example of success in case of similar invitation to the private sector for power sector reforms. The concessionaires were expected to pay annual fees to MWSS. They were also expected to shoulder the burden of MWSS debt repayment. While Manila Water became responsible for 10% of the debt repayment, Mynilad was responsible for repaying 90% of the debt. The difference in their burden was explained by the fact that much of the capital investments in the past were undertaken in West Zone which became Myniald's area of responsibility.

Both Manila Waters and Mynilad were consortiums of domestic and foreign companies. Manila Waters was a consortium of one domestic company, Ayala Corporation, and three foreign companies - United Utilities, Bechtel and Mitsubishi Corporation. Maynilad Water Services, Inc., was a consortium of Benpres Holding Corporations, the Filipino partner and majority stakeholder, and Suez Lyonnaise des Eaux of France.

A Regulatory Office (RO) was established in the MWSS. It was expected to function autonomously, and funding for its operations was to come from concessionaire as part of the the contract provision. The government could appoint four regulators in the Regulatory Office – one each for supervising technical, economic, financial and legal aspects of operation. The appointees were expected to serve for a fixed term of 3 years and their salary could not be varied to their disadvantage once they occupied office. The salary was competitive to attract best talents in the country. The decision of Regulatory Office was subject to approval by Board of Trustee - the same political entity to which MWSS also reported.

The concession contract for 25 years was signed in Feb 1997 and operational responsibilities for their respective zones handed over to Manila Waters and Mynilad from 1 Aug 1997. In the succeeding years, both operators faced severe difficulties on account of Asian financial crisis in 1998 and, soon after, El-Nino related drought. The water in Angat reservoir, supplied 98% of city's bulk water, declined by nearly 30%. The crisis resulted in confrontation between operators and MWSS, with Regulatory Office trying to find an amicable solution acceptable to both. In a way, the contract was tested to

its limits very early in its life. Pursuing separate management, financial and technical strategies, the two companies emerged differently from the crisis. While Manila Water declared its first profit in 1999, Mynilad was on way to declaring bankruptcy by 2003, never ever making profit.

In 2001, Mynilad suspended payment of concession fees to MWSS and the issue went to international tribunal. The problem was about quantum of debt repayment. Under the concession agreement Mynilad was obligated to assume the burden for re-paying 90% of MWSS debts. Since peso, the local currency had devalued considerably on account of Asian financial crisis, Mynilad found its debt repayment obligation in dollar very high. Mynilad asked for tariff increase to recover the difference on account of currency devaluation. The regulatory office was accommodative but the level of increase proposed was not acceptable to MWSS. The issue, therefore, reached the international tribunal. In early 2003, Mynilad served notice for termination of contract and later that year filed legal documents for bankruptcy protection. In 2004, Supreme Court of Philippines ordered forfeiture of the performance bond of US$ 120 million, which Mynilad was liable for, having terminated the contract. In the same year, MWSS submitted to the Supreme Court a rehabilitation plan for Mynilad which was accepted by the Court.

In 2005, Mynilad and MWSS, assisted by the regulatory office, operationalized the rehabilitation plan. Under the agreement, MWSS assumed ownership of 84% of the company, and this share was re-bid in 2006. Although Manila Waters was one of the

bidders, it lost out to a consortium led by Consunji – a leading civil contractor group in Manila. The new consortium is now operating Maynilad.

The performance of Manila Water and Mynilad is compared with pre-privatization period in Table 5.2 below. There is an all round improvement in services, particularly in respect to the quality of water and continuity of service. Coverage has also significantly increased. UFW is low in case of Manila Water but remains significantly high in case of Maynilad.

Table 5.2: Comparing Pre and Post reforms Water Supply Service Indicators

	Prior to PPP (pre-1997)	**Manila Water**	**Mynilad**	**Remarks**
Households served (in millions)	7.3	3.4	6	Data: 2002
Water availability (hrs/day)	16	24	21	Data: 2008
Staff per 1000 connections	9.8	4.1	4.1	Data: 2002
Water Coverage	67%	82%	78%	
Unaccounted for Water	63%	20.2%	66%	Data: 2007
Fecal Coliforms Counts (sample tested/ found positive)	639 samples of which 45 (7%) tested positive	6234 samples of which 21 (0.3%) tested positive	7549 samples of which 52 (0.7%) tested positive	Data: 2002

5.2.3 Property Rights:

The issue of property rights is on account of high government opportunism witnessed in water utilities of developing countries. In case of Manila, the property rights in water supply have been traditionally strong compared to other cities in developing countries. The water supply infrastructure construction was initially funded by a benevolent donor.

Over time, waster supply districts were constituted, reflecting the general belief in the government of the time that utilities should have independent source of revenue. But, government opportunism was not totally overcome, as evident from other aspects of water supply management. The tariff was low. A number of water connections were illegal.

Prior to PPP, government enacted laws which clearly articulated property rights in water utility operations. The theft of water was made illegal and an offender could be imprisoned. Illegal water connections were liable to be severed. Possibility of private sector involvement in water sector was clearly articulated in the new law. Concession contract constitute the basis of property rights, In case of Manila concessions, rebasing, which is mandated by the contract, provides a significant opportunity to limit government opportunism. Rebasing is a five yearly exercise in which the regulator scrutinizes in details all expenditure and revenue of the private operator tor ascertain if tariff is leading to fair returns to investments. This protects the property rights of private operator.

The views of regulator, private operator and other parties in regard to property rights security from government opportunism, as collected during interviews, are listed below.

Table 5.3: Summary of Interviews – Property Rights, Manila Utilities

Regulator Views	Private Operator Views	Views of ADB officials
* Contract provisions, including provision for rebasing ensures no expropriation. * Maynilad failed because of poor management and not government	*This is not a worry for Manila Water officials as they feel there is credible commitment from the government, asexpressed through laws. * contract is well specified	*Contract provisions plus rebasing take care of property rights * government expropriation is not an issue to worry in current context.

opportunism; it has been revived now. * Water law hasstrong property rights clauses * Contracts are followed in letter and spirit; periodic discussions are held with private party.	and protects property rights; * secure property rights have enabled innovation as evident from the fact that a new water treatment method is being tested by Manila Waters. * Manila Waters is concerned about their property rights security when contract ends. * new property rights have been created through publicly traded shares of Manila Waters * Maynilad officials believe that MWSS acted opportunistically, disallowing tariff increase to recover from currency devaluation.	

The regulators believe that property rights of the private operator are secured through laws and contract provisions. The experience over last 10 years has been that these rights were duly protected. The property rights of the government are secured through concession contracts, with annual fees paid to MWSS by concessionaire. This arrangement has functioned well so far. The property rights of the customer are secured by ensuring good quality service for the price they are paying, in accordance with contract provisions and rebasing agreements.

Manila Water officials believe that the company's property rights are well secured under existing arrangement, with protection granted by law as well as contract provisions. Mynilad officials, however, did not share this belief. They stated that MWSS acted opportunistically, not cooperating during the Asian crisis of 1998, resulting in failure of

Mynilad. Regulator, however, disagreed with the opinion of Mynilad management and stated that they were flexible to the extent the contract permitted. While sympathetic to operator's problem, they deliberately did not show flexibility beyond a point because of fears that this would undermine credibility and expose the government to charges of favoritism. Also, the regulators countered that property rights are secure because when West Zone operated by Mynilad was re-auctioned, consortiums of private companies submitted bids, including Manila Waters. This would not have happened if private operators were concerned about property rights security. The regulators believe that Mynilad failed because of poor management and not due to opportunistic behavior of the government

An issue of concern articulated by an official of Manila Water was with regard to property rights security at the end of contract term, particularly of the shareholders of Manila Waters. In recent rebasing exercise, Manila Waters had approached the regulator to consider extending its contract term but the regulator turned down the proposal. Perhaps preparing for the uncertainty at the end of contract, Manila Water has begun entering new water markets, establishing business partnerships in several countries in Asia, including India.

Property rights security is leading to innovations. Manila Waters is experimenting with a new water treatment method. It is also contemplating entering bottled water segment.

Asian Development Bank (ADB) officials believe that property rights in water supply are fairly well secured in Philippines, including in the case of Manila. Laws and concession contracts define property rights in Manila while periodic rebasing help sort out differences.

An interesting observation is that new property rights were created when Manila Waters went public. The shares of Manila Water is held by general public and traded in the Manila stock market. This has resulted in new property rights being created which is beyond that envisaged by the law or the concession contract. As the share price of Manila Water is directly linked to its performance in supplying water to Metro Manila, the property rights of the shareholders are directly related to the quality of performance. Shareholder expectation is resulting in the management striving continually to improve performance and maintaining good customer relationships.

5.2.4 Effectiveness of Regulatory Office:

Traditionally, water supply in Manila was managed by MWSS. It had financial autonomy but was run by civil servants under general control of politicians. There was no incentive in exploiting market power through high tariff or monopoly pricing.

During the process of public private partnerships, the geographical area of Manila was divided into two parts and bid separately for preventing monopolistic control. The objective was also that if service in one of the areas failed, the operator of the other could

take over the functions. The staffs of MWSS were proposed to be absorbed by private firm that wins the bid. There would, thus, be continuity of sector knowledge, and if the arrangements were to fail, the manpower would at least have familiarity and linkage with MWSS. Further, the contract envisaged regulatory office, to be funded by the winning bidders, which had the mandate to control monopoly powers and ensure service quality.

The views of the regulator, private operator and other stakeholder in respect to control of market power were as follows;

Table 5.4: Summary of Interviews – Control of Market Power, Manila Utilities

Regulator Views	Private Operator Vews	Views of Others
* Contract does not allow for unilateral rate revision by the operator. * regulator considers rate revision every 5 years. * dividing of area of Manila into two parts limited market power of the private operator. * creation of autonomous regulator has prevented operators abusing monopoly powers. * regulator monitoring to control market power.	* have never intended to abuse monopoly powers. * competitive bidding reduced opportunities for capture by firms which might have been attracted only by market power. * proposal for tariff increase is always backed up with reasons.	* rebasing of tariff and other rates (concession, debt payment, etc) every 5 years prevents monopoly power. * control of market power has to be achieved in tandem with other regulatory requirements such as high service quality and control over externalities.

In the interviews, the regulators stated that their presence and active monitoring prevents private firms from gaining undue market power. Also, the initial decision to divide Manila city into two parts for bidding reduced chances of undue control of market power by any single private entity. Further, the rules for bid were such that the same operator could not be granted concessions for both parts even if its bid was lowest. The objective was to control market power and the rule came to use immediately after the bids were

opened. Manila Water had quoted the lowest for both the zones. It was asked to choose one of the two. After Manila Waters selected East Zone, Mynilad, the next lowest bidder, was awarded the concession for West Zone.

The regulator added that periodic rate rebasing balances any disproportionate market power that may become evident.

Both private operators denied any intentions on their part to gain monopolistic control over water supply, saying they always cooperated with the regulator on such concerns. They agreed that dividing the city into two parts prevented concentration of market power on any one private entity.

ADB officials interviewed were of the opinion that periodic rebasing was an effective tool for controlling market power. If the regulators were to observe that the private operators were making heavy profits through efficiency improvements or technological innovations, it possesses the power to realign incentives in next rebasing exercise.

In summary, the control of market power has been achieved through two means. The first was the decision to divide Manila into two zones with different concessionaire for each. The second is the periodic rate rebasing exercise. However, it is apparent that the period between two rebasing can provide substantial control over market power to the private operator, particularly when the information asymmetry between regulator and the operator is high.

5.2.5 Governance Mechanisms:

Governance mechanisms imply the type of regulator and the manner in which contracting parties manage relationship. These are arrangements established by the contracting parties and do not demand behavioral changes among consumers, although the outcome of the arrangement could demand behavioral change.

In years prior to reforms, MWSS was the service provider and also the regulator, as often is the case in utilities of developing countries. It functioned under general control and guidance of the government, reporting to Ministry of Public Works and Highways (MPWH). The regulatory function was distributed between MWSS and MPWH. In view of inherent conflict of interest in such arrangements, there was no effective regulatory enforcement.

The need for reforms was for overcoming the imminent crisis due to past practices of MWSS. Excessive dependence on groundwater was leading to subsidence in some parts of Manila city (Munasinghe, 1992). The quality of water was deteriorating. Poor maintenance was leading to loss of much water in transit. There was also substantial theft of water through illegal connections established in connivance with MWSS staff. MWSS lacked fund for operational and capital expenditure while government grants were declining under fiscal pressure. These circumstances resulted in government enacting National Water Crisis Act, 1995.

Regulatory office was established in accordance with concession contract terms. It is not, therefore, based in statute.

The views of the interviewed regulator, private operator and ADB officials regarding the autonomy and capacity for credible commitment of regulatory office is listed in the table below.

Table 5.5: Summary of Interviews – Governance Mechanisms, Manila Utilities

Regulator Views	Private Operator Views	Views of ADB officials
* Regulatory functions limited to Manila city. * MWSS staff, current and previous, cannot be appointed in regulatory office * Regulatory office owes its origin to contract and not to any statute; derive authority from the contract terms. * Regulatory Office run by fund which concessionaire obliged to pay by contractual terms *Regulatory Office reports to MWSS Board of Trustee, but this does not compromise their autonomy. * RO not quasi-judicial in character * 4 regulators whose tenure is staggered to ensure continuity of knowledge. * regulators are aware of the sensitivities of the Congress when they take decisions * Regulators have	* Officials of Manila Waters believe that Regulatory office is autonomous from the government, but this view was not shared by officials of Maynilad. * advice of regulatory office rejected by MWSS Board of Trustee during Asian crisis. * regulator is constantly in touch with private operator over various issues. * there are also informal relationship between regulator and private operator which helps in accomplishing tasks faster and leads to better understanding of issues * regulators were not competent in the beginning but have improved vastly over time. * regulation has got tougher over time; less accommodating now than earlier. *	* regulator should have national mandates; the current one is limited to Manila. * regulator is not independent; it advises the Board of Trustee which may or may not accept recommendations. * in past, during the Asian crisis, the Board of Trustee rejected the advise of regulators. * the rejection of regulators advice is not commonly observed now. *capacity of personnel in regulatory office requires strengthening * there are too many lawyers and too few representatives of other disciplines relevant for regulation. * although the regulatory office is not the most ideal, the regulator and the private operator have developed informal relationship which

developed informal relationships with private operators. * rebasing exercise is very exhaustive and could last as long as 8 months. *foreign experts are inducted for specialized purposes for which regulator believes it lacks capacity. * relationship with private operator is similar to that of "marriage" where both parties want the relationship to work and learn more about each other's behavior over time.		somehow works.

During the interview, regulators were emphatic in claiming that they act independently. While accepting that they submit recommendations to MWSS Board of Trustee, a politically appointed body, they argued that their recommendations were backed up with logic and they have been firm in standing behind their decisions. The regulators appeared highly conscious of the need to maintain their credibility. They have relatively lean office, with about 70 staff in all. In case of need the office hires experts from the open market, including international expert.

Manila Water officials stated that regulator functions independently but Mynilad official did not share this opinion. The regulator's recommendations for tariff increase had been rejected by MWSS Board of Trustee in the aftermath of the Asian crisis, and Mynilad official pointed out to this fact in arguing that regulator office was not fully autonomous.

Manila Water officials shared that the capability of regulator has improved tremendously over time. While they found dealing with regulators easy at the beginning of the contract, the regulators were much more demanding now. This was resulting in tremendous pressure for performance on officials of Manila Waters.

ADB officials shared their belief that regulatory office is not technically independent from the government but functions credibly because of government's cooperation. They, however, conceded that regulator have taken stand in the past which were opposite to government views. Two ADB officials were insistent that fully independent regulator was essential in the long-term and its jurisdiction should be the entire country. One of them stated that the capacity of the regulator could be further improved by hiring experts from different disciplines; currently regulatory office is heavily dominated by lawyers, "which may not be helpful in balanced understanding of various problems".

Concession contract constitutes the core of governance structure for managing relationship between private operator and government. Prior to the reforms, there was no (or weak) regulator. The government and public operator were in a hierarchical governance structure. The concession contract, however, resulted in a trilateral governance structure. The regulatory office, international arbitrator and the local courts could become the third party to which both private operator and the government had the option to turn for remedies. During the Asian crisis, disputes between private operators and the government went into international arbitration, but most of the time regulatory office has successfully resolved relationship issues.

The informal relationship that regulatory office has maintained with the private operator, and its comparative proximity to government, has resulted in a relational contracting type of structure developing over time. Regulatory office has facilitated the informal development of relational contracting, and one of the regulator characterized relationship with private operator as similar to "marriage" where both parties seek commitment and fair play. Clearly, the regulatory office is acting as the representative of the government in this "marriage". But by scrupulously maintaining relative autonomy and independence from the government it has facilitated developing a relationship of trust with private operator.

In summary, the independence of regulator in Manila appears well adapted to the low level of political opportunism found there. Past experiences indicate that political opportunism in Manila water supply systems were not to the level noted in many other developing countries. MWSS was ring-fenced in terms of finances, i.e., its accounting systems was independent from other municipal functions. Moreover, the move for reforms was driven by President Ramos, the highest leader of the country, which reduced opposition and rent-seeking at lower political levels. Thus, although regulatory office is not technically independent, it has served with considerable autonomy over past one decade. The skills and competency of the office has improved over years. The hiring policy appears flexible for bringing on board experts, including foreign experts, as and when needed. The regulatory office has tended to be rigid in its interpretation of contracts, afraid that flexible interpretation could compromise its credibility. On the other

hand, for issues not covered by the contract it has shown reasonable degree of flexibility too, as evident in its response to Asian crisis when its recommendations were beyond the contractual terms and was not fully acceptable to the government. In summary, it has followed a balanced, middle path.

5.2.6 Competition:

There was no competition in water supply in the year preceding reforms. MWSS was a monopoly. Several types of competitive pressures were noticed during interviews. The views of the interviewed regulator, private operator and ADB officials regarding competition is listed in the table below.

Table 5.6: Summary of Interviews – Competition, Manila Utilities

Regulator Views	Private Operator Vews	Views of ADB
*Mynilad vs Manila Water division resulted in competition not only during bidding but even after. * Benchmark competition is occurring.	* benchmark competition is being utilized * internally, Manila Waters transfers its employees to all departments in rotation, so they might have information concerning all facets of utility and the organization can achieve better coordination * Corporate governance structure created after going public, resulting in greater accountability. *Maynilad officials felts that competition policies were not well planned; they pointed out to "unjustifiably" higher debt repayment allocation to	*shares of Manila Waterstrading publicly is a great plus *imperfect information is the greatest obstacle to competition; don't even know the length of pipelines buried underground.

	Mynilad * Mynilad official added that water PPP was driven by ideology and undertaken in haste.	

Regulatory officials in their interview stated that initial competition was for prices because the contract was proposed to be awarded to the lowest bidder. Interestingly, the lowest bids were below the existing prices. This indicated the belief of the low bidding companies that they could make profits by improving operational efficiency than by relying on tariff increases. The strategy followed by Manila Waters and Mynilad were, however, different. Manila Water concentrated on reducing Unaccounted-for-Water but not Mynilad. By 1999, it was clear that the strategy of Manila Waters was succeeding while Mynilad had started to falter. Although competition resulted in reduction in prices and improvement of services, the gains could not be sustained all through the city. Also, this competition was only a one time process.

Both officials of the regulatory office and Manila Waters mentioned about benchmark competition which currently guides their performance. Manila Waters officials stated that there were no benchmark earlier but of late the regulator has set 8 Benchmark Indicators against which the performance of the utility is monitored. This has resulted in great pressure on Manila Waters. One of the first actions the management of Manila Waters has undertaken is reconfiguring the organization, aligning it to the performance requirements. Also, as a matter of policy, staff of Manila Waters are rotated from one

department to another so they may have sound understanding of how their works are inter-related and what can be done to improve efficiency through better coordination. Staff performing excellently are recognized and rewarded, including vehicle drivers and store keepers. In other words, all levels of jobs are given importance and incentives provided for all to perform their best.

Another driver to performance appeared to be the competition in capital market. As shares of Manila Water are publicly traded, the management is under capital market pressure to perform. Since tariff is fixed after rebasing, the immediate means of improving financial performance is expanding services and customer networks, enhancing efficiency and reducing costs. Emboldened by its success in Manila, and conscious of its responsibilities towards shareholders, Manila Waters has begun expanding to water supply markets in other Asian countries, including India. This is possibly because Manila Waters will reach the end of its current contract in 15 years time and unless there are other businesses at hand, the company will be out of work.

The interviewed official of Maynilad explained that competition could have been better but the entire process of privatization was driven hurriedly, under direct orders of President Ramos who wanted the process completed before his demitting office a year later.

ADB officials stated that public trading of shares has made Manila Waters more competitive and professional. They acknowledged that competition at the time of bidding

was not perfect because of incomplete information about the assets. The resulting loss of welfare can be perceived as the transaction cost of the entire public private partnership process and is acceptable as long as it is less than net gain to social welfare from improved services and coverage.

Although some experts have cited Maynilad as a case of failure of PPP, this does not appear to be the case. Firstly, the government did not discontinue PPP; instead, the operation was re-auctioned and concession granted to a new consortium. There was no public opposition to PPP. Moreover, Manila Waters participated in re-auction but failed to win the concession; their success could have heightened fears of monopolistic control. Secondly, the initial concession contract was also a learning process, revealing many information not available before. The fact that a consortium of private firm not in water business won against Manila Waters indicate sufficiency of information now for submitting competitive bids.

5.2.7 Monitoring:

In years prior to reforms, monitoring was the responsibility of MWSS. Being both the service provider and monitoring agency resulted in conflict of interest, preventing efficient operations and service delivery. Regulatory Office became the monitoring agency after PPP.

The views of the interviewed regulator, private operator and ADB officials regarding monitoring is listed in the table below.

Table 5.7: Summary of Interviews – Monitoring, Manila Utilities

Regulator Views	Private Operator Vews	Views of ADB
* Regulators were trained in Florida for monitoring tasks *23 points of performance monitored – 14 KPIs and 8 BM * failure has impact on next rebasing exercise.	*Regulatory Office is regularly monitoring performance *Rebasing is a 5 yearly monitoring process *Independent surveys and monitoring by NGOs also * Initially regulator was weak; but over time it has become strong * In 2008 rebasing for Manila Water, regulator placed restrictions on how expenditure can be made; reorganization resulting from this rebasing in an attempt by Manila Waters to adapt to this new regulatory requirement. * public assessment are also carried out *NGOs are active, and keep both the regulator and Manila Waters on toes. *Monitoring by other government departments also – health, safety, environment. * MWSS information about Mynilad areas was not	* Manila Water sells to bulk consumers and their distribution performance is not as rosy as claimed by them; regulator should address this issue.

	institutional but individual; Maynilad found more assets in field than reflected in bid documents.	

Soon after concession agreement was concluded, the Regulatory Office staffs were trained in University of Florida to strengthen their capacity for monitoring and regulation. The interviewed officials of regulatory office stated that they are currently monitoring Manila Water and Mynilad over 23 performance parameters. Out of these, 14 are performance indicators and 8 are benchmarks. These are regularly monitored and operators are asked to explain shortfalls. These performance indicators are not directly mentioned in the concession contract but are derived broadly from the contract documents. Agreement to monitor them were reached with the private operator during the rebasing exercise (rebasing with Mynilad was in process at the time of interview). In addition, the officials shared that independent monitoring by internationally recognized institutions are undertaken from time to time at the request of regulatory office. Non-government organizations are also active and conduct their own evaluation.

The officials of Manila Waters stated that they were regularly monitored for performance by Regulatory Office and the most intensive monitoring occurs during five yearly rebasing periods. They have a separate office for coordinating queries from the regulatory office. Over years, the regulator has become tougher with monitoring, and this is a source of concern for them. As for example, regulatory office is now monitoring expenditure for each sub-project agreed in previous rebasing; earlier, monitoring was confined to broad targets, and Manila Waters could change sub-projects as long as the overall targets were

being met. Thus, if land problems prevented laying down water supply pipelines in one particular area, Manila Water could undertake the same task at another location. The regulatory office was satisfied as long as the number of households connected was as per target. But now the regulatory office does not accept such unilateral changes in sub-project locations.

In addition, Manila Waters and Mynilad are also monitored by other departments such as Department of Health (for quality of drinking water) and Department of Environment and Natural Resources (for pollution control standards).

ADB officials stated that monitoring could be further improved. The coverage claimed by Manila Waters is perhaps not entirely correct because many are bulk connections with distribution from the bulk point onwards the responsibility of other agencies. Thus, connections in Manila city may not be as high as claimed, and requires closer scrutiny.

With shares of Manila Waters trading in stock market, the capital market regulator of Philippines monitors its financial statements. This is an added dimension of monitoring which contributes to improvement in corporate governance. Such monitoring was not envisaged in the contract document.

5.2.8 Incentives:

The views of the interviewed regulator, private operator and ADB officials regarding incentives is listed in the table below.

Table 5.8: Summary of Interviews – Incentives, Manila Utilities

Regulator Views	Private Operator Views	Views of ADB
*Some targets are specified in contract while others are decided during rebasing *RO have to keep Congress in the back of their mind while rebasing. *Expenditure can be disallowed if performance targets are not met. *Currency devaluation risk is covered. *Tariff can be revised in case of extraordinary situations	* Targets are more specific from 2003 rebasing onwards; tariff increase depends on performance * tax has increased *tariff is linked to customer service * salary of employees higher than earlier; more motivated staff * same set of employees were retained; younger employees recruited in Manila Waters at lower level; Maynilad replaced top level management. * 2003 rate rebasing introduced the concept of performance indicators – both rewards and penalties were possible – forced Manila Water to re-think strategy * 2008 rate rebasing disallowed US$ 200 million of expenditure for Manila Waters	*Poor appear to have no objections to PPP; NGOs are more vocal about rate revision, and they represent the middle class interests. *Penalty should be balanced with incentives; * Penalties are imposed during rate rebasing; for example, opening position could be reduced. The rebasing process takes almost 8 months and is a tedious process. Regulator hires consultant during this period.

The tariff policy follows rate of return regulation. Tariff is linked to inflation and generates the revenue stream. The discount rate permitted between rebasing periods makes it possible for revenue stream to recover expenditure while ensuring fair returns. The rebasing exercise undertaken every five years revises the discount rate and tariff structure, taking into account the expenditure plans for the next 5 years. The expenditures are for capital and operating purposes, and are essential for the firm to achieve the overall targets set in the concession contract.

Current incentive structure favors expansion. More the investments, higher are the returns. However, the rebasing period sets limit to the investment. Over-investments beyond that authorized by the Regulator can result in investments being disallowed for computation of returns. For example, in the rebasing exercise of 2008, expenditure of US$ 200 million made by Manila Waters was not allowed by the Regulatory Office. The rebasing exercise between the Regulatory Office and the private operator is very detailed, and takes as long as 8 to 9 months.

The rebasing exercise has evolved over time. In the second rebasing of 2003, targets were set and allowance of expenditure was contingent on meeting these targets. In 2008 rebasing, the targets were made more stringent.

There are incentives for the staff as also the economically weak customers. In years prior to 1997, the staff of MWSS received salaries similar to the civil servants working elsewhere in the government. With transfer of ownership the salary structure of the staff

has improved. This has attracted many young talents, particularly in Manila Waters, resulting in better service quality at the field offices. The low income groups appear to have benefitted from the concession agreement. In public debates on privatization, the interest groups representing the poor have defended the private sector participation as well as tariff increases, while interest groups representing the middle class have been found opposing tariff increases.

The tariff structure follows an IBT pattern. Tariff also includes an environmental surcharge of 12%. Any differential due to exchange rate fluctuation is passed on to customers – this could be positive (a credit, when peso becomes stronger compared to dollar) as well as negative (when peso weakens against the dollar). The Regulatory Office examines the impact of foreign currency devaluation every quarter. In case of Manila Waters, the current IBT rates are as follows;

Table 5.9: Incremental Block Rates in East Zone serviced by Manila Waters

Consumption Blocks	**Tariff (in Peso)**
First 10 cubic meters	69.16
Next 10 cubic meters	8.44
Next 20 cubic meters	16.00

Source: http://www.manilawater.com/customer-service/how-to-compute-your-water-bill

5.2.9 Dispute Resolution

The views of the interviewed regulator, private operator and ADB officials regarding dispute resolution mechanism is listed in the table below.

Table 5.10: Summary of Interviews – Dispute Resolution, Manila Utilities

Regulator Views	Private Operator Views	Views of ADB officials
*Crisis of 1997-98 was a good experience for future. * have treated differences as conflicts that occur in "marriage". * do not prefer to go to arbitrator and would rather have issues settled by discussions.	*Contract has provision for arbitrator but had to go up that far only once; the crisis was a good learning process for all. * 1998 crisis resulting in arbitration was very useful in one sense – it helped to understand how system works * Maynilad had responsibility for 90% of MWSS debt which led to its failure. * Asian monetary crisis affected the situation. *Maynilad stopped payment of concession fees, declared bankruptcy and went for international arbitration. * the issue went up to Supreme Court and finally the rehabilitation plan proposed by MWSS, prepared in coordination with Regulatory Office, was approved and implemented.	* Crisis was a good learning experience for all parties. * Government wary of its international reputation. * A large number of lawyers have been involved in this deal from all sides; they have played a dominant role.

The first level of dispute resolution mechanism is the Regulatory Office. Thereafter, the contract envisages international arbitration. The Courts in Philippines also have a role to play. Disputes occurred in the early stages of the contract which Manila Waters and the Regulatory Office staff consider as learning experience that tested the robustness of the

arrangements, and helped shape their expectations. The reasons for disputes were the unexpected currency devaluation on account of Asian economic crisis of 1997 and failure of Al-Nino in 1998 which led to draught in Philippines. The experience was particularly bad for Maynilad, and its dispute with MWSS on account of the crisis could not be fully resolved, resulting in its bankruptcy. The main problem of Maynilad was that, as per concession contract, it had the obligation to repay 90% of the past foreign debts incurred by MWSS.This high percentage reflected the fact that most of the old constructions were in West Zone. The Asian crisis resulted in sharp peso devaluation against the dollar. The burden of debt repayment on Mynilad sharply increased. Although the Regulatory Office, with the consent of MWSS, agreed to increase tariff for West Zone to help Maynilad increase its revenue collection, the quantum of increase proposed was not acceptable to Mynilad, resulting in a stalemate that lasted several years, with service in West Zone severely deteriorating. MWSS was not in favor of further tariff increase, fearing it will undermine credibility of bidding process as well as lead to moral hazards.

As dispute could not be resolved, Maynilad reneged on payment of concession fees and declared bankruptcy in 2003. The Supreme Court ruled in 2005 that performance bond of Maynilad, amounting to US$ 120 million, should be forfeited. MWSS drew up a rehabilitation plan for Mynilad, and re-auctioned the concession which was won by Cosunji group led consortium in 2007. In the interim period, the water supply services were being managed by a committee appointed by MWSS. The new consortium is running the services now.

The dispute resolution mechanism functioned effectively in that the supply of water to the customers in West Zone was not completely stopped. However, improvements in service quality were much delayed. The risk sharing under the concession agreement was appropriately recognized. Mynilad appears to have failed more because of its poor managerial decisions than lack of flexibility in the contract. In fact, MWSS and Regulatory Office appeared to have acted flexibly in dealing with the crisis. The credible commitment of the government is evident from the fact that a new consortium has taken over West Zone operations.

5.2.10 Consumer Inclusion

The views of the interviewed regulator, private operator and ADB officials regarding consumer inclusion is listed in the table below.

Table 5.11: Summary of Interviews – Consumer Inclusion, Manila Utilities

Regulator Views	Private Operator Views	Views of ADB Officials
* Although no public consultations are held by Regulatory Office, it organizes public surveys to assess public satisfaction from service delivery. * Tariff increase is discussed in various community forums before being actually implemented	* Sustainable Development Department set up by Manila Water, although not mandated to do so by the contract; gives a lot of time to consumer issues and particular attention to poor; also free water to hospital and schools as part of Manila Water internal policy to demonstrate its sincerity in regard to essential public service. * public assessment of water service performance – current rating is 99%	*Manila Waters show transparency in dealing with public because they are successful; Maynilad is unlikely to be so generous with information; also, people in Philippines are culturally generous in sharing information. *Consumer survey by third party undertaken. * tariff increase has to go through public hearing; the value of such hearing is public acceptance when

	satisfaction * mottos and values are publicized and followed in practice * constant customer education going on – it is not just about tariff * customer service requirements have forced Manila Waters to improve *Manila Waters takes great pride in being transparent *Mynilad is trying to emaluate the successful example of Manila Water under a new leadership.	rates are finally revised. *informal relation between regulator and concessionaire working out very well.

Consumer inclusion is important because it enhances credibility and legitimacy of transactions. Accountability is the most serious concern in regard to PPP. Inclusion of consumers demonstrates that all parties to the contract are willing to be accountable for their actions and are willing to share information. Higher the level of transparency, more the organization is perceived as responsive to accountability concerns.

Tariff increases during the rebasing period are discussed in public hearings. The purpose is to educate common people why increase is being allowed. It also ensures public acceptability to new rates when it is formally adopted. Customer surveys are periodically undertaken by independent organizations to ascertain consumer response to operator performance.

Manila Waters has adopted aggressive consumer inclusion programs, resulting in better relationships with people and good public image. In particular, they have targeted the poor and made them partners in progress. For example, Manila Waters has a department for Sustainable Development. This department provides livelihood programs to poor customers. As for example, signposts announcing construction works which the company uses on roadside while undertaking construction works are painted by group of poor customers. They are trained for signpost paintings and paid at market rates. There are similar livelihood programs, funding for some of which are actually obtained through government sponsorship. In fact, a part of Manila Waters has morphed into a development organization. In addition, Manila Waters provides free water to some public institutions, such as hospitals. This contributes to the positive image of the company. Most importantly, a lot of information relating to Manila Waters is available on its website. The officials were also found to be very transparent, ready to share any information asked. While ADB officials remarked that this could be on account of relative success of the company, they added that the general culture in Philippines is towards openness and sharing. Maynilad was also open to sharing information, although they were understandably defensive about negative aspects of the past.

5.3 Case Study of Tirupur Water Supply:

Domestic water in India was traditionally collected from underground wells. Early habitations were around agricultural land with separate clusters for landowners and

agricultural laborers. The landowners and laborers were differentiated by caste hierarchy. The landlords maintained exclusive underground wells from which they drew water in a pitcher tied to a rope and operated using an improvised pulley. The laborers accessed water from communal wells. Caste restrictions prevented laborers from accessing wells of the landlords. The burden of collecting water from wells fell on women folks. Ownership of land implied ownership of underground water as well.

Water is traditionally associated with purity because of its functional use in religious ceremonies and rituals. In the past, if lower caste individuals touched wells belonging to the higher caste, the well was rendered "polluted". Severe retribution could follow the caste individual who violated such social norms, including physical violence. The well had to be abandoned or purified, depending on the judgment of local priest.

Hindu mythologies indicate how early society revered water bodies and imputed it with spirituality powers. One of the mythological story is about River Ganges, originally a river in the heavens, descending to earth on the request of a king whose kingdom was suffering from prolonged drought. River Ganges agreed to flow through his kingdom but she needed someone to absorb the shock of her fall from heaven to earth. Lord Shiva, one of the Gods in Hindu mythology who represents destruction and recreation, and is commonly depicted as meditating on the Himalayas, offered his matted hairs for her to descend from heaven.. Up until today, River Ganges is pictorially depicted as trickling out from matted hairs of Lord Shiva. The purity of Ganges is believed by many to possess therapeutic values, although scientists warn of dangerously high pollution levels.

People visit cities on the banks of Ganges for undertaking ritual bathe, believing it washes away their sins. In 2001, during a bathing festival which is organized once every 12 years and is a tradition more than 3000 years old, nearly 30 million people gathered on the banks of river Ganges near the city of Allahabad and took a dip in its waters (Shiva, 2002).

Mughal rulers in medieval India introduced canal systems, mainly for watering royal gardens and cooling palaces. They also built large pools for bathing, for supplying drinking water to large armies and for recreation.

Like many other public infrastructure, piped water supply in India is a British colonial legacy. It was initially limited to few large cities, mostly covering areas in which the British or Indian elites lived. In early 20th century, the network started to expand. However, large-scale expansion occurred only after India's independence in 1947.

The Constitution of India places water supply in State List, which implies that State Governments have the ultimate responsibility for construction, operation and maintenance of water supply systems. Fund allocation is made by the central government while planning, design and implementation is undertaken by the States. The construction of water supply infrastructure for much of the time since independence has followed a supply driven approach, characterized by high level of centralization in decision making and implementation. The Public Health Engineering Department of the State governments (or its equivalent) was responsible for design, construction, operation and

maintenance of water supply systems in all cities and towns of a State, taking help of local municipal body where feasible. There were no economic regulator, and the services were free for all practical purpose.

The National Water Policy of 1987 for the first time emphasized that water supply services should be charged. The 74th Constitution Amendment Act of 1992 made it mandatory to decentralize the management of a number of public services, including water supply, to local bodies. By this law, the responsibility of water supply management was vested on the local municipality. However, municipalities were found lacking in capacity and most of them continue to be considerably dependent on centralized agencies of the State government. The National Water Policy in 2002 articulated for the first time the need to involve private sector in water supply, particularly for commercial borrowing.

5.3.1 Public Private Partnership in Tirupur Water Supply

Tirupur is a city in the State of Tamil Nadu, India. It is famous as a textile manufacturing center. The region has had a century old tradition in cotton knitting. The first hosiery unit was set up in 1893. However, people in the region were primarily dependent on agricultural, much like rest of India. Then, cotton spinning received a boost in 1930s when successive years of drought caused the crops to fail. Around the same time, Mahatma Gandhi started advocating the use of home spun clothes and boycott of British textiles, in a peaceful movement for country's freedom. His call might have provided the

impetus and legitimacy farmers needed in switching to an entirely new profession. The town started producing cotton vests which were soon popular all over India.

By 1970s, the town had diversified into many other types of cotton and blended garments. The first export consignment to Europe was dispatched in 1984. With the economy of India opening to the world in 1990s, the entrepreneurs in Tirupur were soon exporting substantial part of their goods to Europe and the United States. Almost 90% of cotton garment exports from India today are from Tirupur, and the business is worth US$ 1.5 billion. In the 1990s, prior to software boom, the town of Tirupur boasted of the largest number of millionaires per unit area, a reputation it eventually lost to Bangalore.

There are more than 700 cotton processing units in Tirupur. Cotton for textile manufacture undergoes four primary stages - knitting of cotton yarn and making fabric, bleaching and dyeing, fabrication of garments and printing and finishing. A large unit may do all these tasks together but there are many small units doing just one of these tasks, resulting in considerable interdependence. Bleaching and dyeing is extremely water intensive activity. Their purpose is to remove grey color of cotton yarn. Bleaching powder is mixed with water and clothes dipped in it for certain period of time. In past, industry procured water through tankers. By early 1990s, more than 700 tankers, each with capacity of 12,000 liters, were making 10 to 15 rounds everyday. Textile processing also resulted in considerable production of sludge, which was disposed untreated into the environment.

The town of Tirupur developed rapidly, populated by migrant labors from surrounding region. Although the owners were of the dominant local caste initially (Chettiars and Gounders), the under-privileged caste, constituted of migrant labors, have also started owning small units. The town is located on the banks of river Noyyal but draws surface water for municipal use from River Bhavani, about 54 km away. The earliest municipal water scheme of 7 MLD capacity was developed in 1965 and the responsibility for management was vested on Tirupur Municipality. In 1971, the State of Tamil Nadu set up Tamil Nadu Water Supply and Drainage Board (TWAD) with mandate to assist urban local bodies in planning, designing and implementing water supply and drainage projects. TWAD developed another water supply project of 32 MLD capacity in 1992 for supplying to the town and surrounding villages. The responsibility for management of this scheme lay with TWAD. But, neither of these two water supply units distributed water to the flourishing textile industry. The supply to Tirupur town was limited to a few hours every alternate day.

In early 1990s, Tirupur Export Association (TEA), alarmed by increasing water scarcity in the region, first took up the issue of piped water supply to textile industry. The water scarcity was on account of depleting water table. The quality of groundwater was deteriorating. These factors were affecting industry productivity. TEA petitioned the Government of Tamil Nadu, asking for a comprehensive area development plan. The State Government mandated Tamil Nadu Corporation for Industrial Infrastructure Development Limited (TACID) to find a solution. A Bombay based private company, Infrastructure Leasing and Financial Services, Ltd (IL&FS), which was known to TEA

because of its long-standing relationship with textile industry, was approached by TACID. In 1994, a MoU was signed between TACID, IL&FS and TEA to develop water services and other infrastructure for Tirupur area.

In follow up to the MoU, a Joint Venture company called Tamil Nadu Water Investment Company Ltd (TWICL) was set up jointly by IL&FS and Government of Tamil Nadu (GoTN). IL&FS is the majority stakeholder with 54% paid up capital and GoTN minority stakeholder with balance 46%. TWICL set up another company called New Tirupur Area Development Company Limited (NTADCL) in 1995 with additional equity partners, which included TEA, Contractor Consortium (Wilbur Smith Associate, Mahindra & Mahindra and United Utilities), Asian Infrastructure Development Co Ltd., Insurance companies (Life Insurance Corporation of India and General Insurance Company of India) and IL&FS. The share each holds in this company are as follows:

Table 5.12: NTADCL Equity Shareholding Pattern

Name of shareholding company	**%age shares held**
TWICL	33%
GoTN	*15%*
IL&FS	*18%*
Asian Infrastructure Development Co Ltd	28%
Contractor Consortium	14%
TEA	03%
Insurance Company	10.5%
IL&FS	11.5%

In 1996, NTADCL invited expression of interest from potential firms for construction, operation and maintenance of a proposed water supply system. Out of 40 expression of interest received from both national and international firms, 10 were shortlisted. In the

final bidding process only 8 participated and 4 were finally found qualified for bid submission. The consortium of Bechtel, United Utilities and Mahindra & Mahindra emerged as the qualifying entity. Negotiations were held to reduce bid prices, which led to detailed studies and discussions on risk reduction. However, the project was stalled for several years at this stage because of political reasons. It was only in 2001 that Government of Tamil Nadu and Tirupur Municipality signed a concession agreement with NTADCL for a period of 30 years, setting in motion the process once again. Being a Build-Own-Transfer project, considerable construction was involved. The construction started in 2002 and was completed by 2005. By end of 2005, NTADCL started supplying water to Tirupur industries, as well as partial supply to towns and adjoining villages.

5.3.2 Property Rights

Property rights in case of water supply services in India have never been very well defined. Although water is a common property resource, this is not true for water supply systems. Technological advances make it possible for water supply systems to be managed as toll goods. But historically water supply systems in India have been treated as common property resource and have suffered rent seeking due to political opportunism.

Defining property rights has been easier in case of Tirupur because the project is directed towards a flourishing industry for which water is a vital input. Clarity of property rights is an acceptable notion in case of business transactions, and it is this value which made it

possible to design contract in a manner that clearly establishes property rights of the utility operator. Many of the city's residents are directly or indirectly dependent on the industry, and hence have been supportive of the reforms. Moreover, it was a BOT project and did not require government assets to be transferred to private operator which often becomes contentious issue because of vested interests and incomplete information.

Property rights in case of Tirupur Water Supply are defined by contract provisions. The views of various stakeholders interviewed on property rights and how it protects against government opportunism is summarized in table 5.13 below.

Table 5.13: Summary of Interviews – Property Rights, Tirupur

View of the Government/Regulator (NTADCL)	**Views of the Private Operator (IL&FS)**	**View of other stakeholders/interested parties (World Bank/UNICEF)**
* Property rights are clearly defined in the Concession contract * There are no laws of the State or Central government clearly specifying property rights. No specific laws against water theft or illegal water connections * Regulations for underground water abstraction present but enforcement is weak. * Joint venture structuring helpful in securing property rights. * government investment and land lease indicate government is serious and will not act opportunistically	* Property rights are protected by concession contract * documentation is very elaborate and took long to prepare and finalize. * risks were very carefully analyzed and incorporated in the contract. * less fear of government opportunism because the project is targeted towards industry * the demand for the project had arisen from industry. * government will lose reputation if it reneges on its promises because loan to private operator is guaranteed by USAID.	* property rights are defined by contract not by law. * easier to define them when customer is an industry. * there were no strong opposition; often NGOs oppose private sector in water for ideological reasons.

NTADCL officials believe that concession contract is the primary document which defines property rights. There are no laws of the government on controlling illegal connections of water supply or responsibility to pay bills, etc. Also, NTADCL is structured as a joint venture which underlines the commitment of the government and its intention not to act opportunistically. Government has invested in the project too.

IL&FS officials and other private agencies working on its behalf believe that concession contract secures their property rights. The documentation is very detailed, and was prepared after considerable studies and discussions. It has tried to capture as many eventualities as possible. As for example, it clearly addresses the possibility that government may try to nationalize the water sector in future, and if it does so, how IL&FS will be compensated. The rate of return is fixed, and was agreed ex-ante in the contract. Further, the joint venture nature of NTADCL ensures that government will not act opportunistically. The nature of demand also secures against government opportunism. The source of demand are industries, which clearly have willingness to pay and ability to pay. Payment of bills is secured by asking each firm receiving water to furnish a Bank guarantee of an amount equal to three month's average bill.

World Bank and UNICEF officials agreed that property rights are protected by concession contract. Private sector participation was possible because the demand had originated from local industry which employed large population. The officials were, however, concerned that current definition of property rights fails to fully internalize the negative externalities. As for example, the demand side management of domestic user is

weak and many households are re-selling water to the industry, making profit out of differential charges for industrial and household users. This is leading to inefficient use of water. Also, excessive water use is resulting in more wastewater generation and greater levels of pollution.

5.3.3 Effectiveness of Regulatory Office:

As water supply services are monopoly, there is risk of private operator making shigh profit making by private operator at the expense of customers. Regulation to control market power is essential in this context. The views of officials interviewed for control of market power is summarized in Table 5.14 below.

Table 5.14: Summary of Interviews – Control over Market Power, Tirupur

View of the Government/Regulator (NTADCL)	**Views of the Private Operator (IL&FS)**	**View of other stakeholders/interested parties**
* Joint venture checks market power *profit margin is specified in the concession contract * supply cannot be varied to reduce cost * government servant appointed the head of NTADCL to function as a regulator * price is fixed by a committee of which Managing Director is a member * sewerage contract also given to NTADCL, although not part of initial concession contract	* initial rates quoted by Bechtel was reduced through negotiations * Bechtel was not turned down because market for water was under developed; would have sent wrong signals to market and no likely bidder next time. * rate of return is fixed (20% approx). * initial assessment of project cost by TEA was US$ 55.5 million; revised to US$ 222 million * government utility could not have produced the same level of operational efficiency as private sector	* a private sector monopoly instead of government monopoly, with some regulatory checks * because government officials are not as efficient as private, in general, all the checks will likely not work. Regulatory control is likely to be weak in long term.

	has done. * main customer (representative of textile industry) is also represented in NTADCL board.	

The officials of the NTADCL were of the view that market power is controlled because the operation is a joint venture. Hence, the private operator does not have unbridled freedom to exploit its monopoly position. Profit margins are clearly specified in the contract. The head of NTADCLis a senior and serving government servant who is expected to ensure that monopoly power is not abused. However, the interviewed officials confirmed that they have received money for sewerage contract from the government without any tender, although this was not specified in the concession contract. All private parties in the joint venture will benefit from this new contract.

The new contract which NTADCL has received is because of the market power it already enjoys; anyone else would have had to incur a huge up front cost for learning and acquiring information before taking up such a task. Economies of scale related to water and sewerage business have also given NTADCL monopolistic market power.

Officials of IL&FS denied that there was any misuse of market power. They argued that government would have lacked the capacity, competence and patience to work out the efficient arrangements that private sector participation made possible. The entire structuring was a highly professional job and a learning process, requiring quick adaptation and flexibility. IL&FS was able to act quickly and adapt flexibly, while

keeping government informed all the time. As for example, Bechtel had quoted very high rates initially because of high risk perception. There was inadequate information to argue with Bechtel on details of the presumed risks. IL&FS asked Bechtel to undertake a detailed engineering study, paying Bechtel separately for this study. The findings of this study were used in discussing with Bechtel the details of risks in each component of the job. New information helped reduce risk perception, and led to negotiations with Bechtel, resulting in reduction of rates.. Further, IL&FS found that it was cheaper to separate construction and financing. So, while Bechtel was entrusted with construction, financing was secured from other sources (borrowing from a consortium of Banks and Insurance companies).

Such flexible negotiation and design would have been very difficult to accomplish if the tasks were pursued through government departments following straight-jacketed procedures with deviations arouse accountability concerns. Also, IL&FS, as a private party, was able to finance studies for generating adequate information because it was in a joint venture relationship, and commitment of government was, thus, relatively assured.

Other interested stakeholders interviewed were of the opinion that Tirupur water supply managed by NTADCL is a monopoly with significant control by private sector. It is more efficient than government operator, but at a high price. Households are not able to benefit from this service. The market segment to serve is controlled by the private operator.

5.3.4 Governance mechanism

In early years, textile industry in Tirupur received some water from public utility but as the industry grew in size, private tankers started supplying much of the industrial needs, drawing water from underground. While there were regulations to control underground water extraction, these were not enforced. The State Government functioned as the regulator for both pricing and quality.

PPP has led to change in regulatory regime. The opinion of interviewed officials of NTADCL, IL&FS and other stakeholders/interested parties in regard to autonomy of regulator, competence of regulator and contract management process is summarized in Table 5.15 below.

Table 5.15: Summary of Interviews – Governance Mechanism, Tirupur

View of the Government/Regulator (NTADCL)	**Views of the Private Operator (IL&FS)**	**View of other stakeholders/interested parties**
* NTADCL is concessionaire, project manager and regulator * NTADCL is promoted by a Joint venture company, TWICL, which is majority owned by IL&FS (54%) and minority by Government (46%) * TWICL set up in 1994, at project conceptualization stage while NTADCL was formed subsequently in 1995. * concession to NTADCL was granted in 2001 after everything was finalized – finance and contractors for capital works	* complex structure for buying different parties into the project and getting them committed. * NTADCL is the concessionaire but it has contracted capital works and operations and maintenance works to other private sector operators/consortiums. * TWICL and IL&FS organized all deals and selected private contractors, including for construction, operations and maintenance, before NTADCL was granted concession.	* Senior civil servants should play the role of regulator and not take up managerial role which should be left to professionals.

* many contracts hold different parties in relationship. * NTADCL has management contract with Mahindra and Mahindra for operation and maintenance * NTADCL has given capital works to other contractors. * long term relationship between government and IL&FS is like a "marriage" where trust is important and objective is "not just money". * financiers of the project, however, are not into this "married" type of relations – they are interested only in profit. * concession contract document is not public – would not like to share * competent manpower in NTADCL drawn from both government and IL&FS.	* there are multiple contracts binding various parties, including industries, to abide by their commitment. * head of NTADCL is a senior government servant chosen because he could move things in government during the project management phase; such an arrangement was not envisaged for entire life of the project. * Board of Director mostly senior or retired government officials.	

The concession to NTADCL is vast in scope including responsibilities for project implementation, management and regulation. The project implementation responsibilities include capital construction which has been contracted out to two consortiums of private firms. The operation and maintenance responsibilities have been contracted out to a consortium of private firms led by Mahindra and Mahindra (M & M). NTADCL monitors their performance, revises tariff and checks quality. The appointment of a very senior civil servant, equal in rank to the Finance Secretary of India, as Managing Director of NTACDL indicates government's expectation that he will function as final regulator.

Besides, the Board of Directors of NTADCL is also crowded with current or retired government servants.

NTADCL appears to have emerged through an adaptive process. At project conceptualization stage, TWICL was formed between IL&FS and GoTN. It was primarily an investment company with government locked into a committed relationship with private sector, having its own share of equity but as a minor partner. As the initial stages were about securing financing and finding out technically competent firms which could undertake utility construction and management, IL&FS undertook these tasks secured by the knowledge that government's commitment is assured by joint venture partnership. The search process was long, taking as much as 5 years, and might not have survived if government commitment was uncertain. Once all elements were in place, concession contract was formally signed to tie up all the major parties. GoTN and Tirupur Municipality signed the concession agreement with NTADCL. With financing aspects taken care of, NTADCL has the responsibility to supervise construction and then monitor and regulate utility's functioning.

NTADCL, being a joint venture, is a vertical integration between private and government entities. Although a concession contract binds them into legal relationship, for all practical purpose they are locked into a relational contract and a bilateral governance structure. Both private and government employees - current and former - constitute the manpower core of NTADCL. At least two of the interviewed members characterized the relationship between private and government in NTADCL as akin to "marriage".

Interestingly, they left out financiers of the project, who they believe are guided only by profit motive. Hence, they were alluding to IL&FS as the private partner in "marriage" with government, interested in making the relationship work rather than "only make profits".

5.3.5 Competition

There was no competition for grant of concession. In fact, the actual process of selecting private contractors and securing financing started before the grant of concession. Concession was merely to formalize arrangements which had already been made and the concessionaire was expected to implements, monitor and regulate in accordance with various agreements already concluded or in various stages of completion.

The views of interviewed officials in regard to competition are summarized in Table 5.16 below.

Table 5.16: Summary of Interviews – Competition, Tirupur

View of the Government/Regulator (NTADCL)	Views of the Private Operator (IL&FS)	View of other stakeholders/interested parties
* Earlier suppliers were tankers; they sold groundwater. *NTADCL was the only entity considered for concession – no competition * government selected IL&FS as a partner and over time felt comfortable with it – started a Joint	* no competition because during that period, the market was not developed; unlikely to have attracted any interest among private players; in fact, Enron power project was also decided on negotiation basis. * partnership formed between TEA, IL&FS and GoTN by mutual agreement *project was designed and road	* water tankers are still operational; buy cheap from farmers and sell it to industry; they are undermining project intentions * benchmark competition is an important step – it can lead to many improvements.

Venture called TWIC with them which, in turn, promoted NTADCL. * bidding for partner may not be a good idea; this is a relationship to be developed by trust. * Management contract to M&M was also awarded for 30 years * Sewerage contract also given to NTADCL, although it is not a concession * intention to go public eventually; this is documented	shows organized to generate interest – the project was bid out and finally only two competitors remained of which one was disqualified for failing to meet technical standards specified in the bid. Only consortium led by Bechtel remained * high risk premium quoted by Bechtel; the issue was how to reduce price; Bechtel was paid to undertake detailed engineering study; after the report was received, each aspect of the project was negotiated from scratch. * parallel efforts were made to in secure from financial market funding cheaper than Bechtel.*the entire process was very complex – like "peeling an onion". * Tirupur Municipality is now upset with its engineers as to why they can't supply water with same efficiency as the M&M operators – municipal commissioners apparently raised this comparison in a recent meeting of the municipality. * municipal employees are not so competent	

The initial relationship forged between GoTN, IL&FS and TEA was not through any competitive procedure but because of mutual knowledge and trust for each other. The relationship was formalized through a Memorandum of Understanding that they would work towards developing a viable solution to the water problems of Tirupur textile

industry. Although it can be argued that GoTN might have had better firms than IL&FS to partner with, the fact is that no other firms approached the government or protested against relationship of government and IL&FS. The transaction cost to the government for searching a better partner would have been likely very high.

The formation of Joint Venture firm, TWIC, and its subsidiary NTADCL, enabled private party to take the risk of investing for information and search. As business risk in water was perceived very high, the IL&FS pro-actively searched for firms willing to finance and undertake construction through road shows. While many firms submitted expression of interest, only a few bids were received for construction works and operation and maintenance.

The risk premium of Bechtel led consortium, which finally qualified in the bid, was considered very high by private partner of NTADCL. Hence, IL&FS spent money in reducing information asymmetry and decreasing risk, asking for detailed engineering studies. Each aspect of risk was then discussed with Bechtel on the basis of this study, and the risk premium eventually declined. The concession agreement was signed only after all cost aspects were acceptable to the government.

Thus, although it may seem technically that concession was signed without competition, the actual award of work followed competitive procedures within the limits afforded by water sector. Investments were made in seeking out firms and in reducing information

asymmetry. The transaction cost of achieving better information, which could have enabled lowest possible cost, would have been very high for the government.

The competitive pressure in operation and maintenance is very low or absent. Ideally, yardstick competition would have helped to ensure operator is working at its best in reducing cost. But there is no yardstick competition in India yet. Although contract lays down benchmarks or targets that operator should achieve in respect to various parameters, the targets fixed initially do not take into account technological improvements occurring over time and the possibility of further cost reduction.

5.3.6 Monitoring

Effective monitoring of contract reduces information asymmetry, enhancing efficiency. The opinion of interviewed officials in respect to monitoring mechanism is summarized in Table 5.17 below.

Table 5.17: Summary of Interviews – Monitoring, Tirupur

View of the Government/Regulator (NTADCL)	Views of the Private Operator (IL&FS)	View of other stakeholders/interested parties
* Senior Indian Administrative Service (IAS) officer is the Managing Director of the private firm; monitoring done by NTADCL; submits reports to government. * Unaccounted For Water (UFW) targets are set * independent engineer for technical audit and	* monitoring done by NTADCL; * operational targets are set out in the concession contract as well as management contract * independent engineering firm for technical audit and independent auditor for financial audit – appointed by NTADCL as contractual obligation – reports are	*Monitoring of water quality is lacking.

independent auditor for finance audit – appointed by NTADCL as contractual obligation – report submitted to government and the company * municipality could also monitor for the part of function related to them but lack capacity, and have never monitored so far. * distribution in town is the work of municipality; we do not monitor *unwilling to share data *NTADCL monitors internally * various types of report formats are prescribed in the contract – the operator submits them * good technical manpower in M&M – more than 50 engineers. * high efficiency noted in respect of UFW and other parameters * giardial cyst removal, virus removal is not being monitored * attention more on hardness because hard water is bad for textile industry.	submitted to government and the company.	

There are two levels of contracts. The first is the concession contract between government and NTADCL. The second is the sub-ordinate contracts, including operations and maintenance contract between NTADCL and Mahindra & Mahindra which supports the concession objectives. NTADCL is the main monitoring body for both contracts. In respect to monitoring performance at the first level, there is definitely a

conflict of interest. NTADCL has operational responsibility as well as the regulatory responsibility. The second level monitoring appears to be well organized. Because the second level also contributes to the efficiency of the first, a certain minimum level of efficiency is assured.

The monitoring problem is partially overcome by two independent auditing conducted annually - one for financial management and the other for technical performance. The auditors are selected by NTADCL. The reports are submitted to NTADCL and State government. While these audits may help in highlighting problems in the system, NTADCL, to whom this report is directed may not have incentives in making changes. GoTN also receives a copy of report but it is unlikely to directly intervene, given that a senior civil servant is heading NTADCL. The government could also lack technical capacity to understand all aspects of the report. Hence, the monitoring mechanism appears to depend too much on NTADCL. Given the inherent conflict of interest, NTADCL response to the report is likely to be reactive than pro-active.

5.3.7 Incentives:

Setting up tariff to recover at least the operational cost is the most critical issue in water supply management. Incentives align the interest of the operator with that of the government, resulting in efficient outcomes. The opinion of interviewed officials in respect to tariff and incentives are summarized in Table 5.18 below.

Table 5.18: Summary of Interviews – Incentives, Tirupur

View of the Government/Regulator (NTADCL)	Views of the Private Operator (IL&FS)	View of other stakeholders/interested parties
* opportunity cost of water is Rs70-80 per Kilo Liter * 20% rate of return is fixed – rate of return regulation * differential tariff for industry and domestic; the former is linked to Consumer Price Index and revised periodically: the latter is dependent on government decisions. * contract provides for a price review committee which consist of a retd Judge, one rep of the government and one rep of NTADCL * 94% revenue from industry * UFW targets are set for M&M. * concession does not have penalty except that government could take over in case of failure to perform. * management contract has both penalties and incentives. * no penalties imposed yet.	* 20% IRR was based on debt equity ratio being 2:1; actual IRR is nearly 24% because debt equity ratio is different than envisaged. (lower debt level) * highly subsidized domestic prices – high cross subsidy not good for demand management	*because of high differential between domestic and industrial water prices, the tankers are still operational; they buy cheap from farmers and sell it to industry at profit; they are undermining project intentions * no demand side management – poor tariff structuring *tariff increase should be considered only after service quality has been improved and not before.

Rate of return regulation is followed for pricing water to the industry. The expected internal rate of return is 24%. Tariff for various customers are as follows:

Table 5.19: Tariff Structure of NTADCL

Type of Customer	Tariff per Kilo Liter	% age Revenue	% age Supply
Industry	Rs 45.00	94%	67%
Tirupur Municipality	Rs 5.00	3%	16%
Wayside villages	Rs 3.50	3%	17%

Average Exchange Rate: US $ 1.00 = Rs 45

Tariff is linked to a basket of expenditure such as power, consumables, O&M costs, etc. The weighted average increase in expenditure is automatically applied for tariff revision every year in July. The revision of industrial supply rate is undertaken every year and while that for domestic is undertaken once in 3 years.

Although a basket based on expenditure increase protects tariff from erosion on account of inflation, this methodology carries the potential to pass on to consumers the inefficiencies of operator as well. Expenditure increase can occur on account of inflation as well as on account of inefficient management. Ideally, tariff should have been linked to a basket of commodities and services, such that inflationary price increase with respect to each item is reflected in the index, proportionate to its weight. Thus, if expenditure of a consumable increased on account of inflation, it would result in increase in index too, proportionate to the weight of consumable in the basket. But if expenditure increased because of inefficient management, it would not result in increase in tariff. There are, however, incentives built into management contract for reducing expenditure, partially taking care of this design flaw. The details of this incentive are discussed in a separate paragraph below.

The tariff for industry can be varied downwards at the discretion of NTADCL. It is observed that although the initial tariff for industry was set at Rs 45 per KL, it was revised downwards to Rs 23 per KL in July 2006 and then upwards in February 2007 to Rs 35 per KL. The changing tariff structure indicates that off take of water was much lower than expected at initial price level. Downward revision increased demand. The current incentive structure, therefore, encourages over consumption of water resources.

The tariff for wayside villages is as low as one tenth the industrial tariff. Thus, there is a perverse incentive for the wayside villages, which receive nearly 17% water, to resale the water they buy cheap at Rs 3.50 per KL to the industries, as long as cost of transporting through tankers does not exceed Rs 41.00 per KL. One official of international development organization indicated during the interview that a black market for water was thriving in Triupur industrial area.

Management Contract with Mahindra & Mahindra has incentive provisions for reducing operational cost. Each year, NTADCL draws up an annual budget of all expenditure that Mahindra and Mahindra will incur for operation and maintenance. If M&M is able to reduce the cost of power, consumables, etc., below the budgeted limit, 50% of savings are transferred to M&M. This creates incentives for M&M to reduce operational cost. Moreover, as some of these items are linked to the basket for tariff setting, there is a downward pressure on tariff.

Overall, the current tariff design encourages revenue efficiency, not cost efficiency. While not evident yet, it is likely that the cost of project will exceed the estimated cost because of handsome internal rate of return under current regulations.

5.3.8 Disputes Resolution and Consumer Inclusion

The opinion of interviewed officials in respect to dispute resolution and consumer inclusion is summarized in Table 5.20 below.

Table 5.20: Summary of Interviews – Dispute Resolution and Consumer Inclusion, Tirupur

Views of the Government/Regulator (NTADCL)	**Views of the Private Operator (IL&FS)**	**View of other stakeholders/interested parties**
* farmers are aggrieved because of pollution to river downstream * NTADCL not fully dependent on operator; if M&M walks out, NTADCLclaims to have technical capacity to run the system on its own. *Disputes are to be settled by arbitration but no such occasion has arisen yet. * TEA, the association representing the customer, is in the board; household consumers are not included in any discussions. * No publicity ever made to make common people aware of performance quality.	* Disputes of technical nature are discussed and resolved at lower levels; some are sent upwards to Managing Director for decision	* distribution of water should be managed by community level organization

The contracts have provision for arbitration in case of disputes between parties but no such need has arisen yet. Operational issues are resolved by discussions between technical personnel, or referred to the Managing Director for his decision.

NTADCL has a separate division, called Marketing Division, to liaison with its main customer base – the textile industry. Staffs in the division maintain relationship with local industries, understand their problems, resolving them and update the industries on policies of NTADCL which might impact industrial productivity.

NTADCL, however, does not interact with household consumers in the town or villages. In general, NTADCL is disinclined to sharing information about company performance with anyone outside the textile industry. NTADCL does not have a website.. The website of IL&FS has very limited information on NTADCL. NTADCL staffs are evasive about information. Contracts are not public documents. One of the interviewed employee, who happened to be a native of Philippines and has been hired by the private operator Mahindra and Mahindra for technical guidance, remarked that he found working environment in India very stiff and ceremonial. He shared that engineers and managers were good at job in private sector, but "very egoistic and rank conscious". He did not think much about the quality of engineers in government departments.

NTADCL has had problems with local farmers who went to court complaining that wastewater from industry was being discharged into a local river without treatment, causing pollution downstream and reducing agricultural productivity. High Court fined

NTADCL, asked the State Government to compensate farmers for their losses, and ordered that wastewater be treated before discharge.

The water supply indicators for Tirupur Municipal utility served area and NTADCL served area are compared in Table 5.21 below. The data is incomplete. NTADCL was unwilling to share data, and the ones presented here is from memory based on limited set of documents which the staffs shared for a brief while. The officials were reluctant to share a photocopy of the documents, afraid it could impact their career. Data relating to Tirupur Municipality is incomplete because the record keeping in the government is poor. The objective of comparison in Table 5.21 is to contrast the quality of service in these two regions - one managed by NTADCL and the other by government.

Table 5.21: Performance Indicator of Tirupur Utilities

Indicators1	Tirupur Municipal Utility Area	NTADCL served Area	Remarks
Population Served	0.29 million	0.90 million	
Area Served	27 sq km	27 sq km	
Production	29 MLD	185 MLD	
Hours of service	2	24	
Operating Ratio	> 1	0.75	
# of employees	50	--	
# of connections	38,812	--	
Coliform	--	< 2 number/100 ml	
Residual Chlorine	--	0.85 mg/l	
Annual Cost	Rs 18 million	Rs 43 million	

5.4 Case Study of Delhi Water Supply

Water supply in Delhi was originally under the control of Delhi Water Supply and Sewage Disposal Undertaking (DWS &SDU) which was reporting directly to Ministry of Urban Development in Government of India. This centralized operation was discontinued from 1998 when Delhi Jal Board (DJB) was constituted under an Act passed by Delhi

Legislative Assembly. Although DJB was expected to function autonomously, the Chief Minister of Delhi was made ex-officio Chairman of DJB. The position of CEO has been traditionally occupied by a bureaucrat from government of Delhi. The autonomy of DJB, therefore, appears to have been incorrectly conceptualized. The only positive outcome of such autonomy was separate accounting of DJB's expenditure, and partial independence in human resource management.

Delhi Jal Board produces bulk water and organizes its distribution in Delhi through a network of pipes. The water supply system has 1.47 million connections spread over 1486 sq km, serving approximately 12.8 million people. About 91% of the water needs of the city are drawn from surface sources, mostly rivers and reservoirs, and 9% extracted from underground. There are seven water treatment plants in Delhi.

Current demand for water in the service area is estimated to be 670 Million Gallons per Day (MGD) or 3046 Million Liters per day (MLD). The average per capita consumption demand under the current production schedule is 238 litres per person per day (lpcd), but a wide variation in actual usage is noticed. For example, in Mehrauli and Narela, it is as low as 29 and 32 lpcd respectively, while in Cantonment area and in Lutyen's Delhi, the actual average usage is nearly 509 and 462 lpcd.

Although production appears to be generally adequate for meeting the demand, Delhi has witnessed acute scarcity of water in last one decade. DJB has failed to ensure regular water supply to households and tap water runs for only a few hours each day, if at all.

This scarcity is primarily because only 402 MGD, which is about 60% of the water produced, actually reaches the households while the balance 40% is physically lost through leakages in the piped systems. These leakages are because of poor technical expertise available with DJB for maintaining and repairing the system. Over the years, DJB has tried overcoming the water shortages by increasing production and treatment capacity. This expensive strategy has failed to fully meet the city's demands because population has been expanding fast while water resource available for the city diminishing steadily.

The problems of DJB are compounded by the fact that it lacks autonomy to set tariff. The financial sustainability of the DJB has been, as a consequence, an issue of concern. It receives a budgetary support from Government of Delhi of nearly US $91.5 million per annum, constituting 35% of the budgeted expenditure, by way of loans/subsidies to maintain its operations. The accumulated past loans of DJB currently stand at US $ 887 million. The performance indicators for DJB are listed in Table 5.22 below.

Table 5.22: Performance Indicators for DJB

Sl No	Indicator	DJB	Remarks
1	Population Served	13 million	
2	Coverage	81%	
3	Area Served	1485 sq km	
4	Production	3046 MLD	
5	Hours of service	4 hours	
6	Annual Cost	US$ 261 million	
7	# of employees	22,731	
8	# of connections	1,350,000	
9	Employees per 1000 connections	17	
10	UFW	40%	
11	Working Ratio (Op expense/revenue)	>1	

5.4.1 Proposed Public Private Partnership with Delhi Jal Board and its failure

The proposal for reforming Delhi water supply started almost around the time DJB was formed. In 1998, DJB approached the World Bank for a loan of US$ 2 million for conducting a study of reform options. The process of selecting a consultant to undertake study took rather long and was finalized in 2001. The responsibility was given to PriceWaterhouse Cooper (PwC). The report was submitted in 2005, advising a pilot project for Management Contract in two out of 21 zones served by DJB. The reform could be replicated in other zones if the contract in these two zones were found to be successful. The vision statement for reforms was "providing universal 24/7 safe water supply and sewerage services" in an equitable, efficient and sustainable manner by a customer oriented and accountable service provision approach.

As soon as the PwC report became public, opposition to reforms began gathering momentum.. Non-Governmental Organizations (NGOs) were leading the opposition. PwC had anticipated opposition to reforms from employees, and had consulted them in preparing the report. But reform design had not envisaged extensive stakeholder consultation and for many NGOs the reform proposal came as a surprise. While some NGOs were ideologically opposed to private sector participation in water, others were concerned because of international experience of PPP failures in water over last several years.

As NGOs began to scrutinize the reform recommendations in details, they chanced upon the controversy surrounding the selection process of PwC for the study. Apparently, PwC

had not bid the lowest in the first as well as the second bid for the study, but DJB, acting on the advice of the World Bank office in New Delhi, and after initial reluctance, ignored procedural integrity and selected PwC. The NGOs wanted to discuss with the World Bank about reasons for asking procedural changes mid-way through the bidding. The Bank refused to share with NGOs information about the project and this heightened public concerns. The Delhi Government, on finding that the issue was becoming politically sensitive, agreed to share all information. These documents showed that World Bank had advised DJB on procurement process of consultants in great detail. The NGOs were of the view that the entire procurement process had been guided by the World Bank with the objective of getting PwC the contract. NGOs used the information to successfully mobilize public opposition against reforms, and by 2006 Government of Delhi had decided not to pursue the PwC/World Bank recommended reforms.

5.4.2 Property Rights

There are no legislations supporting PPP in water supply. The only protection of property rights, therefore, is the contract. The views of DJB /government officials, private firms in water business in Delhi and other stakeholders interested in water sector in Delhi are summarized in the table below.

Table 5.23: Summary of Interviews – Property Rights, Delhi

View of the Government/Regulator (Delhi Jal Board)	Views of the Private Operator	View of other stakeholders/interested parties
No legislation on PPP in water, which is why the interest of private sector is low; legislations were	No property rights security excepting the contract and the possibility of going to court if clauses are violated	Government is distrusted by people Government afraid of

enacted in power sector in 2002 and private sector showed interest thereafter. Contract clauses are the only means of securing property rights of the private party at the moment In proposed reforms, payment of fee was proposed for the private operator – manpower would have been their only investments. Meters are defective and people prefer average billing because it is cheaper. Tariffs are low	Government assumes a very domineering position in all discussions	legislating in water sector because of the mess in power sector. Water is stolen all the time and traded in the market

The security of property rights is weak under current functioning of the DJB. Water is stolen, tariffs are low, meters are defective and general public trust for DJB is low. Political opportunism is extremely high. Government's relationship with private sector is not very cordial, in general, and political patronage for contract award is common.

The proposed reforms intended to have a management contract. No private sector investments were expected, nor were they to assume any risks. The project conceptualized hiring high quality technical manpower from abroad to guide existing staff of DJB in performing better. There was no risk of government opportunism or threat to property rights of the private operator in this type of arrangement.

5.4.3 Control of Market Power:

Private sector opportunism becomes an issue when Public Private Partnerships are formulated. How this could be controlled is an important regulatory issue. In this respect, the views of DJB, private sector and other stakeholders are summarized below. As no private operator had been selected for Management Contract because the PPP process did not go as far as that stage, the questions for private sector were posed to firms already working for DJB under service contract.

Table 5.24: Summary of Interviews – Control of Market Power, Delhi

View of the Government/Regulator (Delhi Jal Board)	**Views of the Private Operator**	**View of other stakeholders/interested parties**
DJB area of operation is divided into 21 zones; the management contract was proposed for 2 of these; separate operator for each zone was proposed to control market power Contract clauses for controlling market power Contractors are influencing politicians for award of contracts.	Expect an IRR of at least 18-20% but have bid as low as 13% in the past; many employees with us, but we are not able to justify our continuance because business is slow to come	Contract clauses were framed by the World Bank and PwC. It was "biased in favor" of private operator. The contract clauses were prepared without adequate study of the system; no one even knew how much water is being distributed. Contractors are influencing politicians for award of contracts. Once contract is awarded , the private sector will have monopoly as government cannot afford disruption in water services

The private sector abuse of monopoly power was sought to be addressed by awarding contracts for different zones to different parties. NGOs and other stakeholders were not satisfied with this arrangement. The view of private sector was that establishing a reasonable rate of return for investments could help in controlling market power of the private operator. In other words, the interviewed private operator favored rate of return regulation.

As management contract involves high quality technical manpower, the project should have conceptualized private sector hiring through a competitive process, and paying returns on investments for manpower at an IRR previously agreed upon (or arrived at competitively).

5.4.4 Governance mechanism

Governance mechanism includes the regulatory body, its autonomy, its competence and the instruments, such as contract or statutes (or both), on which its decisions are based. The views of DJB officials, private operator and the stakeholders in this respect are summarized in the table below:

Table 5.25: Summary of Interviews – Governance Mechanism, Delhi

View of the Government/Regulator (Delhi Jal Board)	Views of the Private Operator	View of other stakeholders/interested parties
DJB is the service provider and also the regulator; does not report to the government; in fact prepares all legislative bills	Need someone to trust well and understand the private sector better Contracts are good but they	Regulator is a bad idea; it is against democratic principles Involvement of people and

for the government Management contract was to operate relationship of the private party and the DJB MoU between DJB and government at present; but this is not effective. Competency of manpower in DJB is not of high standards	are not complete	transparency of processes are the key to success of PPP DJB not as smart as the private sector, so how will it manage relationship fairly?

DJB has a MoU with State government of Delhi which specifies performance targets based on which funding is to be released. But MoU is not enforced in practice. DJB is the regulator of its own services, which poses a serious conflict of interest. DJB does not have control over tariff, which it has to refer to government for approval. The competency of manpower in DJB was learned to be low. In the proposed reforms, the relationship between private operator and the DJB was to be regulated through management contract.

NGOs and several other stakeholders in Delhi are against the idea of regulator because they feel that this militates against the idea of democracy. They demand greater involvement of people in water related reforms. In making their claims, they cite examples from USA where community level organizations make decisions through town-hall meetings. Also, they are concerned that current level of transparency in DJB is very low and that DJB simply lacks capacity to monitor contracts.

5.4.5 Competition:

Competition is meant for removing information asymmetry and getting the best firm to operate the system out of all those bidding. The views of DJB, private operator and NGOs/other stakeholders are summarized in the table below.

Table 5.26: Summary of Interviews – Competition, Delhi

View of the Government/Regulator (Delhi Jal Board)	Views of the Private Operator	View of other stakeholders/interested parties
Currently, service contracts are given for 4 to 5 years to private operators for water treatment plants; payment is based on production. Longer period not preferred; renegotiation avoided at all cost Diversifying into bottled water Competition for project formulation went awry; DJB had followed the directions of the World Bank. Competition was to be in the form of Management Contract which meant not much risk was to be transferred to private operator At the time of reforms, the bureaucracy did not believe deep form of reforms was	Willing to compete with others in even playing field; there are political influences and we even pay money Technology important for leakage control; many government engineers do not want new technology probably because they do not understand it Pre-qualification for bidding is not desirable; firms create consortium with small companies to qualify which cuts into the profit of the larger and competent firms; capable manpower and financial soundness should alone matter to the government. ADB and the World Bank are more of a competitor – they corner the best projects using their clout – hence more of a competitor than facilitator	World Bank was "dictating DJB and government and that is why we opposed this reform"; for example, "which consultant DJB must choose was decided by Bank by using its clout– although PwC did not qualify in the bid, the officials were forced to select them – first by canceling the bid then by altering marks PwC had received in the bids, and declaring PwC as an Indian company. This was all farcical". Management contract is worse than concessions – no risk to private sector, only profits Loan from the World Bank was not justified – there were cheaper source of fund available locally; even Delhi government is flush with money, and it has no

possible; their intention was money from the World Bank.	Competitors are handful only – JUSCO, Veolia-Doshion, Subhash Projects, IDFC Projects and Feedback Ventures.	fiscal pressure Benchmark competition is important for India but is missing currently.

Currently, DJB engages private operators for its water treatment plants. This is done through service contracts for a period of 4 to 5 years. The contracts are awarded on the basis of open biddings. Some political influence appears to matter in the award of contract, perhaps by inserting clauses in the bid documents which favor specific parties, but the process itself is fair. Longer contract periods are not preferred because changes in circumstances can lead to demands for renegotiation, which is always a controversial issue. DJB is now competing in the bottled water segment and a dedicated ozonation plant has been set up for this purpose.

In case of proposed reforms, the competition at the very initial stage ran into problem because of advisory inputs from the World Bank. In trying to ensure fairness of tendering process, the direction of the World Bank were construed by the NGOs as trying to favor PriceWaterhouse Cooper (PwC). Perhaps because PwC has not had good image in India, having been involved in controversy several times in last two decades, NGOs started opposing the reforms (PwC figured once again last month (Feb 09) in Satyam Computers scandal; the issue involves PwC falsifying accounting records of Satyam to show billions of dollars in accounts, while the company was actually bankrupt. Several senior managers of PwC are in judicial custody, along with Chairman of Satyam Computers).

Management contract, suggested by PwC as the model for competition, was questioned by NGOs. There is no risk transfer to the private sector in management contract. They are expected to provide technical inputs through technical manpower hire from international market The cost for such hiring was perceived to be exorbitant, with one NGO computing the amount to be US$ 22,400 per person per month. Also, the private operator had the responsibility to set up budget, and ask DJB for the entire amount. The operator was not expected to invest. On the other hand, the operator could invest money received from government in any way it liked. NGOs argued that under proposed arrangements, money could have easily been diverted to sister concerns.

The initial information asymmetry was also a serious handicap. There were no reliable data on how much water was available for distribution and how much was leaking. Without these data, the NGOs argued that no projects could be fairly prepared. They believed that the project was biased towards private operator, ”under the influence of the World Bank”.

5.4.6 Monitoring

Monitoring is an expensive proposition but necessary for reducing information asymmetry and ensuring that service is in accordance with specifications. The views of DJB, private firms and NGOs/others in respect to this are summarized in Table below.

Table 5.27: Summary of Interviews – Monitoring, Delhi

View of the Government/Regulator (Delhi Jal Board)	Views of the Private Operator	View of other stakeholders/interested parties
DJB monitors itself Technical competence for monitoring is low Water quality monitoring through 7 labs; independent quality audits also received from autonomous institutes of Government of India, namely National Environmental Engineering Research Institute and Central Pollution Control Board.	There is no documentation in the public utilities which makes it very difficult for them as well as private sector to set and agree on reasonable targets of performance	DJB appeared to have no power over the private operator excepting to cancel the contract, which is not an easy option to exercise in case of water – the contract provisions were biased towards private sector Quality monitoring is absent Management information system is completely absent

DJB monitors itself and admits that it does not do a great job. There are 7 labs in Delhi which tests water for quality every day. In addition, there are independent audits on water quality conducted by national level organizations.

The problem of monitoring performance of private sector in case of reforms was mainly with respect to lack of data and poor documentation. In the absence of a counterfactual, it was not clear on what basis will DJB measure performance. Also, DJB had track record of poor performance and lacked capable manpower. So, the concern was how it could monitor a private party which was likely more sophisticated. The NGOs also suspected if DJB possessed the capacity to monitor the performance of private operator.

5.4.7 Incentives:

Incentives linked to tariff, incentives for coverage and penalties for non-performance are important for aligning the interest of the private operator and the government. The views of the DJB officials, private firms and NGOs/others, are summarized in Table below.

Table 5.28: Summary of Interviews – Incentives, Delhi

View of the Government/Regulator (Delhi Jal Board)	Views of the Private Operator	View of other stakeholders/interested parties
Tariff is revised every 5 years, in average but last revision occurred after 10 years gap; usually increase of 10%; DJB pushes proposals for hike in the very first year a new government comes to power, else it is unlikely to take place; current rates are very low Tariff increase not associated with fees of management contract; last increase in tariff was proposed as part of reform initiative. Coverage targets given in the management contract	Volumetric tariff structure preferred; should increase with time, taking into account inflation Tariff increase should be linked to some objective criteria	Fear that tariff will go up – this has been the case in all international PPP in water Standards of service should be improved before asking for tariff increase No incentives to private operator for extending service coverage to slums; instead, all existing means of supplies to slums were to be cut under the proposed reforms; also, the proposal was to provide one piped water connection to 5 households but the question was how will these 5 families divide bills? Will this not lead to conflicts? Although contract had provision for penalty and bonus provision based on performance indicators, these were not properly quantified Total penalties could not exceed 30% of management contract fee

Tariffs are much below the cost currently. While average treatment cost is US$ 0.19 per KL, the recovery is not more than US$ 0.07. DJB generally revises tariff every 5 years, approximately by an increase of 10%. The proposal for revision is sent to Delhi Government as soon as a general election is over and a new Chief Minister is in office. Usually, it is cleared in the first year of office of the elected Chief Minister (also the Chairman of DJB) and, if not, the chances of clearance declines as next election draws nearer. Before the last revision, tariff was unchanged for last 10 years

In the proposed reforms, fees of the management contract were not linked to tariff. The private operator would have continued to receive his fees irrespective of tariff. The suggestion for increase in tariff was included in the report of the PwC. NGOs were afraid of tariff increase and its likely impact on the poor because of past international experience. Specifically, they were afraid of big water companies such as Vivendi and Suez coming to Delhi, fearing that their financial power could be used to twist the government into submission once contracts were in place. These misgiving were on account of past experiences in water PPP in Argentina, Puerto Rico and Bolivia.

Currently, coverage targets are annual political exercise. The reforms also intended to specify targets for expansion. The NGOs were, however, skeptical if the firm would expand to slums where actual needs existed. Past experiences in other countries suggested that private firms tended to divert water to high paying customers. Although in management contract there were no incentives in such diversion, as revenue was not linked to fees, this point was not clear to NGOs.

There were penalty clauses in the contract if operator failed in achieving performance targets. The NGOs first questioned the targets, claiming these were easy to achieve. Second, they argued that at the maximum only 30% of the management fees could be deducted as penalty which was not sufficient deterrent.

5.4.8 Disputes Resolution

Dispute resolution mechanism is important for credible commitment. The views of the DJB officials, private firms and NGOs/others, are summarized in table below.

Table 5.29: Summary of Interviews – Dispute Resolution, Delhi

View of the Government/Regulator (Delhi Jal Board)	Views of the Private Operator	View of other stakeholders/interested parties
DJB fares well in grievance redressal; not more than 30 days in attending to complains; all complains are monitored centrally PwC report had plagiarized from earlier report of Tata Consultancy Service;DJB served show cause to PwC on this account Number of people who visited DJB on behalf of PwC was not as per norm; they overcharged	Private operator can set timeframe for resolving consumer complains – their capability for customer service has already been demonstrated in other services, including Business Process Outsourcing (BPOs).	World Bank did not respond properly to our initial queries on the project Later our communication with the World Bank was from press conference to press conference We had a feeling that the World Bank was driving this project; why were they reacting when DJB should have been?

Disputes with private parties in regard to service contracts are currently resolved following contract clauses. Renegotiation is strictly avoided because it can lead to serious

controversy. Customer grievance redressal is achieved through field offices where anyone can file complaints. The complain resolution process are tracked by one senior officer at DJB headquarter. The complaints are attended within 30 days time, and DJB appears to be satisfied about its performance in this regard.

Private firms believe that they can do better job in terms of grievance redressal, as observed from experiences in other sectors where private sector is active, including Business Process Outsourcing (BPOs) which concerns managing problems abroad.

The credibility of the entire PPP process appears to have taken a serious hit right from the stage of selecting the consultant for initial feasibility study. When questioned by NGOs about the selection process, the World Bank declined to share documents but rebutted the allegations of NGOs through Press Conferences. The NGOs said that they felt from the reaction of the World Bank that the entire process was being "dictated by them". The NGOs stated that Delhi Jal Board should have reacted to allegations being made, not the World Bank.

Further, Delhi Government agreed to share all documents relating to the process followed in selecting PwC. The World Bank had declined to share these information. This undercut the credibility of the process.

Finally, a former official of DJB shared that PwC report was found to have plagiarized in part a previous report by Tata Consultancy Service. He added that PwC even copied

"errors in the spellings". PwC was issued a formal showcase, he said. This too undercut the credibility of the process.

5.4.9 Consumer Inclusion

Consumer inclusion is about credible commitment and transparency. While credible commitment underlines the seriousness of government's resolve, transparency strengthens community perception about legitimacy and accountability. The views of the DJB officials, private firms and NGOs/others, are summarized in table 5.30 below.

Table 5.30: Summary of Interviews – Consumer Inclusion, Delhi

View of the Government/Regulator (Delhi Jal Board)	Views of the Private Operator	View of other stakeholders/interested parties
Transparency is important, but at some point reforms have to be pushed; political will and ownership are very important Consumer inclusion through "bhagirdari" which are residential welfare organizations – government has regular interaction with them	Transparency and consumer inclusion will strengthen us and we welcome it	World Bank refused to share documents while government of Delhi shared the same; why should an entity which "teaches transparency to the entire world not show transparency in its own operations?" Basic accountability should be in place before PPP; also, transparency with respect to information essential – should put up these in the website

Currently, consumer inclusion is through a system called "Bhagirdari" under which Residential Welfare Association members meet with government representatives on a regular basis to discuss various problems they have, which includes water supply related

problems. The proceedings of these meetings are recorded and a senior officer of the government follows up.

Concerns about consumer inclusion and transparency in dealing with consumers also contributed to rejection of the proposed reforms. NGOs claimed that Government agreed to share all documents relating to reforms, particularly the documents relating to selection of PwC, while the same documents had been declined by the World Bank. This undercut the credibility of the process. The NGOs argued that basic accountability structure should be in place before PPP, and wished that important information were up loaded on website for all to see.

CHAPTER 6: FINDINGS OF THE RESEARCH

This chapter analyzes the findings of the quantitative studies and case studies for potentially broad generalizations that could assist in designing institutional and regulatory structures for PPP in water supply. The following are the two broad themes around which answers to research questions are organized (i) effect of country-wide institutional environment, (ii) effects of regulation and contract structure. In addition, there are two general findings. The findings are related to design aspects of PPP in water supply and are expected to enhance legitimacy, coherence and credibility, defined earlier as desirable attributes of good regulation.

6.1 Effect of country-wide Institutional Environment:

The impact of country-wide institutional environment on the cost efficiency of water utilities is not always in the expected direction. This underlines the need for special attention, while contracting, for those institutional aspects whose outcomes are counter-intuitive.

Empirical evidence in Chapter 4 indicated that some institutional aspects had positive impact on cost efficiency while others did not. As for example, property rights were found to be positively associated with cost efficiency. This is in line with expectations that regions where property rights are more secure will have utilities that are more cost efficient. The practical reasons could be that less number of guards were needed to

protect property, the transaction cost of settling property related disputes are low, thefts are low, etc.

On the other hand, some institutional aspects can have impacts which are counterintuitive. Business Freedom, for example, was expected to be positively associated with cost efficiency. Empirical evidence, however, indicated that they are not positively associated in case of public utilities. The reasons could be that in regions with high business freedom, good managers prefer employment in other business than public utility. Secondly, in case of government managed utility, regions with good business environment are likely to have governments that are cash rich. Therefore, more funds are likely budgeted for utility than in cash starved regions. The excess cash is likely to be used by the bureaucracy for unproductive purposes (Savedoff and Spiller, 1999). Finally, the cost of finance for utility business is likely high in such region. The best quality finance is likely to be used up by other business competing for finance. All these are potential reasons and require empirical investigation; they are potential topics for future research.

6.2 Effect of Regulation and Contract Structure:

6.2.1 Property Rights:

Property Rights security assured through relevant laws and supporting contracts bear the potential to attract private sector. While property rights security is

important for private sector participation, the dispersion of property rights among several private principals reduces information asymmetry.

Laws clearly articulating property rights are important for attracting private sector. In case of Manila, Water Crisis Act clearly articulated property rights. There are no similar laws in India. One of the officials from DJB stated that private sector interest in power increased only after specific laws articulating property rights were enacted. The concession in case of Manila is backed up by law but not in case of Tirupur. The higher risk perception in case of Tirupur might be the reason for private operator seeking higher rate of returns. While rate of returns (real) in case of Manila averages 10%, that in Tirupur is nearly 20%.

Monitoring is one of the means of reducing information asymmetry, although it is expensive (Shirley and Menard, 2002). The principal monitors the agent to ensure that the agent is pursuing his interests (Laffont and Martimort, 2002). In case of PPP, financing mechanisms can create new principal-agent relationships which can intensity the level of monitoring, specifically with regard to efforts. All financiers in the consortium are principals with respect to the private operator, the agent responsible for implementation.

Manila Waters financed its operations through a consortium of private firms with Ayala groups taking the lead. Between private firms in the consortium and Ayala Group, the former were the principals while latter their agent. The Mynilad Inc also had similar

financing relationship with Benepres Group as the agent. Such consortiums may have common interest in concealing ability, but their interest diverges with respect to degree of effort. For example, concealing information about ability will imply imitating an efficient firm with higher marginal cost. This is to the advantage of all consortium members. However, performing at lower level of efforts is not in the interest of the consortium members, particularly when the effort has the potential for positive outcome in the future (Iossa and Martimort, 2008). Thus, financing consortium will exert a pressure on the agent for effort.

The trading of shares of Manila Waters in the capital market created new property rights. The shareholders have property rights and it is in their interest to closely monitor the management of Manila Waters to ensure that maximum value for the shareholders is being realized.

In the case of NTADCL, the consortium of financiers, other than Government of Tamil Nadu and IL&FS, are several Banks and insurance companies, and a foreign investor from Singapore. IL&FS is the agent for these Banks, insurance companies and foreign investor. It is in their interest to closely monitor how IL&FS is managing the concession and whether best effort are being made. The independent monitoring reports relating to engineering efficiency and financial efficiency are two means by which all other private parties are kept informed about agent's effort levels.

In the case of Delhi, the only property rights holder, apart from DJB, is the Government of Delhi. There are no private property rights. There are no incentives for efficient performance.

6.2.2 Regulatory Governance:

Although water supply concessions are formally neo-classical contracts, social and cultural norms could skew the contracts into behaving as relational contracts or into informally assuming a bilateral governance structures. The ability of informal transformation into relational contracts appears to be directly related to the level of transparency the utility maintains with respect to customers.

In many cases, the formal relationship between government agency and private operator is regulated by concession contract. Such contracts lay down the terms and conditions of the relationship and specify in writing expected behavior from each. Differences are settled by mutual discussions and, failing that, through arbitrator.

In practice, evidence from case studies seems to suggest that the contractual relationship tends to turn relational. Both MWSS and NTADCL described the relationship with private entity as "marriage" with long term commitments. This belief appears to override the concern that incompleteness of contracts could result in problems at some point in future. While the relationship between government and private party in case of Tirupur appears to be truly a "marriage", that between MWSS and Manila Water (and now

MWSS and Mynilad also) appears to be a "live-in relationship". The reason for difference is that Tirupur is a formal joint venture with bi-lateral governance structure. MWSS and Manila Waters are not joint venture but they do resolve their differences in a manner characteristic of bilateral governance. However, as the case of Mynilad showed, the relationship could not withstand a serious crisis.

MWSS regulator appeared to be the crux of the informal relationship. All transactions between Manila Water and Mynilad with MWSS appeared to filter through the regulator. Although not fully autonomous, the MWSS regulator has, over the years, built up a reputation of being relatively independent and fair. This has been possible because it has attracted and recruited as regulators very talented people from outside the government. In case of DJB, such regulatory competence was lacking when it decided to undertake reforms. Bureaucrats and officials running the system inefficiently up until then were expected to regulate the performance of the private operator. This did not inspire confidence in common people. On the other hand, the presence of bureaucrat as a regulator alongside the private sector was not resented by customers in Tirupur because the opportunity cost of water was higher. In case of industry, the demand for water and, hence, the regulatory requirements, appear to differ much from domestic.

Theory says that relational contracting is not possible in water utility because of accountability concerns (Spiller, 2008). However, high level of transparency could be conducive for relational contracting. Both Manila Waters and Tirupur utilities showed significant transparency towards customers. Manila Water has a separate Sustainable

Development Department whose purpose is to connect with customers and assist in their welfare. This department was not a specified requirement of concession contract. It was set up to connect with the customers, and assist the most vulnerable. In case of NTADCL in Tirupur, which lacks transparency with respect to general public, there is a separate Marketing Department which is deals with its customers – the textile industries, keeping them informed on all issues of their concern. Besides, NTADCL has a bilateral governance structure with government and the private operator fused into one.

The potential for relational contract evolving and succeeding could also be on account of cultural characteristics. In both Philippines and India, the impersonal rule of law is not fully developed. Courts take a long time to adjudicate disputes. On the other hand, informal relationships matter much. In case of Manila Water and Mynilad, the regulator and the private sector officials had cordial, informal relationship. They met often, informally, because their offices were in the same building. In one of the interviews with Mynilad official, one of the regulator walked down to show his room, sat down for initial period of interview, objected to some of the remarks of the Mynilad official, debated his rebuttal and, after a while, left the room, exchanging pleasantries. It was apparent that Mynilad official and the concerned regulator were in good personal terms, but held professionally different points of view, with due respect to each other.

In Tirupur, the relationship between private sector official and the regulator - government officials - was relatively ceremonial but formal joint venture between the two rendered their contract relational. The government officials appeared willing to accommodate

private sector professional advice as long as their hierarchical dominance is not questioned. The private sector officials appeared to be comfortable with hierarchical dominance as long as the returns to investments were secure.

6.2.3 Regulator Effectiveness:

The quality of service delivery and control over externalities is dependent on the autonomy and competency of regulator. More autonomous and competent the regulator is, better the quality of service delivery and superior its control over externalities.

Although autonomy of regulator is usually discussed only with reference to tariff, it has impact on quality of service and control over externalities. In case of Manila, the regulator is relatively autonomous compared to Tirupur. As the volume of water supplied has increased in Manila because of efficient utility operations, so has the wastewater generated. In recent years, the regulator has begun emphasizing investments in sewerage. Groundwater extraction, which was rampant prior to reforms, is no longer a problem for the city. Wastewater treatment plants have been set up in several parts of the city and the sludge from these are taken away for disposal to a nearby island where volcanic eruption couple of years back had rendered soil unfit for agriculture.

In Tirupur, the NTADCL, as a regulator nominally separate from the government as well as service provider, has not been responsive to wastewater generation. The discharge of

pollutants in the local river resulted in the agricultural land downstream becoming polluted. Unable to convince the government and NTADCL to act, agriculturist went to the local High Court, which awarded damage to the agriculturists and asked NTADCL to immediately take measures for reducing pollution. New sewerage works have started in the city.

In DJB, where regulator and the service provider is one, there is no control over groundwater extraction, resulting in continuing decline of water table. Sewerage treatment plants are available but much of the sewerage is directly discharged into the rivers because of sewer line blockages. Stagnant water at many location results in dengue and malarial fevers during the monsoon season.

6.2.4 Competition:

There is a potential to increase competitive pressure on private utility through ensuring its listing in capital market and shares trading publicly.

This finding is characterized as a "potential" because more study will be needed before confirming the actual effects of going public. In the case of Manila Waters, the fact that it shares were being traded in the local stock market made the managers conscious of performance. They face the challenge of improving their current quarter performance with respect to the last. Expansion of service coverage has been vital to Manila Water's business strategy, and as the coverage has reached its limit, the company has begun

searching for new markets, including markets outside the country. The oversight by Capital Market regulator contributes to transparency and reduces information asymmetry. In case of Tirupur utility, NTADCL officials confirmed that they plan to list the firm in capital market soon, and will have shares trading in the market.

Although this finding is based only on one observation – that in Manila, it has been deliberately included because it is peculiar enough to deserve attention even if supported by one case study alone. There aren't any examples in developing countries of a concessionaire succeeding to the extent that it decides to list in the capital market. Importantly, such listing can have tremendous implication in designing re-auctioning of concession at the end of current life term.

There are certain caveats, though, such as the need for competent regulator and that the firm going public should be managing one or limited number of utilities. If regulator is not competent, the competitive pressure could result in rapid price rise, which is the easiest means of making profit and enhancing company value. A competent regulator, on the other hand, will force the company to make profits through enhancing efficiency and coverage. In case of Manila Waters, the regulator has focused on efficiency improvement and expanding coverage. But this is not the case with NTADCL in Tirupur which relies primarily on prices.

Competitive pressure could work against the interest of a city when large international firms operating in multiple countries are the utility managers. The changes in share prices

of such companies do not indicate how much of the change is on account of efficiency of utility operation in a specific city.

Bakker (2003b) lists examples from UK where he noticed a trend among private utilities towards "community mutuals". Many of the private firms, concerned about the conflicting interest of shareholders and customers, had begun restructuring in a manner that shareholders and customers were the same set of people. This trend began in 1999 when the price cap regulation limited the profits a firm could make. While Manila Waters has got enlisted in capital market at this stage, it will be interesting to observe future trends, particularly any potential move towards "community mutuals", and its impact on competitive pressures.

6.2.5 Monitoring:

The effectiveness of monitoring is positively associated with autonomy and competency of regulatory office.

Monitoring is important in case of PPP in water supply because it reduces information asymmetry (Shirley and Menard,2002). As the potential for competition, also important for reducing information asymmetry, is limited in PPP for water supply, monitoring assumes greater importance. Given incomplete information scenario, in which new information arises in future, poor monitoring can intensify information asymmetry

problem. The outcome could be economic inefficiency, control of market power by private operator and endemic disputes.

Monitoring is more effective when regulatory office is autonomous and competent. In case of Manila, the regulatory office is a separate entity with competent persons functioning as regulators. Their monitoring of Manila Waters and Mynilad is continuous, sustained and improving with time. In case of need, they hire outside experts. Periodic rebasing further improves the effectiveness of monitoring.

In case of Tirupur, the regulatory office and the concessionaire are both the same entity, resulting in serious conflict of interest. As the concessionaire has contracted out operations and management to another private entity, they have incentive to monitor only a limited aspect of PPP. Thus, operational expenditures are regularly monitored but the impacts on health and environment are not. The complaints of the industry are urgently attended but expectations of households in the city are not given much importance.

In Delhi, DJB is its own regulator. No independent regulatory office was envisaged for monitoring the performance of private entity to which management contract was to be awarded. NGOs did not believe that effective monitoring was possible under DJB's stewardship.

6.2.6 Incentives:

Rate of return regulation with periodic rebasing is suitable for developing countries. The contracts should have incentives for innovation.

Rate of return regulation is suitable for developing countries for two reasons. First, it is simple to apply. Second, it has incentives for expanding coverage and increasing capital expenditure, which is necessary in developing countries where coverage is poor and networks insufficient. Periodic rebasing can control over-investments.

In Manila, rate of return regulation has worked well. It has succeeded in attracting private capital and the coverage increased from 63% in 1997 to 99% in 2007. Rate of return regulation is also successful in case of Tirupur. However, in the absence of rebasing, the level of investments may exceed actual requirements. Also, absence of rebasing enhances market power of the private firm without any risk. As for example, Government of India has asked NTADCL to undertake sewerage expansion on its behalf. This task was not bid but directly awarded to NTADCL. If rebasing was present in Tirupur, the allocation of risks and rewards for undertaking the task could have been raised by the regulator.

Incentives are limited in case of PPP in water supply. Pricing policy is one of the major incentives for private operator. While price cap regulation rewards innovation, most developing countries prefer rate of return regulation for its simplicity (Kirkpatrick, Parker & Zhang, 2004). The incentive for innovation is low in rate of return regulations.

Innovation in technology, particularly process research, and innovations in managerial practices are distinct possibility in case of PPP, if adequate incentives are present. As for example, meter reading technology has potential for improvement. Tariff structuring could be done using methodology other than IBT which is commonly preferred.

In Manila, the incentive structure could have been better. While in Delhi, DJB, a public sector undertaking, has taken initiative for exploiting the commercial segment of bottled water, Manila and Tirupur, despite having PPP, has not. Understandably, the concession contract might not have a provision for bottled water sale but this is exactly the type of flexibility needed in the contract to encourage innovation. During the time Tirupur and Manila concessions were finalized, bottled water was not a large and growing business. But, with market potential growing, entry into bottled water could have had a positive impact on the firms. Bottled water is purely for drinking while domestic water supply serves a range of function from drinking to car washing. If bottled water sale is increasing, it implies that demand for drinking water through piped water supply is decreasing. This implies potential to reduce water tariff, depending on the revenue generated through sale of bottled water.

6.2.7 Dispute Resolution:

Disputes in PPP of water supply services are likely to occur on account of information asymmetry and unexpected shocks. Anticipating disputes on these

account, the contracts should be flexile enough to resolve them, should any arise. Regulatory Office embedded in a contract can become the source of contractual flexibility.

The chances of disputes in PPP for water supply are high. This is primarily because of high level of information asymmetry on a business very critically linked to public needs. Disputes can be reduced by finalizing contracts on the basis of long and detailed discussions, backed with credible studies and data. In Tirupur, the signing of contract was preceded by a long period of study and discussions. These studies helped reduce information asymmetry and enabled the financiers and the contractors to scale down risk perception. It also enabled government to better understand potential for opportunistic behavior by private financiers and firms.

In case of Manila, the disputes were on account of an unexpected marco-economic shock, besides new information that became available to parties as they went about their business after the contract. Some of these facts were at variance from their initial understanding, and resulted in bid assumptions becoming wrong. The presence of an autonomous regulatory office created flexibility for absorbing the impact of macro-economic shocks. Tariffs were re-adjusted to account for currency devaluation. However, the flexibility was not sufficient for dealing with information asymmetry which Mynilad blamed for its debt servicing burden. With government also lacking information about the issue in its entirety, as the matter related to assets constructed long back and buried

underground, it could not afford being too flexible without risking accountability concerns.

6.2.8 Consumer Inclusion:

Transparency of process and responsiveness to customer concerns are critical to the success of PPP in water supply.

Transparency and consumer inclusion is critical for overcoming accountability concerns among citizens. In many developing countries, common citizens do not trust their government because of generally poor service delivery in different sectors. They also do not trust private firms which are often found to be manipulating finances or misrepresenting facts, given the imperfect regulatory environment and predatory political system within which they must survive and succeed. On an issue critical as access and control over water, transparency and consumer inclusion, therefore, allays public concerns about PPP and limits opposition to reforms.

In case of Manila, the level of transparency has been very high from the very initial stages of PPP. Information is easily accessible. Consultation with people and educating them about plans is a constant feature. Surveys on public opinion are regularly taken through independent agencies. On the other hand, there is hardly much transparency in case of Tirupur and Delhi. Customers are given attention in case of Tirupur but not ordinary citizens, who are not directly supplied by NTADCL. DJB lacks transparency

like a typical public sector organizations. It also does not involve consumers much, relying on political executives for understanding and interpreting public concerns.

It is beneficial having a separate division in the utility devoted to customer inclusion. Manila Water has a separate division for Sustainable Development. NTADCL has a Marketing Division. Both these divisions actively interact with their customer base, and attend to their grievances. These divisions have also helped the firms develop positive image and enhance credibility. Mynilad and DJB do not have such division.

6.3 General Findings:

Institutions and organizations for PPP should be designed with due understanding of relevant "status functions" and deontic values in the society.

An important aspect is the manner in which PPP related institutions and organizations are chosen or created. They should be linked to status functions and deontic values which society regards highly. In case of Manila, the status function associated with President Marcos, who has successfully reformed power sector, mattered much. Further, to reform MWSS, President Marcos appointed Vigilar as its Chairman. Vigilar was known for his integrity and efficiency. Incidentally, he was brother of the person who had successfully implemented the power sector reforms. Both President Marcos and Vigilar had, in the eyes of an average Filipino, the status function of successful reformers. The deontic value

for the reform was obligation to act against a crisis. The society could easily identify with this requirement.

In case of Tirupur, IL&FS was imbued with the status function of an organization that supported textile industry. The posting of senior government servant belonging to the Indian Administrative Service (IAS) as head of NTADCL had the status function of underlining government's commitment to provide water to the industry. The deontic value for the reforms was the obligation to save the textile industry. These resulted in high support for the projects from the textile industries. But, being limited in their status function and deontic values, the project has not expanded to other areas.

In Delhi, the responsibility for reforms was vested in DJB, and it lacked the status function of a reformer. PwC and the World Bank also lacked positive status function – the former for having been associated with several financial scams in India and the latter for being a foreign entity and for showing "self-righteous attitude", as an interviewed NGO explained. The deontic value projected for reforms was 24/7 water supply which was not a powerful vision, failing to resonate with public sentiments. Most middle-class citizens in Delhi own over head tanks in which they store water and, therefore, have 24/7 access. The poor and under-privileged believed that 24/7 supply was meant for the well-off citizens, and any benefits to the poor would only be incidental.

New institutional arrangements for transaction exchange are more likely to occur if past arrangements are perceived to have failed. New institutions are refinement of the old, reinforced by social/cultural beliefs and expectations.

The need for new institutional arrangements are felt when the past arrangements are found inadequate (Greif, 2006). This could be on account of new technological developments or changes in resource endowment. Cultural and social perceptions impact the choice of new institutional arrangement (Ruttan, 2006)

In case of Manila, need for new institutional arrangement was on account of crisis in the water supply sector. It resulted in the enactment of Water Crisis Act. The depletion of groundwater and resulting sea water intrusion as well as risks of subsidence were some of the causes of crisis. There were also crisis of financial and technical management. MWSS was unable reduce UFW, and even basic issues such as procurement of materials, were delayed, often reaching the Courts on account of disputes. MWSS lacked finances for capital investments and Government lacked fund to deploy in MWSS capital expansion plans. PPP was chosen as the preferred arrangement for reforms.

The choice of concessions was made possible because historically MWSS had been maintaining separate accounting of water revenue and expenditure. Local politicians were on the Board of Trustee of MWSS and understood its business model. Consumers were paying for water services, even if rates were lower. Culturally, there was widespread acceptance of commercial principles of management, including business relating to water

sector. The administration of President Ramos was perceived as competent for managing privatization, given the successful example of power sector reforms.

In case of Tirupur, the need for new institutional arrangement was also on account of a crisis. The water supplied to textile industry by tankers was worsening in quality, with potential to disrupt a flourishing business employing thousands and generating considerable revenue for the State Government. The declining groundwater table was adversely affecting farmers in adjoining villages who were dependent on groundwater for irrigation.

The choice of PPP model as the new arrangement for water supply was made possible because the industry was already paying substantially for water. Earlier they paid to the tankers but now they would pay to a private operator. Government financing was not possible because of equity concerns. All other districts would have demanded similar investments for rehabilitating their water supply systems. The industry already had linkage with IL&FS for financing textile business. They found it easy to approach IL&FS for water supply project, with assurance of a steady revenue stream. Culturally, people in India regard water as sacred but they can have no reason to oppose industries paying willingly for water, particularly when part of it was to be diverted to the villages and townships at much lower cost. Finally, a lot of people were dependent on the industry for their livelihood. Hence, supporting project benefiting the project was also to their advantage.

In case of Delhi, a new institutional arrangement - Delhi Jal Board (DJB) - had been established in 1998 to overcome managerial, financial and resource related challenges. PwC proposed another institutional arrangement few years later, in 2003. This new arrangement intended PPP in part of the area serviced by DJB but this reform appear to have no linkage with the existing arrangements. For example, DJB is permitted make a profit of 3% per annum as per its bye-laws. The Management Contract proposed in the new arrangement was not linked to this fundamental commercial principle. It appeared to those who opposed the reforms, and rightly so, that the private operator could make unlimited profits. Management Contract carries low risk but assured rewards. Also, DJB was not a "failure" yet, in public perception, having just been established. The available data was inadequate to conclude if DJB was performing more poorly than its predecessor, DWS&SDU.

Cultural and social beliefs and expectations also militated against proposed reforms. In general, people in India are against paying for water. Delhi, however, already had a payment system in place. But, the likely presence of foreign companies in water management and perceived dominant role of the World Bank enabled NGOs to easily mobilize public opposition, playing on the historical fears of powerful foreign businesses and financial institutions.

Table_6.1:_Research Questions and Findings Presented in a Tabular Format.

Research Question 1:

Research Question	**Hypothesis/Auxiliary Question**	**Findings**
What is the impact of country-wide institutional environment on the efficiency of water utilities?	Secure Property Rights should result in improved cost efficiency	Property rights security is positively associated with cost efficiency
	Greater Business Freedom should result in improved cost efficiency	Business Freedom is not positively associated with cost efficiency
	Privately managed water utility should be more cost efficient than publicly managed utility.	The cost efficiency of privately managed utility is not necessarily greater than publicly managed utilities.

Research Question 2:

Research Question	**Auxiliary Questions**	**Subsidiary Questions**	**Findings**
How to design institutions in case of public private partnerships in water supply systems?	How to design regulatory governance structure in case of public private partnerships in water supply systems?	How to design property rights structure in case of PPP in water utilities?	*Dispersion of property rights among several private principals could reduce information asymmetry, which is good for PPP.
		How to ensure effectiveness of regulatory office in case of PPP in water utilities?	* regulatory office can exercise control over market power, ensure quality service delivery and protect against negative externalities if it is competent and autonomous.
		How to design contract governance structure in case of PPP in water utilities?	*Possibilities for relational contracting should be explored.

	How to design regulatory incentive structure in case of public private partnerships in water supply systems?	How to design competition in water supply contracts?	*Competitive pressure can be increased by ensuring listing of utilities in capital market, and its shares trading publicly.
		How to ensure effective monitoring in water supply contracts?	*Effectiveness of monitoring is positively associated with autonomy and competency of regulatory office
		How to design incentives?	*Rate of return regulation with periodic rebasing is suitable for developing countries.
		How to design dispute resolution mechanism between government and operator?	*contracts should be flexible * In case of concessions, explore possibility of embedding regulatory office within the contract structure
		How to design mechanisms for consumer inclusion?	*Transparency of process and responsiveness to customer concerns are critical for setting up PPP contracts and ensuring its smooth run.

CHAPTER 7: POLICY RECOMMENDATIONS AND CONCLUSIONS

This chapter discusses policy recommendations, taking the specific context of India, and concludes the research. Public Private Partnerships in infrastructure has been adopted in India since last few years, and has been successful in highways and power sector. The Government of India has begun encouraging PPP in urban water supply too, but the approach has been tentative and low-key, given social and political sensitivity to water.

Social sensitivity is because water is traditionally perceived as free gift from God and associated with religious purity. This attitude, however, is changing in urban areas and people are paying for water services in most Indian cities. People also buy bottled water for drinking purposes. The political opportunism in water supply has generally been high in India, with tariff very low in most cities. The distrust for politicians and government departments is very high. People are unwilling to pay extra for better water services because they do not believe government utilities can improve services. There is no city in India which has 24 hours continuous supply. Although the official figure for water leakages is as low as 25%, this is unlikely to be true. Metering is only partial, so no authentic figures are available. In some cities, such as Delhi, where experts tried estimating UFW, the figure they arrived at was as high as 60%.

Private sector has performed exceedingly well in different infrastructure sector over last one decade. Technical capacity is high in private sector but low in government.

In past, managerial capacity was higher in the government compared to the private but this trend has been changing. Managerial capacity in private is now comparable to government or superior. Taking these factors into account, the policy recommendations made below are for streamlining institutions, improving prospects of PPP in water sector, and for strengthening regulations to avoid negative consequences of PPP.

Firstly, there are no federal or state laws which explicitly specify government's intent of PPP in water sector, the process for PPP structuring and powers of authority competent to take decisions. Such a law is essential because municipal and urban local bodies are not aware of their legal and financial powers for entering into PPP contracts. The law should clearly articulate government's intent and specify the powers of the municipal/urban local bodies in respect to PPP contracts. Further, it should also specify fair protection to property rights of the private operator which may enter into PPP contracts.

Second, PPP in water supply should be encouraged only in those States and cities where possibilities of success are higher because of historical factors. Some States have had tradition of operating their water supply systems on commercial principles through State Water Boards (Kerala, Tamil Nadu, Maharashtra). Some of the cities in such States may be having industrial clusters where demand for water is high. Others (such as Jharkhand) may have history of greater private sector participation in water supply management. Success of PPP in power and highways in States can enhance prospects for PPP in water (Andhra Pradesh). Importantly, crisis on account of water scarcity, finance

or any other reason can be a powerful reason for contemplating PPP in water supply (Gujarat, Rajasthan). States with high business freedom should also be encouraged to consider PPP in water supply to improve efficiency (Maharashtra).

Third, only those States which have a certain minimum level of technical competency and managerial capacity should be encouraged to consider PPP in water supply. The role of the government is technically more sophisticated and demands assumption of higher level of responsibility in case of PPP. In fact, PPP should not be adopted at all if government severely lacks basic capacity and competency for managing its utilities. Also, the decision to adopt PPP should be left to the State and city, as widespread community consensus is essential for PPP in water to succeed. The Central government could create a panel of experts who could help governments evaluate their strengths and competency for entering into PPP for water supply.

Fourth, regulation by contract, supported by a contract specified regulatory office, is a suitable mechanism for India, given the vastness of the country and numbers of cities. A centralized entity may find it difficult to quickly respond to new information of each city as the PPP contract progresses. Also, relational contracting is more likely when the principal and agent are in close proximity, where they have greater chance to understand each other. While bilateral governance structure, such as in Tirupur, could be a good model for concessions, it should be accompanied by an independent regulatory office to monitor the contract and conduct rebasing periodically. The suggested models could be Manila type, with a concession contract and regulator specified in the contract or a hybrid

of Manila and Tirupur with joint venture between government and private, and a separate regulator appointed by the government to monitor its performance. In such hybrid cases, it is essential that the hierarchy of the official heading the regulatory office be higher than the official heading the joint venture, should the latter be a government official, as in case of NTADCL.

While the above discussed arrangements are appropriate for concessions, in which relational contracting can improve performance, this does not apply to all other forms of contracting. Management Contract and Lease contracts are fixed rate contract for short period, with low incentives and low levels of risk and, therefore, need not be relational. In these cases, a State level regulator, at a relative distance from the operator, should be sufficient.

Fifth, the Government of India should promote yardstick competition between utilities. Besides creating competitive pressure, it will also show the trends in improvement over time, and enable comparison of PPP operated utilities with public utilities. Another policy aspect to seriously consider is to make it mandatory for concessions to enlist in the capital market. A suitable threshold may have to be provided in the concession contracts.

Sixth, the private firms permitted to bid for water supply contracts should not include foreign companies. In case of consortium, the majority stakeholder should be an

Indian company. This is essential given sensitivity of people with regard to foreign control over vital resources such as water.

Seventh, tariff structuring based on rate of return regulation is suitable for India. Its simplicity will make implementation easy. Potential for fixed return will attract private investors, particularly in concession contract which is long term, as it will be a financial asset not subject to swings of the market, diluting their long term overall investment risks. Rate of return regulation is also suitable for expanding coverage and this is particularly important in cities of India. The bid should be structured such that there is minimal or no increase in tariff at the beginning of the contract. In fact, lower tariff is also a distinct possibility, as seen from the case of Manila, and should be the preferred strategy. Increases in tariff in future should be linked to improvement in service quality. This is a delicate balancing act, but possible with a competent private operator and a competent regulator working in coordination.

Finally, Government of India must have an explicit policy for transparency on all aspects of PPP in water utilities. The Right to Information Law, which allows common people to ask and receive any information from the government, should be made applicable to future concession contracts too. All the process leading to contractual agreement should be open to public participation and scrutiny.

In conclusion, the research finds that PPP in water supply is a possible reform option if institutions and regulations are well designed. But to successfully negotiate and

manage PPP contracts, the government must possess certain basic capabilities. In other words, PPP does not imply that government ceases to play a role in water supply. Instead, there is a re-definition of the role of the government as that of an effective regulator and the new responsibility is often a greater challenge. The government must develop its capabilities before embarking on PPP. With contract design that reduces information asymmetry and provides right incentives, it is possible to vastly improve the quality of service through private sector participation.

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Annex 1

Sl No	INTERVIEW QUESTIONS (Government agency/Regulator)
1.	Could you briefly explain if existing laws or executive orders address the potential issue of (i) expropriation of private sector investments by government and (ii) monopolistic pricing by the private operator?
2.	Who is the regulator, what is expected out of it and how independent is it from the government? Please elaborate.
3.	What are the government policy regarding competition among private companies in water supply and sanitation management? How has the experience been so far? What other strategy were adopted or considered to improving private sector performance?
4.	How do you monitor the private operator (please specify the parameters) and in what way is the monitoring data utilized? Are the data publicly available?
5.	Could you please explain the different types of incentive offered to the operator for performing efficiently and how effective these have been?
6.	How is tariff structured? In what ways are incentives linked to tariff, if at all?
7.	What are the penalties for non-performance, how frequently are they imposed and what has been the response?
8.	How are disputes between government and private operator resolved?
9.	How are consumers included at different levels of decision making or implementation?

Annex 2:

Sl No	INTERVIEW QUESTIONS (Private operator)
1.	Could you briefly explain if existing laws or executive orders protect your organization from potential issue of (i) expropriation of private sector investments by government and (ii) how does law address the issue of monopolistic pricing by the private operator?
2.	Who is the regulator? What is your views about its independence and technical competency? What has been the experience so far?
3.	Who are your main competitors? What are the competitive pressures you have encountered so far? What other factors might have forced you to improve your performance?
4.	Who monitors your operations and on what parameters? How has the experience been so far?
5.	Could you please explain the types of incentive you receive as an operator for performing efficiently?
6.	How is tariff structured? In what ways are incentives linked to tariff, if at all?
7.	What are the penalties for non-performance, and what has been the experience in this respect?
8.	How frequent are disputes with the government and how are they resolved? What has been the experience like?
9.	How are consumers included at different levels of decision making or implementation?

Annex 3

Sl No	INTERVIEW QUESTIONS (NGOs, other interested parties)
1.	In your opinion, does the existing laws or executive orders address the potential issue of (i) expropriation of private sector investments by government and (ii) monopolistic pricing by the private operator?
2.	Who do you believe is the regulator, how is it functioning and how independent is it from the government? Please elaborate.
3.	What are your perceptions about the government policy on competition among private companies in water supply and sanitation management? How has the experience been so far? What other strategy could have been adopted or considered for improving private sector performance or the water sector performance?
4.	Are you aware how private operator is monitored and how monitoring data is utilized? Are the data publicly available?
5.	Are you aware of the different types of incentives offered to operator for performing efficiently? In your opinion, how effective have these incentives been?
6.	How is tariff structured? In what ways are incentives linked to tariff, if at all?
7.	Are you aware if penalties exist for non-performance by private operator? What has been the experience with provisions for penalties for non-performance?
8.	How are disputes between government and private operator resolved?
9.	How are consumers included at different levels of decision making or implementation?

Annex -4

STOCHASTIC COST FRONTIER

The dissertation uses cross sectional Stochastic Cost Frontier for analyzing cost efficiency of utilities. Conceptually, technical efficiency as related to cost frontier is derived from the same logic as applied for production frontier, excepting that the directions are opposite. Thus, while firms produce on or below the production frontier, they operate on or above cost frontier. The further is a firm from the cost frontier, the more technically inefficient it is.

Cost efficiency is the ratio of minimum feasible cost for a firm, given its environmental characteristics, to observed cost. The minimum feasible cost has two parts – deterministic and stochastic. The deterministic is common to all producers while the stochastic is random and producer specific. The observed cost, on the other hand, is composed to three parts – deterministic, random and firm specific inefficiency. If there is no firm specific inefficiency, the observed cost is the same as the minimum feasible. But if there is firm specific inefficiency, the econometric objective is to disentangle the three parts – deterministic, random and inefficiency - and analyze, for the purpose of this dissertation, whether the inefficiency terms can be explained by (i) ownership and (ii) institutional indexes relating to property rights and business freedom.

Mathematically,

$CE_i = c(y_i, w_i; \beta).\ \exp\{v_i\}/ E_i$

where,

Ei = observed cost; $c(y_i, w_i; \beta)$ is deterministic component common to all producers; vi is random noise specific to the firm, which is normally distributed with mean 0.

By definition, $Ei = c(y_i, w_i; \beta). \exp\{\varepsilon_i\} = c(y_i, w_i; \beta). \exp\{v_i + u_i\}$

Where ε is the error term and ui is the inefficiency term. The term ui is positive and always greater than or equal to zero. This implies that for a efficient firm, ui will be zero but for all others it will be a positive number greater than zero. The distribution of vi is normal but ui could be either half normal, exponential or any other positive distribution. In the dissertation, it is assumed that ui is half normal.

Thus, $CEi = \exp\{- u_i\}$

Assuming half-normal distribution for ui;

The density function, $f(u) = 2/ \sqrt{2\pi}\sigma_u . \exp\{ - u^2/2\sigma_u^2\}$

And $f(v) = 1/ \sqrt{2\pi}\sigma_v . \exp\{ - v^2/2\sigma_v^2\}$

Then, $f(u, \varepsilon) = 2/ 2\pi\sigma_u\sigma_v . \exp\{- u^2/2\sigma_u^2 – (\varepsilon-u)^2/2\sigma_v^2 \}$

The density function of $f(\varepsilon) = \int f(u,\varepsilon)\, du$, integrating from 0 to infinity

$$= \int 2/ 2\pi\sigma_u\sigma_v . \exp\{- u^2/2\sigma_u^2 – (\varepsilon-u)^2/2\sigma_v^2 \}. du$$

$$= 2/\sqrt{2\pi}\sigma .[1 – \Phi(-\varepsilon\lambda/\sigma)] . \exp\{- \varepsilon^2/2\sigma^2\} \text{---------- (A)}$$

Where, $\sigma = (\sigma_u^2+\sigma_v^2)^{1/2}$,

And $\lambda = \sigma_u/\sigma_v$

And, Φ = standard normal cumulative distribution

The marginal density function f (ε) is asymmetrically distributed with mean and variance as follows:

$$E(\varepsilon) = E(u) = \sigma_u \sqrt{(2/\pi)}$$

$$V(\varepsilon) = \{(\pi - 2)/\pi\}\sigma_u^2 + \sigma_v^2$$

Using the above equation, A, we can have a log likelihood function for a sample of I producer as follows;

$$\ln L = \text{constant} - I \ln \sigma + \sum \ln \Phi (\varepsilon_i \lambda/\sigma) - 1/2\sigma^2 \sum \varepsilon_i^2$$

The log likelihood function can be maximized with respect to parameters (β) to obtain MLE of all parameters.

In the next step, the cost efficiency of a firm can be estimated. As u_i cannot be directly observed, its expected value given ε_i is derived. There are several econometric techniques for deriving the expected value of u_i and one of them is the method proposed by Battese and Coelli (1988) based on the following formula;

$$E[\exp(-u_i) \mid \varepsilon_i] = \{[1-\Phi (\sigma_A - \gamma\varepsilon_i/\sigma_A)]/[1- \Phi (-\gamma\varepsilon_i/\sigma_A)]\} * \exp(-\gamma\varepsilon_{i+}\sigma_A/2)$$

In this, Φ is the distribution function of normal random variable. Further, following the parameterization proposed by Battese and Corra (1977), $\sigma^2 = \sigma_v^2 + \sigma_u^2$, $\gamma = \sigma_u^2/(\sigma_v^2 +$

σ_u^2) and $\sigma_A = [\gamma\ (1-\gamma)\ \sigma^2]^{1/2}$. The parameter γ should lie between 0 and 1, with 0 indicating that deviation from frontier is entirely because of stochastic noise and 1 indicating that the deviation is entirely due to inefficiency. This permits the testing of hypothesis that there is no inefficiency effect in the model, Ho: $\gamma = 0$, as against alternative that Ha: $\gamma = 1$.