

# **Explaining the Determinants of Contractual Inefficiencies: The Case of Water Provision in Saltillo, Mexico**

by

**Abdelali Soto- Vázquez**

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UNIVERSITY *of the*  
WESTERN CAPE

**Supervisor:  
Prof. Pieter le Roux**

**Co-supervised by:  
Dip.Ök. Iris Vernekohl**

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## INDEX

DECLARATION.....	vi
ACKNOWLEDGEMENTS .....	vii
KEY WORDS .....	viii
LIST OF ABBREVIATIONS .....	ix
LIST OF FIGURES .....	x
LIST OF TABLES .....	x
ABSTRACT .....	xi
INTRODUCTION.....	1
WATER MODES OF PROVISION AND DEVELOPMENT .....	3
2.1 The Importance for Water and Development.....	3
2.2The Economics of Water Service Delivery: Some Normative Issues.....	3
2.3 Modes Available for Providing Water and Sanitation Services.....	6
2.4 Research Question.....	9
DETERMINANTS OF CONTRACTUAL PROBLEMS AND THE OPTIMALITY OF CONTRACT DESIGN.....	11
3.1 Contracts as coordination mechanisms .....	11
3.1.1 The technical governance of the transaction .....	12
3.1.2 The Enforcement Mode.....	13
3.1.3 The Remuneration Risks and Sharing Mode.....	14
3.1.4 The contract duration.....	14

3.1.5 The diversity of contractual arrangements .....	14
3.2 A Review of Theories on Optimal Contractual Design and Contractual Problems .....	15
3.2.1 Complete Contracts, The Incentives Theory (IT).....	15
3.2.2 Incomplete Contracts Theory: The Incomplete Contract Theory (ICT) and Transaction Costs Theory (TCT).....	16
3.3 Transaction Cost Approach by Williamson.....	20
3.3.1 General Argument and Concept Definition of the Transaction Cost Approach by Williamson .....	20
3.3.2 Transaction costs and cost types associated with the contracting process ....	21
3.3.3 Types of governance structures .....	22
3.3.4 Properties of The Transaction and Associated Optimal Governance Structures .....	23
3.4 An Application of the Contract Typology to Describe Alternative Modes for Water Provision .....	26
3.4.1 Characterization of Transaction Properties for the Water Provision Services .....	27
3.5 Theoretically derived hypothesis and sub- hypotheses .....	30
METHODOLOGICAL APPROACH .....	32
4.1 Research questions relevant for the case study. ....	32
4.2 Indicators and Data Needs given the Hypothesis and Research Questions.....	32
4.3 Methods of data collection .....	38
4.3.1 Study Qualitative Approach .....	38
4.3.2 Sources .....	38

4.3.2.1 Primary sources, Design and Conducting of the interviews.....	38
4.3.2.2 Secondary sources .....	39
4.4 Methods of data processing and evaluation.....	39
4.4.1 Evaluating the hypothesis.....	39
4.4.2 Evaluating Interviews .....	41
4.5 The Saltillo Case Study .....	41
FINDINGS AND INTERPRETATIONS.....	45
5.1 Water Provision in Saltillo: A Characterization according to TC Properties.....	45
5.1.1 Investments Specificity .....	45
5.1.1.1 Service area location and topographical characteristics .....	45
5.1.1.2 Origin of water .....	46
5.1.1.3 Properties of raw water.....	47
5.1.1.4 Distribution networks physical conditions .....	47
5.1.2 Uncertainty and Complexity.....	49
5.1.2.1 Type of water supply sources .....	49
5.1.2.2 Climate Variability .....	49
5.1.2.3 Growth in water demand for human consumption and other productive uses .....	50
5.1.3 Frequency and duration .....	51
5.1.3.1 Total population and water coverage rate.....	51
5.1.3.2 Water service availability at service area .....	51
5.1.3.3 Incidence of water production and distribution activities .....	51
5.2 Theoretically Optimal Governance Structure for Saltillo.....	53
5.3 Description of the Governance Structure Chosen: AGSAL.....	54

5.3.1 The Technical Governance.....	54
5.3.1.1 The Authority Element.....	54
5.3.2.1 The Strategic Coordination.....	56
5.3.1.3 The Organizational Coordination.....	56
5.3.1.4 The Operational Coordination.....	58
5.3.2 The Enforcement Mode.....	60
5.3.2.1 The supervision and conflict–settlement devices.....	60
5.3.2.2 The incentives and sanctions scheme.....	61
5.4 The Remuneration and Risk Sharing Modes.....	63
5.5 The duration of the contract.....	64
5.6 AGSAL, a hybrid contractual arrangement.....	64
CONCLUSIONS AND RECOMMENDATIONS.....	66
6.1 Main conclusions and findings.....	66
6.2 Scope and limitations of the research.....	68
6.3 Final considerations.....	68
BIBLIOGRAPHY.....	70
ANNEX.....	76
Table 1. Hypothesis, Indicators and Measurements (Complete Version).....	77
Table 3 Conclusions on Theoretically Based Hypothesis.....	82
Questionnaires for Interviews.....	89
Interviews with Local Authorities.....	89
Interviews with AGSAL officials and other Water Experts.....	91

## DECLARATION

I, Abdelali Soto Vazquez, hereby declare that the thesis entitled “*Explaining the Determinants of Contractual Inefficiencies: The Case of Water Provision in Saltillo, Mexico*”, is of my own work and that I have received no other assistance in completing the said work other than stated sources and citations. Furthermore, I declare that this mini-thesis has not been submitted at any other university, college or institution of higher learning for any degree or academic qualification.

**Abdelali J. Soto -Vazquez**

**May, 2006**



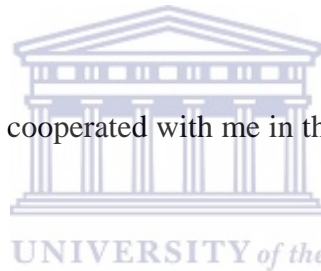
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## KEY WORDS

Water provision

Public goods

Contract

Transaction costs

Public-Private partnership

Property rights

Governance structure

Efficiency

Private provision of public goods

Public provision of public goods





## LIST OF ABBREVIATIONS

<b>AGSAL</b>	Aguas de Saltillo
<b>WSS</b>	Water and Sanitation Services
<b>PPP</b>	Public-private partnerships
<b>BOT</b>	Build-Operate- Transfer Contract
<b>IT</b>	Incentives Theory
<b>ICT</b>	Incomplete Contracts Theory
<b>TC</b>	Transaction Costs Theory
<b>TCT</b>	Transaction Costs
<b>AS</b>	Asset Specificity
<b>AUAS</b>	Local Water User Association
<b>mcm</b>	Million cubic meters
<b>SIMAS</b>	Municipal System of Water and Sanitation
<b>AGBAR</b>	Waters of Barcelona
<b>INTERAGBAR</b>	Mexican Subsidiary for Waters of Barcelona
<b>CEAS</b>	Coahuila Water and Sanitation Commission
<b>l/s</b>	Liters per second
<b>CNA</b>	National Water Commission
<b>INPC</b>	Price Consumer Index

## LIST OF FIGURES

Figure 1 The Range of Options Available for Private Participation	p. 11
Figure 2 Characterization of Modes of Water Provision as Governance Structures	p. 30
Figure 3 Theoretical Derived Hypothesis and Variables	p. 33
Figure 4 Owners of AGSAL and Assets Ownership Distribution	p. 60
Figure 5 AGSAL Managerial-Organizational Structure	p. 62



## LIST OF TABLES

Table1 Hypothesis, Indicators and Measurements	pp. 37-39
Table 2 AGSAL'S Working Capital and Distribution of Shares	p. 59
Table 3 Conclusions on Theoretically Based Hypothesis	pp. 87-93

## **ABSTRACT**

### **Explaining the Determinants of Contractual Inefficiencies: The Case of Water Provision in Saltillo, Mexico**

**A. Soto-Vazquez**

**M. Admin. Minithesis, School of Government, University of the Western Cape**

Public-private partnerships to provide services are a relatively new policy initiative in Mexico, and have shown contrasting results. This research has endeavored to analyze the possible determinants behind the failure—or the success—of the choice of a specific mode of service provision. By using contracting literature based on transaction costs, and looking specifically at the case of AGSAL, a joint venture established between Saltillo, a northern Mexican city, and INTERAGBAR, a private investor, for the provision of water, this study shows that characteristics of the transaction at stake. More specifically, it shows that specificity of the investments that support a given transaction, the unanticipated changes in circumstances surrounding an exchange—either from physical assets or its ownership rights—and the frequency and duration with which parties engage in the transaction. This will determine a specific contractual arrangement (i.e., mode of provision) that will mitigate the possibilities for these contractual failures to occur, and will provide efficiency benefits.

Finally, this research concludes by saying that despite the usefulness of Transaction Cost Approach to explain the optimal functioning of a contractual arrangement, there may be further reasons that also are important drivers of the choices made by governance structures.

**May 1, 2006**

# CHAPTER 1

## INTRODUCTION

Today around the world, governments are confronted by increasing demands for goods and services from their citizens—a task that each year becomes harder to achieve. Among the main constraints faced by Governments to meet such demands are, on the one hand, a limited access to human and capital resources, while, in the other hand, there is an insistent society pressure on public authorities to operate more efficiently: to provide a service of the highest quality at the lowest possible cost.

In order to ameliorate this situation, Governments are permitting private investors in areas that not long ago were considered their exclusive domain. However, while the private participation is relatively easily accepted in some utilities, when it comes to water and sanitation, it becomes a polemic issue because of the essential role of water for sustaining life and the continuing monopolistic tendencies in the provision of water. Yet, increasing access to potable water for most people still remains a critical challenge in many countries. (PPIAF, 2001:3)

Whether private participation in water provision is right or wrong remains an open question. This study is conducted at a time when Government has already made the decision to include a private investor in water provision; it will find that there are a wide variety of options to do so; but the question remains: which option really is appropriate for its area specific needs and conditions.

In Mexico, where nearly 18.1 million people lack water services, more than 85 % of water systems are still operated by local governments which faces the seemingly insurmountable challenge to assure universal drinking water service and to establish and maintain adequate facilities for treating sewage water in an financially efficient and viable manner. Therefore, private participation has been perceived as a very likely possibility in helping authorities to overcome these challenges. However, even at a stage where private companies are participating in the management of fewer than 5% of the local water and sewerage systems, some public-private partnerships have been set as international examples, while other have resulted in costly failures.(Tortajada, 2004:13-15)

This study, by looking at the specific case of Aguas de Saltillo (AGSAL), the only joint stock company in Mexico, which provides water to the northern city of Saltillo, is aimed at explaining what those factors are which determine the optimal mode for water

provision according to the needs and circumstances of a given area; what is the rationale behind including the private sector, and up to which extent should it be done; but above all to offer possible explanations of why some inefficiencies can occur, after a specific mode for private participation in water provision has been adopted.

This research is structured into six chapters. The first chapter corresponds to this introduction. The second chapter looks at the importance that water and its provision have for development and discusses the main arguments available in favor of and against private participation in the sector and it finally introduces the different alternatives for water provision. The third chapter presents an overview of the principal theoretical currents dealing with how to optimally design a contract and address the main causes of contractual failures. Also, this chapter highlights the testable implications of the Transaction Cost Approach, which has been selected as theoretical background for this research.

The fourth chapter presents the methodological aspects of this study and these include the indicators, measures of variables, data needs and methods of data collection, processing and analysis. The fifth chapter introduces the empirical analysis of the mode of water provision that has been put in place in the case of Saltillo and the main requirements for optimal contract design. Finally, the sixth chapter contains the main conclusions drawn from the empirical case analysis and some considerations about the applicability and further development of this research.

## CHAPTER 2

### WATER MODES OF PROVISION AND DEVELOPMENT

#### 2.1 The Importance for Water and Development

Water is necessary for the survival of all life; yet, over one billion of the world's more than six billion people don't have available sources of clean water for drinking. An additional 1.6 billion people who have access to water for basic survival do not have sufficient water from health and hygiene (Scanlon, 2004:1-2). Ensuring access to safe water worldwide is imperative. Water is an economic issue since it is essential for poverty alleviation, agriculture, food and energy production, as well as recreation. It is a women's issue in the developing world because women have primary responsibility for household water gathering in many of these countries. Time spent hauling water robs women and girls of the opportunity to get an education or engage in meaningful work. It is a children's issue because water is essential for healthy development. A youngster dies every eight seconds from water-borne disease. (Clarke, 1993:19) And water is a national security issue because some of the world's conflicts today arise from disputes over arable land and water. But most of all, water is a fundamental global health issue. Unsafe water and sanitation is now the single largest cause of illness worldwide. Many of the 10 million child deaths that occurred last year were linked to unsafe water and lack of sanitation. Children can't fight off infections if their bodies are weakened by water-borne diseases. (Harderberg, 2005:333-334)

The United Nations has set a Millennium Development Goal — to be reached by 2015 — of reducing by half the percentage of people without access to safe drinking water and basic sanitation. There is a long way to go to reach this goal. A global coalition of organizations, businesses and individuals must be mobilized across the public and private sectors for infrastructure development and innovation. Developing countries should involve their societies in decision making about how best to get improved water and sanitation services to their people. And developed nations should work with those countries and people they are seeking to help so that improvements can be sustained over the long term. (Gray & Sadoff, 2005:1-2)

#### 2.2 The Economics of Water Service Delivery: Some Normative Issues

The water sector, along with other utilities, has certain specific characteristics, which have clear implications for the way water is managed.

First, water systems include both the supply of clean water and the treatment and removal of sewage. These services are a natural monopoly involving large fixed costs and significant economies of scale. (Clark & Mondello, 2002:1) There is typically little competition to a well functioning water system from alternative sources. One of the main alternatives, for example, is household self-provision through pumped wells, rainwater catchments and septic tanks. Self provision suffers from low quality and high costs. Similarly, the sale of drinkable water from private vendors is substantially more costly and therefore does not present serious competition either. (Shirley & Menard, 1999:4)

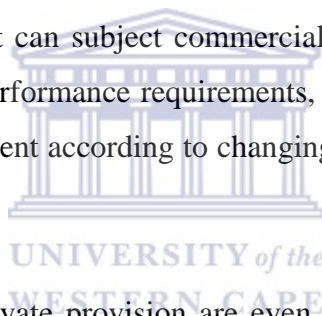
Secondly, the water sector is characterized by high capital intensity and the presence of sunk costs, which implies that the investments undertaken in the infrastructure needed to provide a service are neither transferable nor redeployed for other purposes. This invariably increases the risk attached to investment in the sector. (Spiller & Savedoff, 1995:5)

Thirdly, the water sector is also characterized by the presence of significant externalities. For example, the proper elimination of sanitation residuals and treated industrial waste prevents negative externalities through the pollution of natural bodies of water and other natural resources. (Toolkits for Private Participation in Water and Sanitation, 1997)

Finally, another special feature of water supply is that, as human life depends on access to drinkable water, so the demand for water is far less responsive (inelastic) to price, of course, than water demanded for other non-survival household (i.e. lawn watering) and productive uses ( i.e. power generation). (Toolkits for Private Participation in Water and Sanitation, 1997)

These features—natural monopoly, the presence of significant externalities, the inelasticity of demand, and the pursuit of universal coverage—have traditionally been used to argue for the public provision of water services. Most countries supply water services through the public sector, but many governments have often failed to universalize access to water services. This is the case for various reasons which include inadequate financial resources to undertake the investments needed for adequate provision of these services, mismanagement and poor institutional arrangements. Consequently, there are a growing number of calls to consider allowing a regulated private sector to deliver water services.

Private supply has the advantage of providing strong incentives for cost reductions and other productivity enhancements. This is because under private ownership, the rights to enjoy the benefits resulting from selling water are concentrated among identified individuals, and thus the owners are motivated to improve efficiency and control management to maximize their profits. In contrast, these incentives are weak under public ownership; where typically agents cannot reap the results of their effort and innovation. Nevertheless, the weak efficiency incentives in public firms can represent a social advantage when cost reductions by private suppliers come at the expense of undesirable quality deterioration or reductions in access by the poor. In particular, unregulated private providers may undersupply the socially optimal quality of water in the presence of externalities because they fail to take into account the marginal social benefits in their decisions. Similarly, private owners may exclude low-income households from the network by raising prices, strictly enforcing payment, and concentrating their investments in high-income areas. However, both the fear of quality deterioration or access exclusion can be monitored and enforced through having strong regulatory bodies in place that can subject commercial providers to tariff regulations, quality standards, and other performance requirements, which are renegotiable in order to allow for regulation adjustment according to changing economic circumstances. (Lee & Jouravlev, 1997:10-11)



The arguments in favor of private provision are even stronger when considering that private participation reduces political interference in the management of the service. Privatization insulates the agency from inefficient political influences because it reduces possibilities of government intervention in enterprise decision-making. In order to attract private investors' interest a well-defined property rights system, which protects private ownership, must exist; thus the government role is reduced to ensure non-negative expected returns. Private management also creates separation between public sector regulators and enterprise decision makers making more difficult for public authorities to intervene in the daily running of the enterprise because of information asymmetry between parties. This is in the interest of the enterprise. (Lee & Jouravlev, 1997:10-11)

Finally, the process of resource allocation within the aggregated public sector does not guarantee the assignment of funds to the most profitable projects. The chronic underinvestment in physical capital that plagues many public utilities is aggravated for debt-



ridden governments with large fiscal deficits. Privatization can significantly improve the access of the firms to the capital markets and therefore their ability to invest, since they are then subject to the discipline imposed by capital markets to raise resources. (Lee & Jouravlev, 1997:11)

In sum, it can be concluded that governments who privatize water systems are typically motivated by potential efficiency gains. They hope that these efficiency gains will be translated into expanded access and improved service quality and thus impact on society well-being. However, specially in the water sector and perhaps because of limited experience, evidence suggests that the privatization of monopolies produces ambiguous results in terms of improving economic performance and it is to be expected that the institutional requirements needed to ensure that privatized monopolies perform well, notably an effective system of state regulation and supporting property rights structure, will be particularly missing in many developing countries. (Water-The Essence of Life, Development News: 2002)

### **2.3 Modes Available for Providing Water and Sanitation Services**

A great variety of modes for providing water and sanitation services (WSS), coexist today. They can conveniently be differentiated according to the degree of public control over asset ownership; therefore we can arrange them along a continuum starting from the extreme of a public water utility to an almost private water entity.

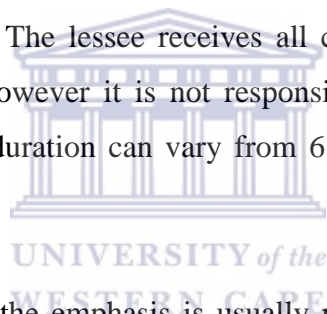
A *public water utility* is a government-owned corporation under a public water authorities' management. However, it can take alternative forms from a public operator supervised by a bureau, or one that is part of a ministry, to a public owned corporation that operates as an independent firm. (Shirley & Menard, 1999:7) Those modes in which water management is a joint responsibility and involve public and private parties are known as *public private partnerships* (PPP): under this arrangement both parties share risks, responsibility, and in some cases investment. (Budds, 2000:4) There are diverse forms of PPP.

The *service contracting* is a short, fixed-term contract for specific services or for the operation and maintenance of elements of infrastructure. The contractor is paid for service delivery and compensation fees are usually linked to operational efficiency. The public utility retains overall responsibility for the system, except for those specific services contracted out, and it finances working capital and fixed assets. Since assets

belong to the utility, it bears the full commercial risk for service provision. Control is exercised through setting detailed performance indicators. Service contracts are usually for short periods. (Lee & Jouravlev, 1997:33-35)

Under *management contracts* the public owner transfers to the private party full managerial control with the freedom to make day-to-day management decisions. The government keeps full ownership and is responsible for capital expenditures, maintenance, and working capital, while the private agent supplies only management and technical skills. Various compensation packages are used in management contracts. The contract duration is from 3 to 5 years. (Lee & Jouravlev, 1997:36-39)

For *lease contracts*, the public lessor grants to a private lessee an exclusive right to use facilities to conduct business on its own account for a specified period at a specified rent. The lease contract transfers full operational and financial control of the assets essential for the operation of the utility. The lessee rents the facilities but the contract does not transfer ownership. The lessee receives all commercial risk for day-to-day operation and maintenance; however it is not responsible for capital expenditure for major new investments. The duration can vary from 6 to 10 years. (Lee & Jouravlev, 1997:40-43)



Under a *concession contract*, the emphasis is usually placed on the management and expansion of an already existing system. All responsibility for financing major investments is now for the concessionaire. This implies that all commercial risks and most financial risks are shifted to the private investor. A concession contract may or may not transfer ownership of facilities to the contractor. In either case, the contractor must return them in good condition at the end of the contract period. The public authority keeps control over service provision through reviewing of investments plans and their implementation, and by regulating tariffs. Concession contracts are designed to be long enough to allow the concessionaire to depreciate investment and to provide a reasonable return to the equity investors, typically from 15 to 30 years. (Lee & Jouravlev, 1997:44-45)

The *Build- Operate- Transfer Contracts (BOT)*, are a particular kind of concession, but focus more on the building and engineering of works within the utility. Under BOT, public authorities grant to a private contractor a long-term concession contract, during

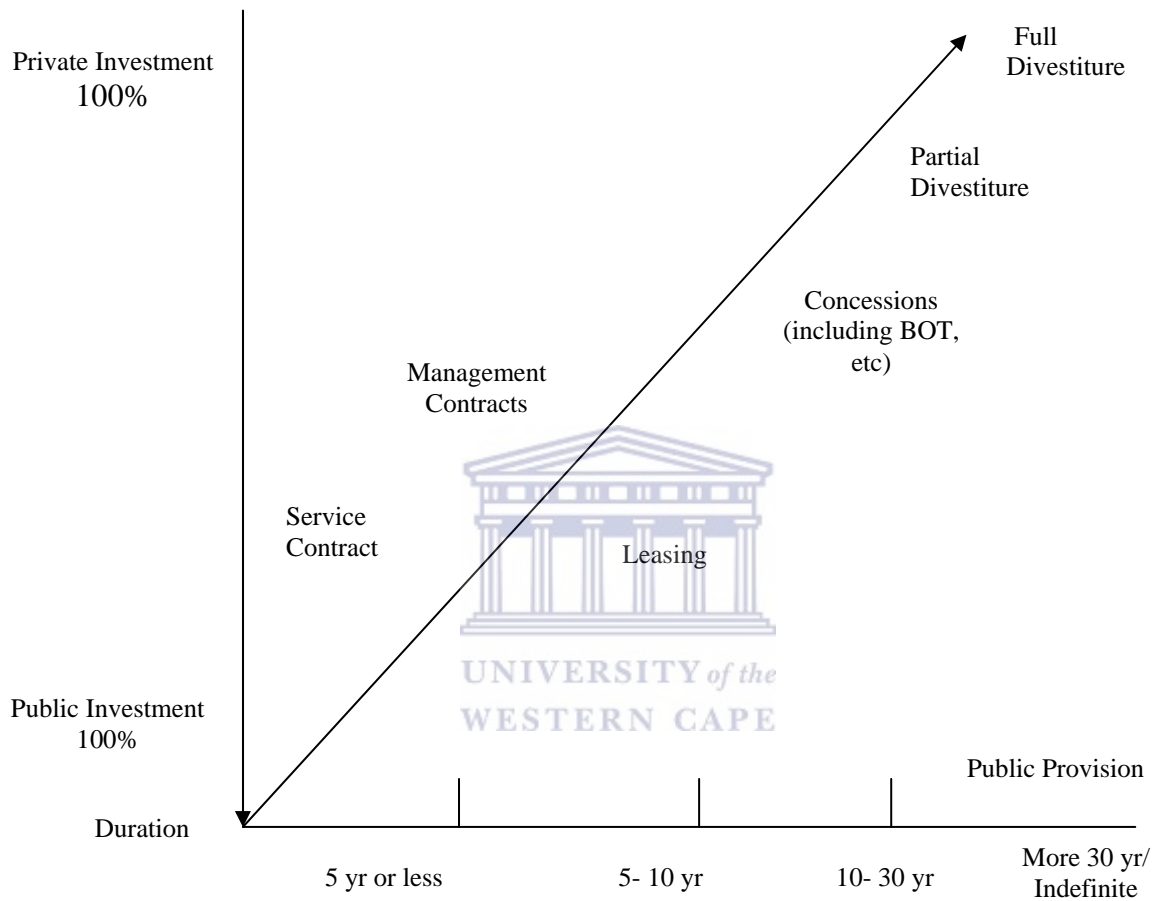
which the government has a regulatory and monitoring role to finance, build and operate the physical works. The contractor is usually a private “*project company*” in which private investors typically have complete ownership. At the end of the contract the project company transfers the system to the public sector, usually at no cost, although the transfer may include a final payment to the equity investors. BOT contracts are usually for a fixed term, typically from 15 to 25 years according to the life of the facilities. The revenue can come either directly from customers, or from a government-owned buyer, or even the general government budget. There are many variations of BOT contracts which are commonly used for infrastructure projects built with private investor participation. (Lee & Jouravlev, 1997:45-48)

The *joint public-private arrangements* are based on commercial principles, with more or less complete autonomy, where public sector administrative and financial regulations do not apply. The governance retains the ability, however, to guide and to control activities so as to ensure that the public interest is served. Equity investment by the public sector may either be in the form of in-kind or financial contributions. Under joint ventures, public and private bodies enter into the business as equivalent equity partners and each stands to lose part or all of its capital contributions if the project is unsuccessful. (Lee & Jouravlev, 1997:55-57)

Finally, at the opposite extremes is the *full divestiture*, which grants to a private agent full responsibility for operations, maintenance, and investment. The full divestiture transfers ownership of the assets to the private sector, leaves the government only with the task of regulation, since, in theory, the private company should be concerned about preserving its asset base. The revenue to the private operator comes straight from billing customers, and profits depend on the operational efficiency. (CNA, 2003:32)

The following figure (Figure 1) shows the different forms available of private sector participation according to the investments of public and private sector on the water system.

**Figure 1 The Range of Options Available for Private Participation**



Source: Lee, Terence and Jouravlev, Andrei, 1997, p14 (Adapted)

## 2.4 Research Question

Potable water services are a critical part of the urban fabric of all societies as they influence health conditions, land prices, manufacturing costs, and provide a daily comfort. Although, all countries have committed resources to increasing access to safe drinking water, they have fallen short of reaching this objective and have resorted to alternative ways to achieve this goal. One increasingly popular proposal is to turn water provision over to the private sector. However, it has been shown that transferring the responsibility to provide water to the private sector has resulted in ambiguous experiences. There are thus many open questions about the factors that influence

whether private participation will result in optimal alternative to better provide potable water services—given the characteristics of the sector—, for a specific location

Resulting from this situation and based on the high impact that potable water has on development and the significance that an adequate choice of structure or mechanism for water provision has for societies, the general research question that this study aims to answer is

**What is the optimal mode of provision of water and sanitation services and by which factors is it determined?**



## CHAPTER 3

### DETERMINANTS OF CONTRACTUAL PROBLEMS AND THE OPTIMALITY OF CONTRACT DESIGN

The present chapter explains the different elements which are common to all contracts, and which together compose a set of three coordination mechanisms that ensure cooperation among contracting parties. In addition, it reviews the three main theories which deal with the problem of optimal contract designing to analyze in detail the Transaction Cost approach as proposed by Williamson, which has been selected as theoretical framework for this study.

#### 3.1 Contracts as coordination mechanisms

According to Brousseau “a contract is considered a combination of coordination mechanisms that ensure the creation of a quasi-rent and sharing it out between contracting parties.” (Brousseau, 1995:409) To carry out these roles, all contracts consist of a combination of mechanisms that

- a) organize contractors’ actions to generate a desirable output;
- b) guarantee mutual promises’ enforcement and;
- c) prescribe an output-sharing rule.

These coordination mechanisms are grouped into three categories: A first set of *technical governance mechanisms*, defining the actions that each contractor has to undertake to produce a quasi-rent. A second set of *enforcement mechanisms*, which intend to avoid parties’ opportunistic behavior and compel them to fulfill their promises. A third set of *remuneration mechanisms*, which motivates agents to behave efficiently and to compel them to adhere to the stipulations of the contract. It also defines the sharing out method. (Brousseau, 1995:412)

Since all contracts include these categories, we can assume that they can be described with a limited number of clauses, defining each mechanism. Also, each clause can only take a finite number of states, each of which corresponds to a possible design of the mechanism. Therefore all contracts can be described through a collection of clauses (A, B, C...) and the state (a, b, c...) taken by each of them; which produce a discrete number of coordination solutions or contractual arrangements. (Brousseau, 1995:413)

The next section gives a description of the clauses comprising technical governance, the enforcement mode, and the remuneration scheme; and a discussion of their alternative

designs will follow. An additional element, contract duration, is proposed to contribute to a better description of contracts.

### 3.1.1 The technical governance of the transaction

Technical governance sets up the mechanism that tells individuals what to do during the collective action. If designed before the signing of the contract – the *ex-ante stage*– it can be called a *complete contract*. It means that contractors' behavior in all possible scenarios is fully defined by steady routines. A change to this type of clause is possible only through renegotiation of a new contract. But, if high uncertainty surrounds a contract, or its design required expert advice, and as a result it becomes too complex or costly to negotiate a complete contract, parties opt to write down an *incomplete* one. In this case, contractors decide on their behaviors to fit into a certain state of the world at each stage of the cooperation. Incomplete contracts imply the acceptance on both sides of an *authority* figure. Authority means “owning the *decision-making rights over assets' use under unspecified events in a contract*” (Brousseau, 1995:413-414). Such rights can vest in one individual (centralized authority) or both parties (decentralized authority).

The **technical coordination** demands of parties to decide whether a contract should be complete or incomplete with respect to three different categories of problems. These categories include the choice of a unified competition strategy, the way of using assets and their intervention plans through space and time. Since each decision affects asset values differently, each decision can require a particular solution. This is why technical governance has to consider three different and independent clauses. (Brousseau, 1995:414)

The **strategic coordination** mode (clause A) states the process to redefine – if possible– a contract's main objective. It can take three forms: (a) *Routines*, if the objective precisely defines the expected output, market segment to be served, and competition strategy; (b) *centralized authority*, if only one individual decides on the way of using assets. Or (c) *decentralized authority*, if contractors rely on future negotiations to determine precisely their actual goal and strategy. (Brousseau, 1995:414)

The **organizational coordination mode** (clause B) enables parties to reassign and redesign tasks without altering the contract's objective. The **operational coordination mode** (clause C) empowers parties to regulate the intensity of using all the different assets involved in the transaction, the product's delivery pace, or a working schedule to

respond to short-term contingencies. (Brousseau, 1995:415) Each of these clauses assumes one of the three available alternatives: routine, centralized, or decentralized authority.

### 3.1.2 The Enforcement Mode

The enforcement mode combines supervision and guarantor mechanisms. These mechanisms aim to compel both parties to respect the contract's stipulations. The supervision devices evaluate transactors' behavior and induce deceivers to follow the required conduct. The guarantor mechanism stipulates exist costs (i.e. the cost incurred for leaving the contract) to avoid dishonest behavior, by making its payoffs lower than the reneging costs. The enforcement mode includes two clauses: one which organizes the credible commitment system (clause E) and another which describes the supervision procedures (clause D). (Brousseau, 1995:415)

The **credible commitments** (clause E), looks after contracting agents in case of individual opportunism by modifying the specificity of each agent's assets. It can take on one of three available forms:

- a) *Absence of credible commitment*, where the same assets' specificity controls opportunism of agents through high exit costs;
- b) *Unilateral*, in which one agent deposits a guarantee in the hands of the other. If, promises made are not respected, this guarantee becomes the partner's property and
- c) *Bilateral* in which both partners pay a guarantee to each other. They modify the specificity of the inputs of the transaction to ensure its continuity. (Brousseau, 1995:415-416)

The **supervision mechanism (clause D)** verifies whether parties are—or are not—respecting contractual terms. An agent assumes the duty of determining how the tasks are performed. If necessary he tries to dissuade dishonest behavior by means of fear of punishment or contract termination. Four distinct solutions are available for implementation: (a) *Self-enforcement*, in which each party exercises control over the others. In case of violation of the contract, the only solution is termination; (b) *External non-specialized arbitrator*; refers to external judicial forms, like the Court and the Law, are the only conflict-settlers available. In case of contact infraction, the guilt of the violator and the extent of the suffered loss will have to be proved in Court. In the last



two cases, (c & d) a *specialized arbitrator* is needed. He specializes in supervising this transaction and these precise partners. He has the right to investigate and the means of coercion to oblige both parties to adhere to the contract. The arbitrator can be (c) one of the contractors or (d) a third party, who gets paid to supervise the contract. (Brousseau, 1995:417)

### 3.1.3 The Remuneration Risks and Sharing Mode

The remuneration system simultaneously solves the risk sharing and effort incentive problems. The *risk sharing problem* emerges because agents must decide *ex ante* and under uncertainty, how to share possible benefits or losses from the cooperation. The *effort incentive problem* is faced by agents when deciding on a remuneration mode which strikes a balance between paying inputs according to its real performance, thus encouraging productivity; and the costs associated with calculating productivity value. (Brousseau, 1995:417) As a result, the remuneration mechanism (clause F) will be shaped by the chosen solution to these dilemmas. Four remuneration systems are available, depending on how risks and losses are shared out. If risk is proportionally shared between agents, compensations can be (a) according to each party's individual contribution to the final output or on a *customized basis*; or (b) a similar percentage to each party, independently of performance. If, a single agent assumes all risk, then payments can be (c) on a *flat rate* set *ex ante*, thus not considering the intensity with which an asset is used; or (d) *remuneration ex post*, depending on the intensity of an assets' use. (Brousseau, 1995:418)

### 3.1.4 The contract duration

The duration element (clause G), although it does not define any mechanism, helps to describe better contractual arrangements because the likelihood of behavior change by an agent increases with the length of time. Duration takes three forms: (a) spot contract pertains to one-time transactions; (b) short term contract, which covers several transactions but doesn't allow modification of assets; and (c) long-term contracts, in which agents have the time to modify their assets. (Brousseau, 1995:418)

### 3.1.5 The diversity of contractual arrangements

Up to this point the seven different clauses: (A) The strategic (B) organizational and (C) operational coordination modes of the technical governance, (D) The credible commitments and (E) supervision devices of the enforcement mechanism, as well as the remuneration scheme (F) and (G) duration features, which are common to all contracts,

have been broadly described. Furthermore, we know that each clause can vary (discretely) by adopting a limited number of mutually exclusive states. Thus, by specifying for each clause which state is to be adopted, different contractual arrangements will arise. (Brousseau, 1995:419)

### **3.2 A Review of Theories on Optimal Contractual Design and Contractual Problems**

Literature distinguishes among three main theories, which deal with the problem of optimal design and choice among the variety of contractual arrangements available (i.e. hierarchy, market or hybrids). Classified into two broad categories, these theories are:

- a) Complete Contracts Theory, which includes the Incentives Theory (IT); and
- b) Incomplete Contracts Theory (ICT) containing the theory with the same name as well as the Transaction Cost Theory (TCT).

Because these theories model human behavior differently, diverse problems may arise when contracting; from these perspectives, different solutions to design efficient contracts are possible. The following section introduces the theories' main assumptions and arguments.

#### 3.2.1 Complete Contracts, The Incentives Theory (IT)

This school assumes the existence of fully rational economic agents, who have access to 'complete' information. Their unlimited computing abilities enable them to attach probabilities to events, however they cannot know what issues will arise nor their sequence. Furthermore, individuals have a complete and ordered set of preferences. Because of these characteristics, people make optimal choices all the time. (Brousseau & Glachant, 2002:8-10) However, the main proposition of the theory relies on the following: contracting parties do not have access to the same information on certain variables; there is no reason why one party should know *ex ante* the private information of the other. In case one of the bargainers has relevant information, before the contract is signed, which interferes with the possibility of reaching a value maximizing agreement, a problem of *adverse selection* may occur. It represents a situation in which choices offered are determined in a way, which is unfavorable to the interests of the party who doesn't possess the information. When no private information before the agreement exists, but with inadequate information afterwards to tell whether contract clauses have been respected, or when getting information may be costly; the possibility on self-interested misbehavior appears.

Recognizing this *moral hazard* problem may stop parties from writing a contract or may limit the contract's enforceability. (Milgrom & Roberts, 1992:129) The solution to moral hazard and adverse selection problems starts from a based case in which the under-informed party (*principal*) develops an incentive (payment) scheme. This scheme should be attractive enough to incite the informed party (*agent*) to self-reveal information (in the adverse selection model) or to adopt a behavior compatible with the principal's interests (moral hazard model). In *adverse selection models*, an optimal contract is possible through designing a menu of contracts which maximizes agents' utility for all possible values an agents' private information may take. The contract also minimizes the cost paid by the principal in exchange for this revelation. (Brousseau & Glachant, 2002:8-10) For *moral hazard models*, an optimal payment scheme should combine a part reflecting the agents' reservation utility—expected utility from external opportunities or from taking part in other contracts—plus a component paying for the verifiable part of the information. Thus, the result is a non-linear payment scheme, with a fixed base and a variable indexed part. (Brousseau & Glachant, 2002:8-10).

The main critique to IT arises from its assumption about the full rationality of decision makers and their perfect foresight ability, which enable them to write complete contracts, for all kinds of transactions. (Williamson, 1998:3) In the real world no human can possibly foresee every eventuality relevant to him when contracting. In addition, human language is not precise enough to describe all eventualities, even if they could be foreseen; and the costs of calculating solutions for each of these eventualities could be prohibitive. (Saussier, 1998:3)

### 3.2.2 Incomplete Contracts Theory: The Incomplete Contract Theory (ICT) and Transaction Costs Theory (TCT).

Contrary to IT, both ICT and TCT assume that drawing up contracts perfect for monitoring and enforcement is impossible; therefore all contracts are unavoidably incomplete. However, contractual incompleteness doesn't originate from the same sources in the two analyses. In ICT, it is rooted on the *bounded rationality* of the regulatory body (an external party), which ultimately ensures a contract's performance. Thus, contracting on agents' future actions is impractical, when no third-party can 'verify', *ex post*, the real value of some of the variables central to the relation between agents. *Uncertainty*, also a source of incompleteness, arises because parties have to decide on the unverifiable variable without complete information, ignoring the outcome of their decisions since they cannot anticipate with certainty what the other will do. In

contrast TCT's contractual incompleteness arises from a *bounded rationality* common to all parties in a transaction: both the contractors and the enforcement entity. *Uncertainty* is radical, since neither the parties nor the judge are able to predict the eventualities that may arise in the future. (Brousseau & Glachant, 2002:10-11)

For ICT and TCT, *bounded rationality* refers to the limited ability of individuals to foresee all things that might matter for them in a contract. It includes communication imperfections, which cause added expenses, and limited human calculation abilities for estimating the best solutions for all difficulties. *Uncertainty* results because contingencies that were never imagined at contracting time unavoidably will appear. The incomplete contracts, which result from any of the mentioned sources, don't adequately control self-interested behavior from contracting agents; they therefore have limited effectiveness when trying to achieve commitment among them. Three main effects derive from this commitment problem. The first is the *problem of renegeing*, and second and third are *post- contractual opportunism* situations, respectively the *ex post renegotiation*, and the *hold up problem*. (Milgrom & Roberts, 1992:130-133)

The *renegeing problem* occurs when one of the parties may try to break up the deal, perhaps because the costs of completing it are higher than anticipated. Since an incomplete contract doesn't state what should be done under various circumstances or is written ambiguously (because of language imprecision), and is thus subject to different interpretations, renegeing becomes a problem to take into account. This ambiguity may hinder outsiders from deciding which party is misbehaving and which one is behaving correctly. Renegeing affects contract efficiency when one of the parties refuses to do what was agreed, but it may also indirectly influence performance if, for example, payments are not done according to contractual terms or not done at all. Thus, parties won't have an incentive to continue in the relation. The *ex post renegotiation* problem occurs when it seems advantageous to both parties to renegotiate the contract *ex post*, because what was efficient when writing the contract may not be so once actions have been taken, or further information revealed. Even if parties realized the existence of this situation while designing the contract—that they will later face these incentives—they may not be able to draft the contract in a way that produces the desired behavior. (Milgrom & Roberts, 1992:134)

The *hold up problem* emerges in transactions requiring large and specific investments. Since amounts are significant and because benefits come up only after extended periods, the party who realizes the investment, once it had been incurred, is therefore vulnerable to opportunistic behavior by their contracting partners. The state of affairs where each party to a contract worries about being forced to accept disadvantageous terms later after he has sunk an investment, or worries that his investment may be devalued by the actions of others is called the *hold up problem*. (Milgrom & Roberts, 1992:134-137) “It is the specificity of investments together with imperfect contracting that lies at the core of the hold up problem.” (Milgrom & Roberts, 1992:137)

Once the sources of contractual incompleteness, and their possible effects on contracts, have been described, an explanation on ICT and TCT propositions to overcome these problems and optimally design a contract, will follow:

The ICT proposed solution, consists of signing a commitment limiting the scope of *ex post* negotiations in order to provide an incentive to each contractor to invest optimally *ex ante*. This arrangement considers a centralized authority that will determine the effective level of trade *ex post*, while the remaining level of trade constitutes a default option which meets the other party's interest. Two families of models originate from this framework. In the first model, no efficient investment level is obtained from the party benefiting from the default option, because the level of trade fixed is not big enough to motivate him to invest adequately under all conditions. On the opposite side of the spectrum the second model claims a satisfactory rate on the default rate to impel its beneficiary to invest optimally. Also, it assumes a judge capable not only of verification but also of the provision and enforcement of complex default options which from his side will not admit renegotiation. (Brousseau & Glachant, 2002:11-12)

Although, much literature can be found on the ICT theoretical framework, little has been done to test the theory's propositions. This is in part because of conflict between the main exponents of IT and TCT. The IT thinkers claim logical inconsistency between contractors' perfect rationality and their inability to design a disclosure mechanism *ex ante*, which reveals the necessary information to them when contracting and to the judge to verify *ex post*, the parties' real invested level. Thus, the non-verifiability and uncertainty problems are simultaneously eliminated. In a similar way, TCT criticizes the assumption on a bounded rationality specific to the judge, which prevents complete

contracts from being achieved. For TCT exponents, more scientifically consistent analyses are possible if the same bounded rationality affects not only the judge but also the contracting agents, just like in their theory. (Brousseau & Glachant, 2002:12-13) Another argument derives from the ICT explicit assumption on strong incentives, which induce parties to optimally invest *ex ante*, limiting *ex post* renegotiation. However, the compensatory and implicit premise is that if such *ex post* inefficiencies occur, parties will renegotiate them at no cost. (Saussier, 2000:377-378)

From the TCA perspective to ensure a contract's optimality, despite its incompleteness, parties must focus on designing and including procedures, which dictate their actions *ex post*, and set up mechanisms to ensure the *ex post* performance of their commitments. This is possible through a combination of commitment constraints to guarantee the realization of specific investments, with flexibility constraints needed because of the impossibility of perfectly foreseeing the coordination modes that would be optimal *ex post*. The decision rights can be granted to one or both parties, or to a third one. Monitoring and enforcement mechanisms should be put in place. Because parties' behavior change with time, it becomes necessary to redefine their duties during the contract's implementation. Thus, contract duration is an important component. (Brousseau & Glachant, 2002:13-14)

Notwithstanding all limitations attributable to most theoretical models, the main strength of the Transaction Cost Theory derives from the two former approaches' critiques.

*First*, the assumption of bounded rationality that applies to all agents, rather than only one (ICT) or even none (IT), results in a more realistic characterization of human behavior. *Second*, because TCT allocates rights on the use of assets to one, two or even three external parties—rather than one (ICT)—it makes possible the analysis of diverse contractual arrangements; not only the one associated with a unified form of authority.

In summary, it can be concluded that complementarities rather than incompatibilities result from these three approaches, because none of them emphasizes the same dimension of contracts. For example, IT focuses on the design of incentive schemes to ensure a contract's efficiency, ICT relates to renegotiation provisions framed by default

clauses, and TCT deals with how rights to decide, control, and coerce are allocated between parties. (Brousseau & Glachant, 2002:15)

### **3.3 Transaction Cost Approach by Williamson**

#### **3.3.1 General Argument and Concept Definition of the Transaction Cost Approach by Williamson**

The main argument of the Transaction Costs Approach by Williamson (TCA) is such that the level of transaction costs is directly related to the attributes of the transaction; such characteristics—for cost minimization purposes—fit transactions into a specific governance structure. There are alternative modes of governance, which differ in discrete ways. The following section aims to explain this argument by analyzing its main ideas and their application to this study. (Williamson, 2000:54)

In the study of TCA, the fundamental unit of analysis is the transaction. A *transaction* as defined by Williamson “occurs when a good or service is transferred across technologically separable interfaces.” (Furubotn & Richter, 2002:41) Another definition is given by Commons, “transactions are the alienation and acquisition between individuals of the rights of future ownership of physical things.” (Furubotn & Richter, 2002:42) As it can be seen both definitions refer to the transfer of assets, but while the first emphasizes assets’ physical transfer, the second goes beyond and includes a more legal perspective, which refers to the transfer of sanctionable property rights. The ownership rights of an individual over an asset—from an economic perspective—concern the residual rights of control. These are the rights that spell out the use of the assets, which either the law doesn’t explicitly control or haven’t been assigned to others by contract. (Milgrom & Roberts, 1992:289) To complete the analysis of the implications that property rights have for transactions, attention must be paid to the legal notion of the concept. From this perspective, ownership involves one particular control right, the right of possession, of which the main economic effect is to allow the holder refusal of the use of an asset by anyone who will not pay the price he demands. This right makes possible for the owner to receive and keep the residual returns from the asset. The residual return is the amount that is left after paying for all inputs. (Milgrom & Roberts, 1992:290-291)

Therefore, the allocation of the residual rights, among parties to a transaction, influences incentives and behaviors in a predictable way: because their possessor will fully bear the financial impact of his choices. When, property rights are well-defined,

people have a clear picture of what the possible (legal) uses of the assets are. This is essential for all contracts, so parties can know what exactly it is that they are exchanging. (Roemer, 2000:51)

Since, the ultimate participants in transactions are individuals, it is important to know their human characteristics. One has been already discussed: human *bounded rationality*, which conditions individuals to write incomplete contracts that have to be complemented by setting up mechanisms to monitor parties' performance and to enforce their promises. Thus, costs associated with continuing the transaction increase. (Milgrom & Roberts, 1992:130-133) However, parties are also *opportunistic*. This characteristic implies a likelihood of dishonesty when transactors pursue their own interest, so preferences may be disguised, data distorted, or issues deliberately confused. Opportunism may cause losses in a transaction. Because, if one of the parties doesn't have all the relevant information needed to determine whether, the contractual terms are mutually acceptable or whether they are actually being met; thus, a transaction may fail to occur and therefore it prevents the formation of collective gains. Opportunism also increases costs, because it necessitates the creation and implementation of costly provisions which reflect the added hazards. (Furubotn & Richter, 2002:4-5)

In conclusion it can be said that all negotiations carried out by individuals when establishing, writing, implementing, enforcing and securing a contract involve costs caused by bounded rationality and opportunism.

### 3.3.2 Transaction costs and cost types associated with the contracting process

“When considered in relation to existing property rights and the establishment or transfer of them between individuals; *transaction costs* include the costs of information, negotiation and enforcement.” (Furubotn & Richter, 2002:40) Williamson divides such cost in two types, the *ex ante* and the *ex post* transaction costs:

- a) *Ex ante costs*: Since these are the costs of drafting, negotiating, and safeguarding an agreement that is why these costs mostly occur before the contract formally begins. The *ex ante costs* split into *search and information* and *bargaining and writing* costs. The first category results from the times and means used when identifying and evaluating potential partners while the second associates with negotiating and writing an agreement between partners. (Furubotn & Richter, 2002:46-47)



- b) *Ex post* costs: They arise during the contract's lifespan because of gaps, errors or unanticipated events. The *ex- post* costs divide into *monitoring* and *enforcement costs*. The first are associated with checking on each party's behavior to ensure their adherence to their commitments, while *enforcement costs* refers to ex post bargaining (renegotiation) and sanctioning a partner that doesn't act according to the agreement. (Furubotn & Richter, 2002:46-47)

### 3.3.3 Types of governance structures

Williamson defines a governance *structure* as “the means by which *order* is accomplished [introduced] in a relation in which potential *conflicts* threaten to undo opportunities to realize *mutual* gains from voluntary exchange.”(Williamson, 2000:54) He also mentions that: “A governance structure represents the implicit or explicit contractual framework within which a transaction is located.”(Williamson, 1981:1544) Three generic forms of governance: *unified governance* or *hierarchy*, *hybrids* and *markets*, have been distinguished in the literature.

- a) The *vertical integration, hierarchy or unified governance*: It concerns those transactions that grant residual rights to a single individual. A sole owner decides about the manner of using assets, and he bears all risks and all possible outcomes. To exclude the others from profits, if any, and because incentives to others' productivity and to their behavior are not needed, compensation is on a flat rate basis. The same party undertakes the role of a specialized arbitrator who controls many pressure mechanisms. Penalties are strong and effective. Most hierarchies are of long duration. (Brousseau, 1995:419)
- b) *Market*: It fits simple, one-time transactions that are possible to achieve complete on the spot. Routines manage the strategic, organizational and operational modes, producing complete contracts. The assets involved are standard ones so competence among potential parties (on both the demand and supply sides) arises, reducing possibilities for opportunistic behaviors. Because of the standard nature of the transaction a third, non-specialized party (i.e. Courts) supervises and enforces the contract. Payments are according to individuals' real contribution to the final output. (Brousseau, 1995:420).

- c) *Hybrid*: It suits contractual arrangements designed with a precise objective. Since the two parties own residual rights, both have bargaining power when deciding on the organizational and operational modes. Routines direct the technical level of the contract. Because both agents have means invested in the transaction, a bilateral commitment protects them from each other and compels both of them to fulfill their promises. The sharing of risk and loss is proportional to the owners' distribution of the assets; thus, remuneration is either collective or customized. A contract of this type lasts long periods. Because of these features, hybrids require specialized supervision. If one of the parties performs this role bilateral governance arises. But in case an external and specialized agent (different from the Court) gets paid to perform this duty, trilateral governance takes place. (Brousseau, 1995:420).

### 3.3.4 Properties of The Transaction and Associated Optimal Governance Structures

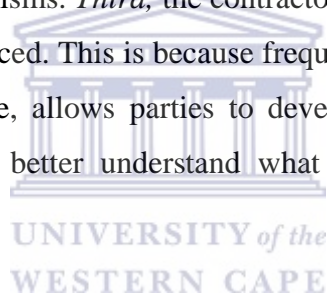
According to TCA, the critical dimensions in respect of which transactions differ are *asset specificity (AS)*, *frequency* and *duration*, and *uncertainty* leading to *complexity*.

The *assets* are *specific* to a certain use if the services which they provide are exceptionally valuable only in that specific setting, so when they need to be used for other purposes assets lose much of their value. This percentage of lost investment value shows the assets' degree of specificity. A closely related effect to that of the potential *hold up*, involving those transactions in which highly specific assets are present; is the *problem of the of underinvestment*. This problem may arise because individuals fearing that their investments will leave them vulnerable refuse to invest efficiently according to the transaction's needs. (Milgrom & Roberts, 1992:137) *Hierarchies* are associated with those transactions involving high AS, because by having a single owner of the residual rights, investments are automatically protected against early termination or opportunistic renegotiations on contract terms by the other party. For those situations in which no specific assets are involved and parties are essentially faceless (no dependency exists) market prices function as means to reach cooperation. (Williamson, 2002:182)

The *frequency* with which similar transactions occur and the *duration* or period of time over which they are repeated, are two further key attributes in which transactions differ. For one-time transactions, which involve low AS and are possible to conclude right on

the spot; it is possible to use the market or other general mechanism available in the society to direct the transaction. Because of simplicity of the assets and the short duration of the transaction, there is only a slight possibility of a change in circumstances before the contract expires that would alter which actions are suitable. If, meanwhile, disputes arise the Court will be the mechanism used to solve them. (Milgrom & Roberts, 1992:30-31)

The combination of high frequency and long duration characteristics has 3 important effects for the governance structure that will minimize transaction cost. *First*, a specialized authority that mediates parties' disputes is required. Specifically geared to the particulars of the relationship, this authority won't only help to keep low the costs of solving problems, but will also adapt to specific circumstances as needed. *Second*, the contract's need for formal and external enforcement devices is reduced; because over time parties produce many opportunities to award or deny favors to each other so enabling them to reward faithful partners or punish disloyal ones—thus, developing their own enforcement mechanisms. *Third*, the contractors' need for explicit planning to coordinate their actions is reduced. This is because frequent interaction, for long periods of time, with the same people, allows parties to develop understandings and habits. These routines help them to better understand what is expected from each other. (Milgrom & Roberts, 1992:31)



However, the determining characteristic of the form of authority, the origin and formality of enforcement mechanisms and the complexity level of the routines will depend on the specificity of the assets involved in the transactions.

For example, for those highly frequent, long transactions, where high AS exists, hierarchy governance is expected. This is because, the longer the transaction, the higher the need to adapt contract to a changing environment and unforeseen events, so increasing *hold up* chances. Furthermore, AS imposes the need for cooperative adaptation in the transaction. The cooperative adaptation, as opposed to autonomous adaptation, requires coordinated actions and deep knowledge by parties, to efficiently sort out eventualities and give continuity to the relation. (Williamson, 2002:175-183) Because solutions which help to protect specific investments, imply large sets of information about the asset, numerous efforts and meetings to reach an agreement, and

perhaps experts' advice; (Milgrom & Roberts,1992:29) this, increases the *ex post-renegotiation* costs, and foster the possibilities for *post-contractual* opportunism.

For those cases involving less specific assets, adaptation needs are of a more autonomous nature. This means that solutions to eventualities are based on general coordination mechanisms like market prices, interest rates, or standard legal and business practices. However, the existence of some degree of specificity doesn't allow parties to rely completely on such types of mechanisms; so a hybrid governance structure is needed. (Williamson, 2002:175-183) It will allow parties to set up enforcement devices strong enough to ensure their performance but also flexible enough to allow independent decisions regarding their assets to each party. The routines developed are a mix of standard and complex practices, which can produce important cost savings. (Milgrom & Roberts, 1992:30-31)

*Uncertainty* about the conditions that will prevail during a contract's execution and *complexity* about what performance will be required, make it impossible or too costly to define in advance, courses of action required for all possible eventualities. (Milgrom & Roberts, 1992:31-32) Therefore, transactions where high levels of uncertainty and complexity predominate and highly specific assets exist, are better organized through a hierarchy. Because AS, will incite parties to promote continuity of the relation due to bilateral dependency reasons. Thus, intensified uncertainty may endorse the need to increase safeguards to protect investments; such safeguards may include penalties, sophisticated information disclosure mechanisms and verification procedures; thus increasing ex-post costs. (Williamson, 2002:175-183)

Those transactions, which involve low specific assets, where agents can easily know and specify what is expected from each other, are better managed through markets. Because of the standardized nature of traded goods or services, conditions surrounding the contract are likely to remain, thus increasing certainty about the transaction taking place. (Milgrom & Roberts, 1992:32)

To summarize, there is not a single, all-purpose form of organization but rather a discrete set of them, in which each generic mode is defined by an internally consistent set of attributes or properties to which differential performance competencies accrue.

### **3.4 An Application of the Contract Typology to Describe Alternative Modes for Water Provision**

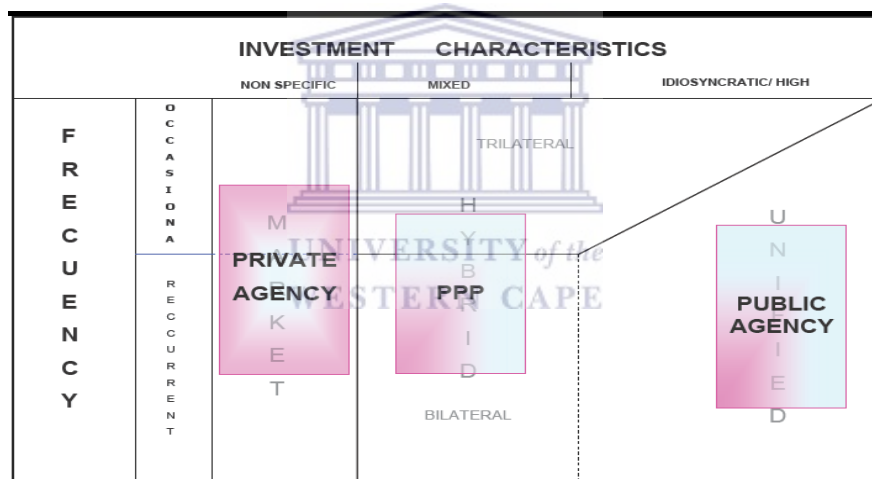
Up to this point, several methods available for providing potable water have been discussed. It is known that various alternatives arise depending on the distribution of asset ownership among parties and which party takes on key issues like capital investment, the execution of the building works, and operation and maintenance among others on the overall management of the service. Moreover, these alternatives run from the extremes of a service under complete public management, passing through shared management (i.e. lease contracts, concessions and partial divestitures), to an almost full private management service (full divestiture). Additionally, it was concluded that different governance structures result depending on the different states of contractual clauses adopted. The three generic governance structures or contractual arrangements available are: hierarchy, hybrid and markets. Recall the definition of PPP as an “agreement between the public sector and a private sector entity, whereby both parties share risk, responsibility, and in some cases investment” (Budds, 2000:4). Thus, it is possible to characterize all different alternatives for water provision, including full public agencies, as contractual arrangements. Here follows some examples:

- a) The public bureau corresponds to a hierarchy, since government represents a single authority, which decides the manner of using assets. The water system’s building and maintenance works are financed through public resources; thus the public sector bears all risks associated with the investments. The control and supervision of running and maintaining the works and service management, is fully a governmental duty. All compensations of those who work for the public bureau are on a flat rate basis; their contribution on the overall service performance doesn’t affect their compensation. Finally, a public bureau’s existence, across time and managerial body changes, is guaranteed. (CNA,2003:28)
  
- b) A full divestiture, concerns market governance. In this case a private investor owns the physical assets. The risk associated with investments and commercial operation is borne by him, although the public sector can act as collateral. Private business-style management dominates operational, organizational and strategic decisions. In this case, revenue varies according to service performance. However, most of the time government keeps some degree of control over water resources, mainly through regulatory mechanisms to assure

contract clauses fulfillment. Most of the privatizations are signed for indefinite periods. (CNA,2003:32)

- c) Concessions, BOT contracts and Partial Divestitures all are contractual arrangements that relate to hybrid governance. The asset ownership is mixed between a private investor and a public one. The contract's scope is precise, whether to manage and expand an existing system (partial divestiture and concessions) or to place more focus on building and engineering works (BOT contracts). Both parties share investment and commercial risks, although not necessarily in equal percentages. Thus, the payments scheme may be based on service performance or fees. Finally, the monitoring and supervision role is performed by the public contractor or can be negotiated among parties. (CNA,2003:32-33)

**Figure 2 Characterization of Modes of Water Provision as Governance Structures**



Source: Furubotn, E. and Richter, R; 2000, p.167 (Adapted Version)

### 3.4.1 Characterization of Transaction Properties for the Water Provision Services

In a PPP the transaction that takes place between the public and the private agents, is the transfer of rights over water usage. Some examples of transaction costs that arise are:

*Information costs*, from identifying the hydrologic and legal characteristics of the served area. The *bargaining costs* from negotiations among service provider, users, and other actors related to water management. The monitoring costs from checking on the fulfillment of quality standards on works and technical assistance; and, the *enforcement costs* to satisfactorily implement the contract. (Roemer, 2000:63) Thus, it is correct to assume that the level of transaction costs will depend on how the transfer of residual

water rights is organized within an established mode of provision, including, of course, the allocation of such rights.

To better understand the rationale behind this idea, it is necessary to identify the different factors about water provision that determine the levels of asset specificity, uncertainty and complexity, and frequency and duration; these factors in turn define more suitable modes of provision depending on whether their level of activity is high or low. For example, the origin of the water has the most important effect on the investments specificity, uncertainty and complexity characteristics in a transaction. The main reasons are threefold: *First* raw water has two origin possibilities, underground and surface sources. The underground sources need large investments in pumps to extract water and into hydraulic infrastructure to carry water from underground through storage tanks and purifying stations, to final distribution among users. In comparison, the distribution of surface water from supply sources to final users only requires canalization infrastructure, consisting of storage tanks and distribution pipelines. (Menard & Saussier, 2002:446-447)

*Second*, underground water is generally of much better quality than surface water; this is because surface water is more exposed to pollutants. Thus, underground raw water requires cheaper and simpler purifying treatments (i.e. disinfection) than surface raw water, which may need a combination of physical and chemical treatment plus disinfection, before it is drinkable.

*Third* investments specificity also depends on the distribution networks and the area's topography. Since the water industry is a network industry, large investments are required to extend and keep such networks in good condition. Because of environmental and public health related issues, most water pipelines are exclusively used for water transfer purposes, leaving reduced possibilities of being employed by other network industries such as natural gas or telephone. Besides extension, maintenance and rehabilitation works produce large externalities on society. These externalities take the form of traffic disruption, stoppage in water supply or noise in adjoining areas. The surface characteristics of the served area also affect investments size, because mountainous areas require larger investments than flat areas may need.

*Uncertainty*, related to water origin, results from the difficulty when calculating physical water availability within time and spatial boundaries. For underground water this is especially true because, despite expensive and complex hydrologic studies, estimations on underground water quantity are less precise than for surface water.

*Complexity*, increases because the task to manage water efficiently and satisfy users' demands will unavoidably have a random component. Also *uncertainty and complexity* are associated with climate variability; since factors like predominant climate type, general pattern of droughts or rainy periods and average temperatures, influence water availability, therefore impacts the extraction and replenishment capacities of the supply sources. Finally, two additional factors affecting uncertainty and complexity characteristics' are the growth in demand for water and the demand for new uses, because both reasons condition the service provider's capacity to meet such demands, since water supply is limited. Also risks associated with incurred investments, when looking for new water sources or when building new infrastructure, can increase.

*Frequency*, takes different forms depending on the water provision stage, it is looking at. For example for the water production stage, it relates to the extraction working schedule and the storage capacity available; because both impact on the number of times a day that extraction machinery runs and that the personnel carry out operating, maintenance and rehabilitation tasks. Concerning water distribution from supply sources to final users, frequency refers to the total number of users connected to the distribution network, and the number of days of the week, and hours per day water services are available for them. Referring to measuring, billing and collecting for water consumption—these mainly impact frequency in proportion to the number of times these tasks are carried out. Finally, *duration* relates to the contract's length between providers and consumers, which can varies according to the mode of provision in place, and the possible competition among providers. (Menard & Shirley, 1999:23-25)



### 3.5 Theoretically derived hypothesis and sub- hypotheses

From a transaction costs economics point of view the optimal modes of governance are those that better adapt to the degree of specificity of the assets to be employed, reduce the uncertainty that may surround the exchange, and reduce the need for any kind of formal mechanism to enforce agreements between –rationally bounded and opportunistic– parties; thanks to mutual knowledge arising from frequent interaction, thus resulting in the minimization of transaction costs. According to this it can be said that:

*The contractual problems/renegotiations/ modifications arising in the case of AGSAL (dependant variable) are due to a transaction cost inefficient governance structure (intermediate variable); This is a governance structure chosen without adequately taking into consideration the transaction characteristics involved in water provision (independent variable); hence, it is not a relative transaction costs efficient governance structure*

The hypothesis to be tested is a causal one in which *ex post contractual problems* arising in the form of contract inefficiencies, renegotiations and modifications are explained by a *chosen governance structure* which does not fit the inherent transaction characteristics of water provision. At this point it is important to mention that transaction characteristics are mutually influential to each other, thus interrelations among them are determinant for identifying the mode of governance which results optimally.

The following sets of sub -hypotheses have been developed to test the above stated main hypothesis:

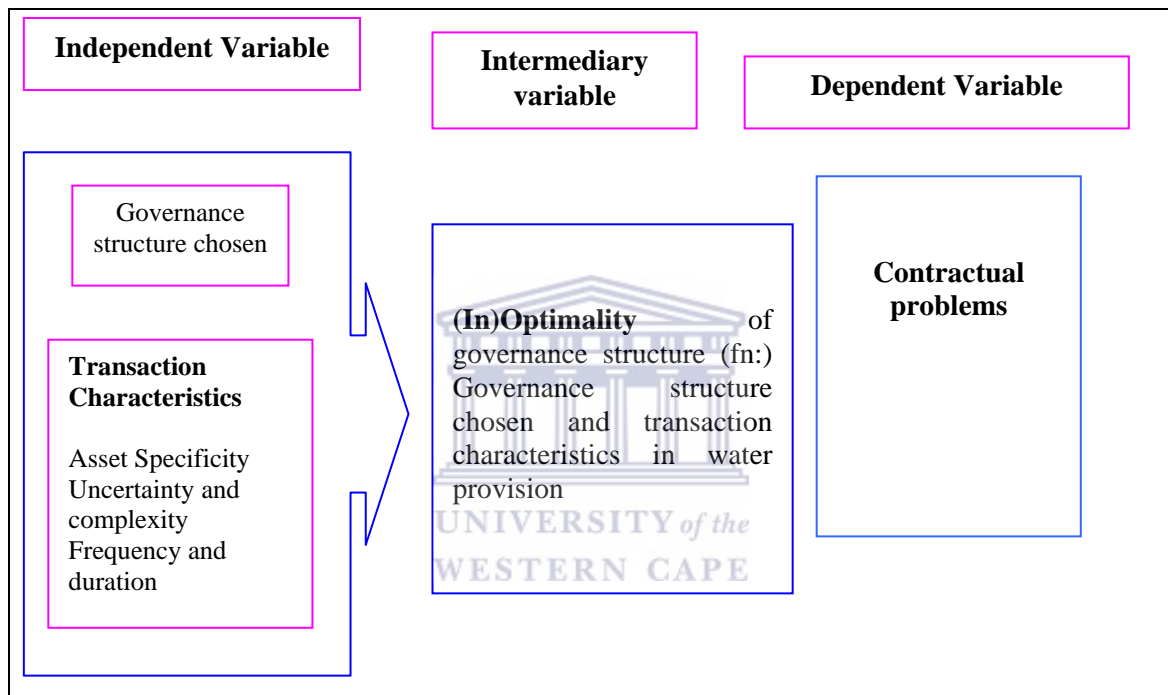
*H<sub>1</sub>: Ex post transaction costs inefficiencies arise if the governance structure chosen does not fit the asset specificity of the transaction. In other words, if water service provision implies highly specific investments, then a more market governance structure would be non- optimal, leading to contractual problems ex post.*

*H<sub>2</sub>: Ex post transaction costs inefficiencies arise if the governance structure chosen does not fit the uncertainty and complexity of the transaction. In other words, if water*

*service provision implies high uncertainty/ complex environment, then a more market governance structure would be non- optimal, leading to contractual problems ex post.*

*H<sub>3</sub>: Ex post transaction costs inefficiencies arise if the governance structure chosen does not fit the frequency and duration of the transaction. In other words, if water service provision implies very frequent interaction between parties and is one of a long duration, then a more market governance structure would be non- optimal, leading to contractual problems ex post.*

**Figure 3 Theoretical Derived Hypothesis and Variables**



## CHAPTER 4

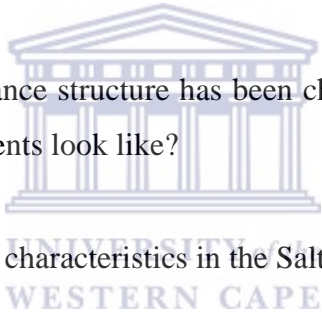
### METHODOLOGICAL APPROACH

This chapter addresses the methodological aspects of the analysis that was conducted. The first section considers in some depth how variables and indicators will be understood and provides a summary table with the hypothesis, variables and indicators. It must be taken into account that a qualitative approach had been chosen for the research analysis, and therefore primary and secondary sources of information were needed.

Finally, the methods of data processing and evaluation are discussed and justified, with separate references to the hypothesis and the interviews.

#### **4.1 Research questions relevant for the case study.**

Before going into detail explaining the methodological aspects of the analysis that was made, the following research questions which are relevant for the Saltillo case study need to be considered.

- 
- What kind of a governance structure has been chosen in the Saltillo case? How do the contractual elements look like?
  - What do the transaction characteristics in the Saltillo case look like?
  - Is the governance structure chosen an optimal one according to transaction cost theory, e.g. is it a governance structure that adequately reflects the specific Saltillo transaction characteristics?

#### **4.2 Indicators and Data Needs given the Hypothesis and Research Questions**

In order to test the hypothesis and to answer the research questions posed by this study, a set of sub-hypotheses and indicators for both the dependent and the independent variables were developed.

Regarding the assessment of that independent variable, which represents the characteristics of the transaction vis-à-vis the chosen governance structure type, a separate set of indicators is needed for each of the characteristics. Thus, in order to measure the *investments specificity*, one needs data regarding the **service area location and topography (ASI)**. Availability of water within a determined area is naturally limited thus impacting on the provider's capacity to the meet demand and on the level

of investments which are required to carry out studies to find new supply sources or to transport water from other sources to final users. The topography of the area is important because a location with highly irregular surface implies larger investments for distributing water to final beneficiaries than a flat area since more complex infrastructure and equipment is needed in order to keep the water flowing through networks over an uneven terrain.

The indicator of **water origin** (AS2) has important effects on the level of investments required for the machinery and equipment to produce water. For example, investments are larger for those areas with under-ground water supply because it is costlier to exploit them than surface water. This is because ground water requires of more expensive pumping systems for extraction in comparison to surface water which merely requires to be routed into canals or pipes systems. Another factor coupled to water origin is **raw water quality** (AS3): since ground water is generally of a better quality than surface water, the source will thus impact on the costs of potabilization treatments which water has to undergo before being distributed; The treatment process are more complex and expensive in the case of surface water because its exposure to pollutants

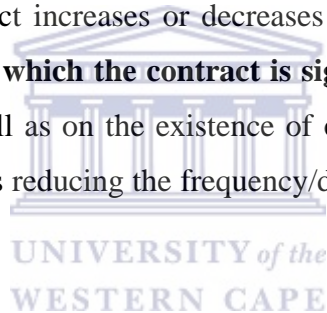
Finally data on the **physical condition** of the distribution network (AS4) is needed since investments associated with its maintenance, extension, and rehabilitation are associated with the few alternative uses that such assets have. Hence, the network's extension, its building material and usable life-span will determine the level of investments required.

In order to measure uncertainty and complexity, three separate indicators have been chosen. The first *UC1* indicates the **type of supply sources** which are predominant in a service area; this because calculating actual water availability for ground sources imposes much greater difficulties than for surface sources—since there is increasing uncertainty about the capacity to meet demand for water and making it more complicated to guarantee the continuation of the services. The second and third indicators refer to (2) climate variability (*UC2*,) and (3) future water demand for human consumption and other purposes (*UC3*).

**Climate variability** (2) implies erratic weather behavior increasing uncertainty to predict rainfall intensity or duration. The phenomenon of variability also has to do with the fact that extreme weather conditions such as ice- storms or very hot temperatures

damage infrastructure facilities thus making it more difficult for the authorities to incorporate these elements into their planning. As for **growth in water demand** (3), since water supply is naturally limited in an area, it implies increasing complexity in the search for alternative water sources, or in planning for appropriate managerial practices to ensure water provision in future periods. Also growth in water demand impacts on expansion opportunities for the provider, as larger demand will help to decrease average production costs.

Finally pertaining to frequency and duration, data on total **population and water service coverage rate** (*FD1*) is needed, since the size of population and the percentage of such population that has access to water service, impacts on the frequency that activities related to water provision—pumping frequencies, needs for maintenance and rehabilitation of equipment, machinery and physical infrastructure, or execution of metering- or billing- tasks—are performed. Closely related is the number of hours for which water **service is available** or number of days available at users' households (*FD2*) because these also affect increases or decreases in frequency. For the duration (*FD3*), data on the **period for which the contract is signed** between users and service provider is needed, and as well as on the existence of other types of providers, which can represent competition; thus reducing the frequency/duration on which users actually buy water to a single provider.



In order to conceptualize the intermediary variable, which refers to the type of governance structure adopted for Saltillo; a set of seven indicators corresponding to the seven clauses that define contractual arrangements, have been selected. Thus, *GR* corresponds to the **authority** element, defined as the residual control rights over an asset. The *GA* indicator represents the mechanisms that establish the rights and duties for each party or the **management authority** within the company. The *GB* specifies the **renegotiation procedures**, or how the operation and maintenance procedures of the overall system are decided and implemented. The *GC* defines the **technical and operational specificities** of the service to be provided, or works execution. In the case of the enforcement mechanism, it has been divided into two indicators: The *GE* indicator for the **supervision and conflict resolution devices**, and the *GD* for the **incentives and sanctions** schemes. The risk-sharing rule and **basis for compensation** are defined by the *GF* indicator. Finally, *GG* is chosen to define **contract length**.

In the case of the dependent variable: this is the occurrence of contractual problems which has caused high *ex post* transaction costs, such as renegotiation or modifications to contract terms and sanctions; two indicators have been designed. The first identifies the main violations to contractual terms which have been perpetrated (*CVI*). The modifications to contract terms, and sanctions— whether monetary or non monetary—, which can be associated with the contract violations are identified through the *CV2* indicator.

A summarized version of the hypothesis and the indicators is presented in the following table. In order to gain a better understanding of how the different indicators are to be measured, please refer to the annex at the final part of this study.

**Table 1 Hypothesis, Indicators and Measurements**

Independent variable	Indicators	How it influences on transaction properties'	Measurements (examples)
<p><b>Transaction characteristics</b></p> <p><b>Investments Specificity</b></p> <p>If water service provision implies highly specific investments, then a more market governance structure would be non- optimal, leading to contractual problems ex post</p>	AS1 Service area location	Geographical location of an area determines water availability; thus less water supply demands higher investments , then a more market-based structure is considered non-optimal	Service area location and Topographical characteristics of service location
	AS2 Origin of water	Since ground water sources imply higher investments levels than surface water sources, then a more market -related structure is considered non-optimal	Predominance of underground water sources vs. surface water sources
	AS3 Quality Properties of raw water	Origin determines quality of raw water which has an impact on purifying treatment costs. Since, low quality raw water requires higher investments level for purifying treatment, then a more market-based structure is non-optimal	Predominance of raw water origin Type of purifying methods
	AS4 Physical conditions and extension on distribution networks	Poor physical condition and extension of distribution networks implies higher investments levels in their maintenance, replacement and/ or rehabilitation, then a more market-based structure is non-optimal	Length of networks in km Age and usable life-span of networks Building material and quality of networks
	UC I Type of water supply sources	Predominance of ground water as source increases difficulty to calculate real water availability, consequently increasing uncertainty and complexity in planning for all stages of water provision. Thus, a more market -based structure is non-optimal	Predominance of underground water sources vs. surface water sources Crisis situations/ consequences attributed (perceived) to lack of adequate information

Independent variable	Indicators	How it influences on transaction properties'	Measurements (examples)
<p><b><u>Transaction characteristics</u></b></p> <p><b><u>Uncertainty and complexity</u></b></p> <p>If, water service provision implies high uncertainty/ complex environment, then a more market governance structure would be non- optimal, leading to contractual problems expost</p>	<p><i>UC 2</i> Climate Variability</p>	<p>Climate variability which includes factors such as rainfalls/ draughts, climate type; among other factors affects replenishment capacity of water sources, thus increasing uncertainty about water availability and increasing complexity for all stages on water provision. Thus, a more market- based structure is non-optimal</p>	<p>Climate type predominance</p>
	<p><i>UC 3</i> Growth in water demand for human consumption and other uses</p>	<p>Ability to meet future/ growing water demands is limited by water availability, thus increasing uncertainty about capacity to satisfy such demands, and complexity in the solutions to look for alternatives water supply sources Thus, a more market - based structure is non-optimal</p>	<p>Population and economic growth for service area</p> <p>Statistics describing changes in water demand for diverse uses</p> <p>Production vs. extraction capacity of sources</p>
	<p><i>FD1</i> Total population and water coverage rate</p>	<p>The size of population to which water services are provided increases the frequency / duration with which activities associated with water production, distribution, and wastewater disposal are carried out. Thus, a more market-based structure for water provision is non-optimal</p>	<p>Total population of service area</p> <p>Total number of connected users in service area</p> <p>Estimated vs. actual coverage rate in service area</p>
<p><b><u>Transaction characteristics</u></b></p> <p><b><u>Frequency and duration</u></b></p> <p>If water service provision implies very frequent interaction between parties and is one of a long duration, then a more market governance structure would be non- optimal, leading to contractual problems expost.</p>	<p><i>FD2</i> Water service availability at service area</p>	<p>The total number of hours / days water services are available determines the frequency/duration with which activities associated with water production, distribution, and wastewater disposal are carried out. Thus, a more market-based structure for water provision is non-optimal</p>	<p>Average water consumption per inhabitant at service area</p> <p>Availability of water according to total number of hours and percentage of users it covers</p>
	<p><i>FD3</i> Water production and distribution activities' incidence</p>		
	<p><i>FD4</i> Contract service duration between provider and user</p>		

**Table 1 Hypothesis, Indicators and Measurements (...continues)**

Variable	Contract element/ Indicators	Possible Contract Features	Measurements
<b>Intermediary Variable</b>			
<b>G O V E R N A C E</b>	Authority (GR) having ownership of residual control rights over assets	Public, Mixed public and private, Private	Shares distribution Capital financing Working capital
	Strategic coordination (GA) or management authority	Fixed Flexible	Precise set of company's objective, delimiting served area and beneficiaries Right to determine tariffs
	Organizational coordination (GB) as (re) negotiation mechanisms	Fixed and stable Flexible	Operation and maintenance procedures Procedures towards company's expansion
	Operational coordination (GC)	Flexible Fixed	Operation and performance goals, such as quality, quantity, efficiency, effectiveness on service delivery. Existence of schedules and activities plan
	Enforcement Mechanisms: Supervision and conflict-settlement mechanisms (GE)	Self enforced contract External and non specialized Internal and specialized External and specialized	Contractual clauses specifying supervisor and arbitrator roles  Contractual clauses specifying origin of investments. Clauses specifying sanctions applied in case of parties failing to meet contract terms. Clauses specifying incentives such as exclusive rights granted to parties, premium bonuses for performance, etc.
	Incentives and Sanctions scheme (GD)	Absence of incentives Unilateral or Bilateral commitments	
	Remuneration and risk sharing scheme (GF)	Set <i>ex ante</i> : Customized/Collective, Flat rate basis, Set <i>ex post</i> Intensity used	Contractual clause specifying payments due conditions
<b>S T R U C T U R E</b>	Contract Duration (GG)	Spot contract Short term contract Long term contract	Contractual clause specifying period for which contract has been signed
<b>I N P L A C E</b>			

Dependant variable	Indicators	Measurements
<b><u>Contractual violations</u></b>	CV1 Contractual violations	Description of the contractual violations which already occurred
	CV2- Modifications to contractual terms or sanctions applied or	Sanctions derived from violations: monetary or non monetary Contractual terms' modifications, which resulted from contractual violations.



### **4.3 Methods of data collection**

#### 4.3.1 Study Qualitative Approach

The contractual inefficiencies in the case of AGSAL will be assessed using qualitative research techniques. Semi-structured questionnaires will be used when the relevant actors are interviewed with regard to their opinions about the contract's implementation and enforcement, also to get to know the quality of the relationship between AGSAL officials and local government. A further objective is to obtain a more accurate description of the characteristics of water provision for Saltillo. Additionally, the perception of the interviewees on the relevance of each of the proposed indicators of transaction characteristics will be taken into account.

#### 4.3.2 Sources

In order to test the theoretically derived hypothesis secondary and primary data sources are needed.

##### *4.3.2.1 Primary sources, Design and Conducting of the interviews*

Regarding the interviews of selected actors, these include interviews with the AGSAL management team, as they are directly involved in water provision and represent local water experts, some of who have worked in the sector for several years. Interviews need to be conducted with members of AGSAL Shareholders' Assembly and Board of Directors, because they represent the main decision makers within the company structure and with Local Government Authorities such as Municipal President, City Councilors and other bureaucrats who are on charge to supervise AGSAL. In addition, with the Local Water Users Association (AUAS), Chamber of Commerce Representatives because they have represented the main opposition forces to private participation.

Two different sets of semi structured interview texts were prepared; both include a brief on the research purposes and the theoretical perspective. Through open-ended questions, one questionnaire aims to capture all possible details regarding water provision in Saltillo according to geo-physical and spatial factors; while the other intends to capture the understanding which parties have on causes of contractual violations and their consequences for: the relation among private investor and Saltillo local government, on the implementation of the contract and its effectiveness and on the functioning of AGSAL compared to the performance of the former public water agency.

The results of the interviews contribute directly to the formulation of answers to the research question and to test the hypotheses. Moreover, the answers can also supply new insights regarding the truth (or otherwise) of the hypotheses.

#### *4.3.2.2 Secondary sources*

The following additional sources of information and data were used

- a) The Association contract between private investor and local government in its written version since all information about the contractual clauses, which define our indicators for the governance structure variable, are contained in the document.
- b) Local statistics on socio-demographic and economic conditions will complement information about transaction properties indicators’.
- c) Previous research on the subject, especially the focus at local level to better identify those factors which cause investment specificity, frequency and duration to strengthen proposed indicators, identify new sources and, of course, to better describe water provision according to transaction characteristics.
- d) Official publications of AGSAL and Municipal Government such as annual memoirs, internal magazines or pamphlets and in general all published information, which contribute, to a better characterization of the relationship among the parties.
- e) Audit reports, Shareholders Assembly and Board of Directors memorandums to track contractual violations since they occurred and how they were dealt with in terms of the contract (e.g. modification of contract terms) and company (e.g. sanctions or removal of personnel)
- f) Newspapers which provide data on status of the company and interaction among relevant actors.

### **4.4 Methods of data processing and evaluation**

#### 4.4.1 Evaluating the hypothesis

The hypothesis and sub-hypotheses, derived from the theoretical framework discussed above, was verified through the proposed indicators resulting from the primary and secondary information collected. The emerging patterns were identified and correlated to the hypothesis statements. Thus, the research investigated the linkages between findings and previously proposed theoretical propositions. The way in which findings

are presented and discussed relates to the hypothesis and sub-hypotheses and the evidence which validate or contradict them.

Regarding, the governance structure: a more unified governance structure (e.g. public utility) is recommended if contractual clauses define a single owner of assets —the government (*GR*)—, that assumes all responsibilities for investment planning, and regulation as well as capital financing (*GD*). The management authority rests on the same party (*GA*) who also directs how works and operation and maintenance duties should be executed (*GB*, *GC*). In addition, the owner bears all commercial risks and thus sets the basis of compensation (*GF*). Finally, the contract is one of indefinite duration (*GG*).

A hybrid governance solution (partial divestiture) arises if asset ownership is divided among parties (*GR*), and investment planning decisions and capital financing comes from both sides (*GD*). Managerial authority vests in a single party, generally the majority shareholder (*GA*) however, decisions about work execution and operation and maintenance are negotiated by both contractors (*GB*, *GC*). Commercial risks are proportional to capital distribution (*GF*), thus a payment scheme is adopted upon common agreement. The contract duration is indefinite or for a long period (*GG*).

A market structure, which represents a full divestiture, comes about if asset ownership is private (*GR*). Although capital financing comes from private sources, investment planning and regulation is under government control (*GD*). Managerial authority (*GA*) and works execution and operation and maintenance responsibilities (*GB*, *GC*) are for the private investor. Since Commercial risk is assumed by private partner; he also gets all the benefits or losses derived from the operations, which most of time depend on its performance (*GF*). The private service agency will last an indefinite time (*GG*).

Since all information regarding the contract clauses are to be found in the contract, document analysis techniques identified exactly how each of these elements are characterized in the case of AGSAL. The information drawn from contract analysis was complemented by comments and opinions from the interviews with AGSAL Shareholders' Assembly and Board of Directors and Local Government Authorities.

The information derived from the indicators were analyzed, in order that the characterization of the water provision in Saltillo according to transaction properties could be completed, and related to a specific form of governance structure, which results in cost-efficient transactions. Once this was done the hypothesis on the misalignment between the governance structures in place —AGSAL, which has caused the contractual inefficiencies—and the theoretically optimal governance structure—could be validated.

#### 4.4.2 Evaluating Interviews

Regarding the contribution of the interviews to the testing of the hypothesis, interviewee perceptions' and comments' were taken into consideration to conclude or complement the following points.

- First the impact that the Saltillo's location and its natural characteristics have on the level of investments for water provision, how uncertainty impacts or had impacted on the execution of their activities, and what are the characteristics for the service they provide in general.
- Second, to compare the *de jure* version of the governance structure as stated in the contract to the *de facto* version according to how contract stipulations have been implemented in practice.

#### **4.5 The Saltillo Case Study**

Saltillo, the capital city of Coahuila, a northern state in Mexico is well-known for being the second largest automotive and assembly producer in the country. However, the city's economic growth has also brought along rapid growth in the migrant population. Both factors have caused a disorderly expansion of the city, where demand for public services has by far exceeded the public authorities' capacity to supply them, especially with respect to the demand for drinkable water. (Coahuila Development Plan, 2000-2005:28)

According to one study carried out by ININSA an independent water consultancy company, from 1980-1990 the ground-water level declined by between 5 to 10 meters (m.) each year. For 1996, this same study calculated an annual water production capacity of 29.47 millions of cubic meters (mcm), while 49.35 mcm were being extracted each year.(ININSA, 1996:27-28) This over-exploitation of aquifer reservoirs, the fact that sections of the distribution networks were more than 100 years of age, and a water agency which required funding by the municipality of more than \$20 million

pesos each year to continue operating; pushed the Saltillo Local Government in 2000 to look for an alternative and better modes to provide water.

The semi-privatization of the Municipal System of Water and Sanitation (SIMAS-Salttillo) started in May 2000 and finished a year later. Saltillo's Municipal Government hired the company Freese and Nichols to make a technical and economic evaluation to advice on the best way to make the system more efficient; a private partnership was seen as the solution. According to a municipal councilor the company made the presentation in such a way that "the only alternative left was to invite a private partner to enter into the water management. Moreover it was guided to promote the partial divestiture scheme" (A Ramos 2005, pers.comm. 10 Aug)

Later in March 2001 the general terms of the bidding process, including the statutes of the new subsidiary, the association and the contractual terms for the technical assistance were released. Only two companies acquired the right to make proposals for the competition, Vivendi and Waters of Barcelona (AGBAR), through its Mexican subsidiary INTERAGBAR; but only the last one made a proposal. On July 19, 2001, the Technical Evaluation Committee, composed of Municipal Councilors, agreed to the offer made by AGBAR. A total of \$ 81.9 million pesos were paid, when SIMAS assets' were valued at \$453 million pesos (Tobon, 2005a:3).

On October 1, 2001 the new *Para-municipal Company of Water Services for Saltillo, Anonymous Society of Variable Capital* (or AGSAL) started operations. (AGSAL's Annual Report, 2002:1) However, after less than two years, problems started to develop between INTERAGBAR and Saltillo Local Government, because of some evident contractual violations.

In 2003, following some reports from the local chamber of commerce and a water users' association; the Contaduria Mayor de Hacienda- an state body in charge of revising and auditing budgets from all public entities in general, including *para-statal* and *para-municipals* companies - initiated an audit process into AGSAL, comprising the financial, technical and public works, and legal areas. (AGSAL's Audit Report, 2003:1)

Some of the most important findings from this audit concerned the Technical and Public works area: More than \$2 million pesos were invested without having the consent of either the Local Government or the Board of Directors. Also, a discrepancy of more

than \$3,871,000 pesos was found between what was reported to the Board of Directors as payment for the execution of works and the invoice for such works. More than \$11 million pesos were spent on vehicles without requesting public tenders for their supply as it is required in the case of all public and semi-public entities by Coahuila Acquisitions, Procurement and Contracting Law. Furthermore, an audit showed these vehicles were bought for the use of AGSAL top officials (AGSAL's Audit Report, 2003:2-5)

For the financial area, the main findings were: there was a payment to SIMAS of expired bills to a total of more than \$18.5 million pesos, which were recovered by INTERAGBAR but which were never reported in the financial statements as an asset on SIMAS behalf. There was no consultation regarding the salaries paid to the Spanish expatriates working for AGSAL, neither were these approved by the Board of Directors; and they were found to be higher than the salaries of any other local public officials on the same level. Still within the financial area and what has been identified as the most serious violation, are the increments of water tariffs from 20 to 30% above what is stipulated in the contract, which limits increments to the rate of inflation, about 6 %, for the same period. (AGSAL's Audit Report, 2003:7-12)

Finally, in the legal area, the audit reported that two contract articles were modified to favor INTERAGBAR. The first was to modify the Shareholders Assembly Decisions to require at least one vote from INTERAGBAR members in order to pass a proposal in those decisions requiring a majority of votes. This contravenes the AGSAL constitution which allocates voting rights according to capital distribution. The second was to allow the General Manager to be a legal representative of INTERAGBAR shareholders. This gave him the opportunity to be party and judge at the same time during meetings of the Board of Directors, one of the governing bodies within Agsal, of which he is a member.

Other relevant findings were: more than four meetings of Board of Directors were held without having the required minimum quorum. In addition, in two cases, not all members representing Saltillo were notified of the meeting. Finally, the audit couldn't find evidence about training and development courses in order to replace expatriates with Mexican personnel, from AGSAL's second year and onwards. Also there was not sufficient evidence to convince auditors that INTERAGBAR was in fact giving technical assistance to SIMAS nor that commercial efficiency and water services

availability were working according to performance indicators set by the terms of the contract at that time. (AGSAL's Audit Report, 2003:15-20)

Resulting from this audit, the contract had to be modified at least three times: first to review and revise those clauses that were modified without the consent of Saltillo authorities; a second time to include a new monitoring body together with the Board of Directors and Commissioners, which already were in place; and a third time to include an additional paragraph to clearly state the eventualities—climate or natural disaster related events—under which the Board of Directors can authorize tariff increments, which should always revert to its normal level, once the “state of emergency” has passed. (Shareholders' Extraordinary Meetings Memorandums February, April and October 2004; Board of Director Memorandums April, July 2004, and January 2005)

In addition, regarding the Technical and Public works; and the legal contractual violations a public *attention call* was issued against the AGSAL General Manager, warning him not to commit the same mistakes again. (Alfaro, 2005) In the case of the overcharges, Board of Directors and The Councilors Water Commission asked INTERAGBAR to return the money; however of the overcharged amount of more than \$50 million pesos, INTERAGBAR agreed to return only 15% not later than 2006. In fact until December 2005, only between 3 to 5% of this money had been returned to domestic users but nothing has been returned to industrials, business and other users. (Noriega, 2005)

With regard to AGSAL a well-known Mexican researcher writes,

Of all the privatizing experiences in Mexico, this is the most controversial. During its first two years, substantial irregularities in financial transactions, including unauthorized tariff increases and service changes, improper procurement procedures and worker-management disputes were revealed by a local congressional investigation. (Barkin, 2005:4)

Finally, it should be mentioned that in spite of these, the company correctly boasts significant achievements in improving collections and the proportion of the population served. However, its flagrant violations of its contract have provoked energetic citizens' protests looking for AGSAL to end operations. This constitutes a very interesting case, which may indicate that an inefficient mode for provision was chosen for Saltillo, thus causing high *ex post* transaction costs, which could have been minimized if the correct governance structure for providing the service had been implemented from the outset.

## **CHAPTER 5**

### **FINDINGS AND INTERPRETATIONS**

This chapter presents the main facts of the field the research. The information is organized into two sections to show the linkages between the findings and the proposed hypothesis. The first section, focuses on the most important elements that impact on the investment specificity, frequency and duration, uncertainty and complexity levels during the provision of potable water. The second section describes the governance structure of AGSAL in terms of technical governance, enforcement mode, remuneration and risks sharing mode and contract duration, as discussed in the theoretical part of this dissertation.

#### **5.1 Water Provision in Saltillo: A Characterization according to TC Properties**

##### 5.1.1 Investments Specificity

###### *5.1.1.1 Service area location and topographical characteristics*

The availability of water within an area is naturally determined by a recharge area which is geographically limited by its extension and climatically limited by the average annual precipitation and infiltration rates (i.e. speed at which water moves through the soil surface into the soil). Clearly those areas where water is naturally scarce will require larger investments to guarantee a reliable supply of water.

In case of Saltillo, both factors play an important role in the scarcity of this resource. The city is flanked on the west, east and south by the Eastern Mother Mountains which greatly reduces the likelihood of rains. In addition, given the city's location in a valley, high infiltration is unavoidable, and the absence of proper rain drainage causes rain water to be wasted. According to Coahuila Water and Sanitation Commission (CEAS) it is calculated that around 40% of rainwater is lost each year. "Furthermore the scarcity of superficial water bodies accelerates vaporization rates." (R Reyes 2005, pers. comm., 30 Jul.) In Saltillo, superficial water bodies are limited to some intermittent streams which appear during torrential rains across the valley, and which also have high infiltration rates. (CNA, 2002:8)

In addition, Saltillo's uneven topography demands larger investments—larger than areas with a flat surface. According to the AGSAL operations manager:



The water distribution stage is the one where the real adventure (in financial terms) begins. Because the ground elevation of the Saltillo valley varies from 1200 m. in the south part of the city to 1800 m in north (a vertical difference of more than 500 m.), transporting water across the city to households is no simple task. It involves a complex system of 25 re-pumping facilities, tall and ground storage tanks, pipelines and valves around Saltillo, in order to ensure that water reaches the highest points. (E Salazar 2005, pers. comm., 18 Aug.)

Supporting this argument, the AGSAL planning manager states:

Re-pumping water from south to north entails large investments. It means additional piping, pressure valves, macro flow meters, and a hell of a hydraulic infrastructure, just to keep the flow running within certain speed and altitude parameters, so to avoid distribution problems because of pressure changes or reasons alike. Beside, the city's growth trends show it is moving to north, and water is coming south; our studies suggest that every year sources will be more distant from the city. (J Arredondo 2005, pers.comm. 15 Sep.)

These two factors of geographical location and topographical conditions are a non-variable restriction on the availability and origin of water. Both, impact on the investments that operator systems have to undertake in the technology and equipment necessary to produce and transport water.

#### *5.1.1.2 Origin of water*

In Saltillo, the only possibility for water supply is underground sources; this is very important in cost terms for a service provider. It is generally accepted that water from underground origin is of much better quality than surface water. The origin of the water impacts on the purifying treatment costs later. In addition, exploiting underground sources entails larger investments on the equipment required for its extraction and its canalization into the primary networks lines before its distribution. (Menard & Saussier, 2002:45)

Saltillo's water supply sources are located in 6 main water-fields distributed on a 1,419 km<sup>2</sup> surface. There are 75 drilled underground wells and 1 spring. The wells' depth is on average 500 m; however there are others more than 700 m deep, a depth that is considered economically unfeasible by international standards. (Tobon, 2005b:8). The distance from supply sources to Saltillo, where most distribution points are located, varies from 0 km for those within the urban area, up to 50 km for the one which provides 60 to 70 % of the total water supply. (AGSAL-Infoaqua, April & July 2003:3-6)

The volume of extracted water per supply source varies between 1,537 to 1,746 liters per second (l/s); this is 145,753 m<sup>3</sup> a day. Extracting water at this rate, according to experts, "worsens the over-exploitation that Saltillo aquifers already have, because their

recharge potential is far below to the extraction volume.” (H Corrales 2005, pers.comm. 4 Oct.). Some studies carried out between 1990 and 2000 calculated the recharge potential between 28 and 39 million- of cubic meters (mcm) a year. It means between 0.9 and 1.23 l/s. (SEPLADE, 2003:78) At present, for human consumption purposes 53.2 mcm a year is extracted while 123.0 mcm are used in industry, agriculture and for public and residential purposes (e.g. private or public swimming pools, and watering of public gardens). (Robles, 2005)

#### *5.1.1.3 Properties of raw water*

With respect to the quality of the water extracted from Saltillo’s underground, it is excellent. Thus, it is only necessary to add sodium hypochlorite or chlorine gas, before it is distributed for drinking purposes. (AGSAL-Infoaqua, October 2003:8) According to local experts, the quality of water at 500m is really good.

To talk about potabilization methods is not appropriate because water is naturally purified. The steps that need to be undertaken during water purification depend on the kind of impurities that are found in the water ... For example, superficial raw water, because it is more exposed to natural or human pollution, requires a combination of mechanical and chemical treatments beside disinfection before it is potable. (H Corrales 2005, pers.comm. 4 Oct.)

Therefore, investments needed to free water from impurities are larger for worse quality water.

Since, the Mexican Health Ministry supervises water treatment and requires the quality of delivered water to be within certain parameters, to prevent gastro-intestinal diseases and related illnesses (*SSA Water for Human Consumption Act, 1994*), in Saltillo water passes through a disinfection or a chlorine adding process. Nonetheless, “potabilization does not represent an important area of investment for water provision, like for example in other Coahuilean cities where water comes from rivers”. (J Arredondo 2005, pers.comm. 15 Sep.)

#### *5.1.1.4 Distribution networks physical conditions*

Investments in water distribution are characterized by extensive capital-intensive networks, which are primarily sunk costs with increasing expenditures on maintenance. The sunk costs are mainly associated with the non-redeployability (having few alternative uses) that most hydraulic infrastructure have in comparison to other network

sectors like telecommunications, of which assets are substantially more mobile than water sector assets thanks to computer technology. (Spiller & Savedoff, 1995:5)

In the case of Saltillo, the primary and the secondary networks are in very bad condition, mainly because of their age and the quality of the construction material; therefore they require large investments for their maintenance, rehabilitation and replacement. For Saltillo's primary network—the big diameter pipes that start near to the source — is 103 kilometers long and has an age varying between 12 and 30 years. According to local experts, there are long sections of the primary network, which have not received maintenance for the past 10 years. Also, leakages occur because of the pipes' inappropriate diameters, which are not big enough to handle most changes in transported water, causing pipes to burst.

Referring to the conditions of the secondary network—pipes, which pass throughout the housing areas—all interviewees, used the word *precarious* when describing them. There is evidence that there are sections of the 1,740 km of secondary network that have been in existence for more than 100 years. All kinds of building material can be found, from clay to iron or cement—most of them having a very short usable life span. The tubes come in three different diameters, which caused them not to seal properly. This creates huge leakage problems. An indication of the network's poor condition is the physical efficiency (i.e. total volume of extracted water/ total volume of delivered water), which in 2001 was calculated to be 46%. This means that for every 100 liters extracted, 46 were lost mainly to inadequately maintained pipes, leakage or clandestine water connections. (AGSAL's Annual Report 2003:9-12)

In summary, concerning investment specificity it can be said that Saltillo groundwater sources predominate, with the depth averaging 500 m, and with a big distance up to the nearest distribution point. These are all factors which imply large investments in machinery and hydraulic works to provide water. In addition, groundwater source depletion caused by sustained pumping, together with old, low-quality and inefficient distribution networks are all reasons which have a high impact on investment needs to improve facilities and guarantee water availability in the future.

## 5.1.2 Uncertainty and Complexity

### *5.1.2.1 Type of water supply sources*

The predominance of ground water sources increases the difficulty to calculate the actual water availability. Thus, uncertainty makes activities along all stages of the water provision more complex. Furthermore, hydrologic studies are very expensive and therefore not very often performed; hence many hydraulic plans and works will be based in old and wrong estimations that can have great consequences. For example in Saltillo from 1979 to 1996 only two studies were carried out to explore hydrologic conditions on the aquifer. This absence of information led to a crisis from 1995 to 2001, in which the volume of ground water in storage was decreasing 12 m. per year, and pumping water was done at 1200 m. out of ground. Some of the negative effects caused were drying up wells, increased pumping costs, and deterioration of water quality, among others. (CNA, 2002:2).

### *5.1.2.2 Climate Variability*

The geographical location of Saltillo in the southeast of Coahuila, between the 20 and 40 degrees of the latitude north, the same latitudes of the Chihuahua Desert, results in a highly erratic rainfall pattern and semi-desert type weather. This type of climate increases uncertainty about rain and drought occurrence and is coupled to extremely low or high temperatures during summer or winter seasons: factors that may damage water-infrastructure causing the system to fail; thus making it necessary to design and have complex action plans in place in case of the occurrence of these events.

In Saltillo, average rain precipitations vary between 300 and 400 mm, and it presents as rainy periods alternating with several drought periods. According to some records, years classified as rainy periods are becoming less and less frequent; so from happening once every 5 years during 1940-1960; their incidence has been reduced to occur only once every 10 years, as happened between 1960 to 1990. (CNA, 2002:8) In addition, “three episodes of winter-spring dryness have prevailed in the Saltillo region after 1950, a much higher frequency of decadal drought than estimated over the past 219 years. This aggravates regional water supply problems”. (Pohl & Therrell, 2002)

A second result of this “relative absence of rain has to do with the replenishment capacity of wells, since vaporization rate varies between 1,672 and 1,910 mm (against precipitation rates of 300 to 400 mm); thus replenishment of water sources is limited”. (Tobon, 2005b:17) Also because Saltillo lacks of physical infrastructure such as dams,

weirs and drainage canals it is not possible to store rainwater. Thus, the uncertainty and complexity on the possibility to provide water for future periods increase.

Regarding climate variability, the AGSAL Planning Manager remarks that although it is true that the weather can be predicted, there is only a limited degree of certainty. This it can have an impact on the company's investments level. He mentions as an example, "the extremely low temperatures which Saltillo had in November 2003 which burst domestic flow micro-meters, resulting in expenditures of more than \$2.5 million pesos, which of course were not provided for in the original budget". (J Arredondo 2005, pers.comm. 15 Sep.)

#### *5.1.2.3 Growth in water demand for human consumption and other productive uses*

An important factor, which affects uncertainty and complexity in water provision, is future water demand, either for human consumption purposes or other commercial and productive uses. The natural limited water availability within an area, constrains water systems ability to accommodate long term future demands, pushing the suppliers to look for alternative water supply sources which may imply further location distance thus increasing complexity of water production and distribution, or the need to alter natural ecosystems to produce water (e.g. swamps, forests) which may produce spillover effects, such as an alteration of natural water flow patterns, the accidental introductions of nuisance species or changes in water levels and temperature.

For the case of Saltillo, with an average population growth of 0.9% and with automotive industry production, representing 20% of all national automotive industry, water demand has increased rapidly. For example water demand for domestic purposes increased 1.3 times (from 45.1 mcm to 52.3 mcm) between 1996 and 2004; demand for agriculture went up at the same rate (21.27 mcm in 1996 vs. 27.27 mcm in 2004) while water demand for industrial purposes doubled in the same period (5.6 mcm in 1996 vs. 12 mcm in 2004). (CNA, 2002:6) According to some studies, "if this increasing trend in demand continues and water extraction is not controlled, 40% to 50% of total current ground wells will dry up within 10 years". (CNA, 2002:9) Besides, according to a hydrologic study carried out by AGSAL's experts in 2004, although

New supply sources have been detected which may help to assure water supply for Saltillo in the next 30 years, some of these sources are located as far as 20 kilometers from the city, and others are within the boundaries of an environmentally protected area. (E Salazar 2005. pers.comm. 15 Sep)

In conclusion, it can be said that predominance of ground water sources, a variable climate type, uncertain and low rainfall, the lack of physical storage infrastructure and a growing water demand for human consumption as well as for other purposes, increase the uncertainty about water availability in the near future. Moreover, management authorities have to plan on dealing with any increased variability induced by climate change making the planning process and the finding of solutions a very complex activity. In addition, externalities that may arise because of extracting water at increasing rates or carrying it from further distances, also impacts on the uncertainty and complexity levels for Saltillo's water provision.

### 5.1.3 Frequency and duration

#### *5.1.3.1 Total population and water coverage rate*

The size (and growth) of the population to which water services are provided increases the frequency with which activities related to water provision are carried out. In the case of Saltillo there were 140,200 water users in 2001; if on average each house has 4.5 inhabitants, then it can be assumed that 630,900 persons had access to water. (Saltillo Municipal Development Plan, 2002:13). This results in a coverage rate of almost 100% given a total population of 600,000 inhabitants, registered for 2000. Specifically a coverage rate, a rate of 83.17 % was reported in 2001, for all regular settlements (i.e. those that were registered within the Municipal Cadastre and the Public Property Registry). (Saltillo Municipal Development Plan, 2002:13)

#### *5.1.3.2 Water service availability at service area*

In order to satisfy consumers' demand on average 53.2 mcm of water is extracted every year from 66 out of 76 sources available, which are used daily. For 2002, the frequency with which water reaches households' taps varies; between 60 to 65% of users receive water all week, from 1 to 24 hours. The remainder receive the service on an intermittent basis; between 27 to 34% receive water 3 to 4 days of the week and 10 to 12 % have water services only 1 or 2 days a week.(AGSAL-Infoaqua, January 2003:3 -5)

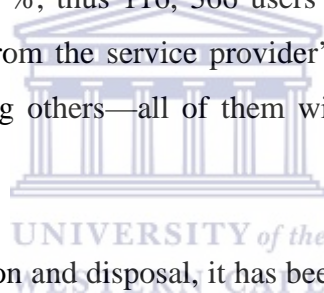
#### *5.1.3.3 Incidence of water production and distribution activities*

Pumping is performed on daily basis, although extraction alternates between the different sources available. This working schedule involves the daily use of equipment and the continual presence of personnel performing maintenance, repair or improvement tasks across pumping stations, treatment plants, storage tanks, primary and secondary distribution networks, and all the rest of the infrastructure. A total of 290 people ranging

from engineers, to technicians and general laborers cover three different daily shifts of 8 hours each to perform all these tasks. The maintenance and rehabilitation of households infrastructure, which is located outside the house perimeter is also the responsibility of the provider (e.g. micro-flow meters, water and sewage pipelines), however these tasks are performed on request. (E Salazar 2005, pers.comm. 15 Sep)

Concerning metering and billing water consumption these activities are performed once each month. For metering a total of 4.4 days approximately are spend to *sweep* the city and read each household's consumption. The measuring coverage rate in 2001 was 85%. "For those cases in which consumption cannot be measured, calculations are based on historical averages consumption". (J Arredondo 2005, pers.comm. 15 Sep)

The processing, calculation and printing of bills are duties performed by the provider's financial departments; then bills are home-delivered, once a month, by the company's personnel. After getting their bills, consumers have one month to pay. For 2001, billing collection efficiency was 83.7 %, thus 116, 366 users where billed. Several locations serve as collection centers—from the service provider's commercial offices to banks, and convenience stores, among others—all of them with different opening hours and service days.



Regarding wastewater collection and disposal, it has been calculated that approximately 1000 to 1100 l/s of water are thrown into the sewerage system each second. All wastewater is gathered at 1 of the 4 residual water collectors located across Saltillo. From there it is carried to two local streams: Los Cardenas, which mostly gathers all domestic and business disposed water and La Encantada, which is located behind the Industrial Zone, thus gathering all industrial residual water and a very small percentage from domestic sources.(Tobon, 2005a:30) Until now, only 10 % of all disposed water is recycled; this in small capacity, private recycling plants, which are the property of the industries, which later reincorporate treated water into their process; the remaining 90% is lost due to the lack of treatment plants. The situation is set to change. "In September 2005, the Local Government jointly with a local company started negotiations to build a recycling water plant with enough capacity to treat 60 to 70% of all wastewater". (G Tobon 2005, pers.comm. 4 Oct.)

In summary, with water services able to meet the demand for almost 90% of total population, 60 to 65% of all connected users receiving water on daily basis and the remainder, getting the service at least once or twice a week right at their houses or places of business, one can assume a high frequency of all activities related to water provision. In addition, efficiency indicators show that 80% of all users' consumption is metered, billed and collected. Hence, a high frequency exists.

Finally, contract services signed between users and service provided are indefinite; this is caused by an absence of competition in water sectors, because the Municipality does not grant licenses to extract water to individuals, except for industrial or agricultural purposes'. Other reason is that the few available small-scale providers sell water at prices three times higher than the municipality; which also offers trunk-tank services to distant communities. (T G Tobon 2005, pers.comm. 4 Oct)

## **5.2 Theoretically Optimal Governance Structure for Saltillo**

After analyzing the investment specificity, uncertainty and complexity and frequency and duration properties which characterizes water service provision in Saltillo, it can be stated that according to Transaction Costs propositions, the governance structure which will result in optimal minimizing of ex-post transaction costs, hence reducing contractual inefficiencies, is a hierarchy or unified governance structure.

A public owned utility is recommended since a high specificity of investments is associated to predominance of ground water supply sources which account for 98.7% of all supply sources, which impact on the expensive pumping system required to extract water. Furthermore, the depth of wells averaging 500 m and a distance of up to 50 kilometers (km) to the nearest distribution point, are additional factors that imply large investments, because pumps used to lift the water from such great depths require more energy to be driven; thus using the wells can become prohibitively expensive. In addition, the ground elevation differential, of more than 500 m between Saltillo south and north areas imposes large investments on the hydraulic infrastructure needed such as pipes, pressure valves, and small mechanical pumps in order to carry water across the city.

The unified governance structure is also suggested by the high frequency and long duration characterizing all activities associated with water provision. The main reasons



for this are twofold: Firstly, service coverage rate is between 85 to 90% of the total city population; this implies high volumes of extracted water which are later purified and carried along distribution lines to consumers' houses. Secondly, of the contracts between service provider and domestic consumers is a long life contract, since there are no other (real) possibilities to get the service.

A hierarchy structure also better suits the high levels of uncertainty and complexity which are present in Saltillo water sector due to the predominance of underground sources, which makes difficult for authorities to know real water supply and has already lead to costly mistakes. In addition, Saltillo has a very variable climate, which results in a highly erratic weather patterns and makes for unpredictable rainfall. Finally, there is a growing demand for water, which further impacts on the already limited supply caused by natural reasons and human over-exploitation; which makes more complex for water authorities to plan for actions to guarantee water provision.

### **5.3 Description of the Governance Structure Chosen: AGSAL.**

#### 5.3.1 The Technical Governance

##### *5.3.1.1 The Authority Element*

According to Brousseau, the authority element is defined by a) the residual rights of control over an asset, and b) the question who decides on the parties' duties and rights to ensure the realization of the contract's objective. (Brousseau, 1995:412)

In the case of AGSAL, 51% of shares are in the hands of SIMAS' (the former public agency); and 49% are INTERAGBAR's property.

**Table 2 AGSAL's Working Capital and Distribution of Shares**

Shareholders	Shares	Capital investment	%
SIMAS	85, 242,857	\$85, 242, 857	51%
INTERAGBAR	81, 900, 000	\$81, 900, 000	49%

Source: AGSAL Association Contract (2001), Clause 3, Section 1, p.6

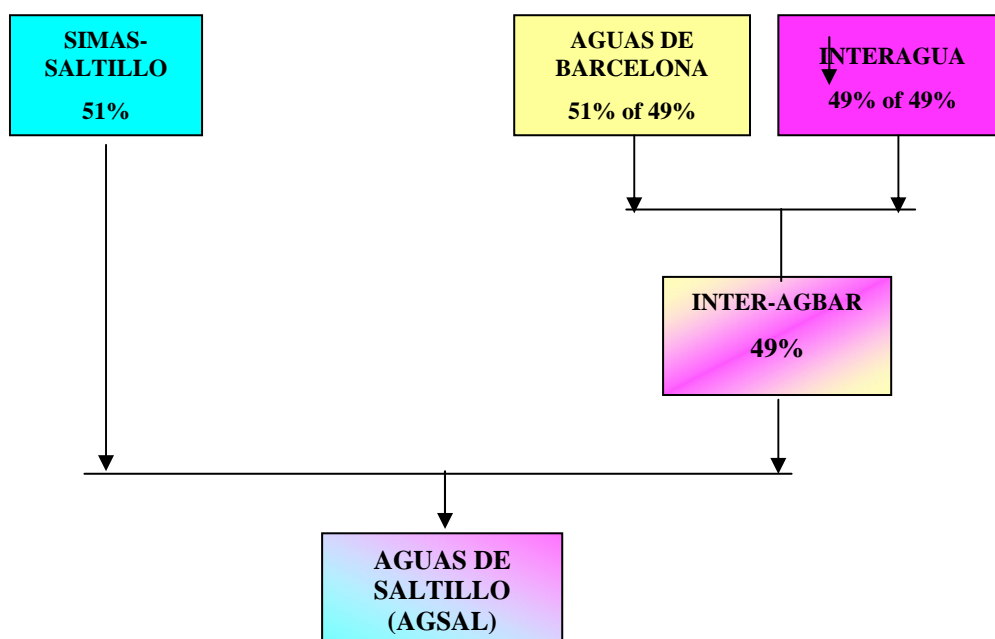
The contract states as SIMAS's rights on: the rights to exploit the water and sewerage networks for up to 99 years, all current, fixed and long-term assets not related to the potable water and sewerage network. SIMAS also brought in all its liabilities except for a \$20 million-pesos debt to The National Water Commission. Finally, all the personnel

and the (longer term) labor liabilities attached to them were similarly transferred. On INTERAGBAR's side, their contributions into the new subsidiary are an initial investment of \$81,900 million pesos and all the company's knowledge and the experience in operating water systems. (AGSAL Association Contract 2001, Clause1, Section 3)

The mixed asset ownership distribution has resulted in a decentralized form of authority that is based on a voting system through a Shareholders' Board, which represents the highest management body of AGSAL. Among the Board's main responsibilities are: 1) the duty to supervise the overall management of the company; 2) the task to discuss and decide on the Company's financial status 3) the obligation to propose and select the members of the Board of Directors; 4) the decision on how to distribute profits; and 5) task to discuss changes in equity capital.

All these issues are discussed during *ordinary sessions* which are compulsory at least once a year. In order for ordinary sessions to take place, members present should represent the 75% of AGSAL equity. The propositions are voted on and confirmed by simple majority. (AGSAL Association Contract, Clause 4, Section 1)

**Figure 4 Owners of AGSAL and Assets' Ownership Distribution**



Source: AGSAL Association Contract (2001), Clauses 3 and 15, pp.3, 23

Since the main financing sources of AGSAL are through contributions to share capital, care has to be taken always to keep majority on assets' ownership with SIMAS. In addition because of its public component, AGSAL receives contributions from the National Water Commission (CNA) and Coahuila State Government, through CEAS. (Tobon, 2005a:18)

#### *5.3.2.1 The Strategic Coordination*

The strategic coordination refers to those mechanisms, which enable parties to redefine the objective of the cooperation without changing the contractual arrangement; this will be possible depending on whether the objective is fixed and clearly defined, or if it is vague and modifiable.

In the case of AGSAL its main objective has been set precisely by both parties as follows,

Water and sewerage services provision, to all population within the urban limits of Saltillo, Coahuila. The company must consider the future growth of the city. As stated in the present legislation, all plans and contracts drawn up by the company should bear in mind the growth element. The potable water and sewerage services, which are provided to rural areas, are not and won't be under the PARAMUNICIPAL responsibilities. (*AGSAL Association Contract*, Clause 2, Section 1)

Regarding the tariff scheme the contract states that increments to the prices for the services of water and sewerage are proportional to those of the Consumer Price Index (INPC). (*AGSAL Association Contract*, Clause 2, Section 3)

In conclusion, it can be said that strategic coordination of AGSAL is based on routines, because on one the hand the subsidiary's objective clearly states which services AGSAL should provide and within which boundaries while on the other tariffs and how they should vary, are already stipulated in the contract, and there are no clauses allowing for changing it.

#### *5.3.1.3 The Organizational Coordination*

The organizational coordination concerns those clauses, which define the way contractors can reassign tasks among them throughout contract's duration.

In the case of AGSAL a redesign of contractual terms is possible by means of two procedures. The first is a Shareholders' extraordinary meeting where the topics dealt with during these meetings are: 1) changes in the Constitutional Act of AGSAL; 2) breakups or early termination of the contract; 3) changes, mergers or splits in the

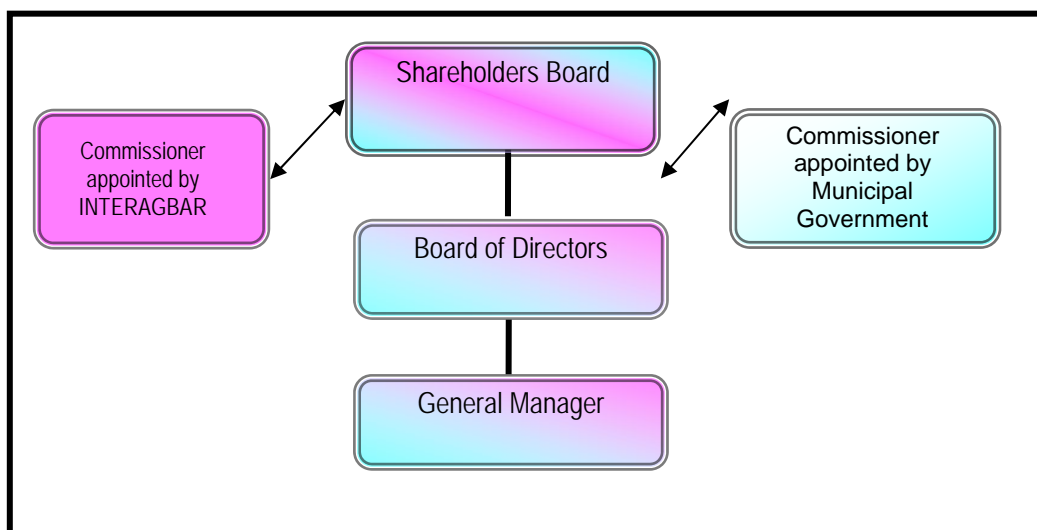
partnership; 4) increasing or decreasing share capital; 5) approval of financial statements, and among others. The decision rule for the extraordinary sessions is based on a unanimous voting result. (AGSAL Association Contract, Clause 4, Section 2-4)

The second procedure available to redesign any decisions already taken or stated in the contract is through Board of Directors' meetings. The Board of Directors is a management structure below the Shareholders Board. Board members should meet every three months, and at least of 6 out of 9 members should attend, including the President of the Board. During the meetings, held to consider and make what the contract calls *transcendent decision* regarding specific contingencies, including issues like: 1) Operating Annual Budget and any adjustments required; 2) to buy -or not to buy- any item which has not been included in the Annual Operations Budget, if its cost doesn't exceed \$100,000 dollars; 3)to authorize -or not to authorize- debt's acquisition, if it hasn't already been accounted for in the Annual Operations Budget, and doesn't exceed \$100,000 dollars; 4) Deciding on changes about AGSAL fiscal status. (AGSAL Association Contract, Clause 5, Section 5)

For such decision to pass 7 out of 9 of the member's votes must concur. Once adopted, a decision has to be confirmed in a written document, which must be signed by each member.

In sum, since the two mechanisms considered in the contract enable parties to redesign duties and rights they grant bargaining power to both parties, thus a decentralized authority has been implemented to manage AGSAL organizational coordination mode.

**Figure 5 AGSAL Managerial – Organizational Structure**



Source: AGSAL Association Contract (2001), Clauses 3 and 15, pp.3, 23

#### 5.3.1.4 *The Operational Coordination*

The existence of a Technical Assistance contract is the means through which AGSAL specifies all the technical conditions under which INTERAGBAR should assist SIMAS in providing water and sewerage services.

The Technical Assistance contract lasts 25 years and began the same day that AGSAL started operations. According to the contract, INTERAGBAR is obligated to work with AGSAL by using its own technology, material and human resources in all activities related to the water cycle. While performing all these tasks, not only should technical support be provided but also all the technical information needed. The term *technical information* refers to all the technical knowledge, data, patents and applications, and consultancy reports either in written, pictorial or verbal forms about the company's management. It also includes all techniques and procedure manuals for training employees. (*AGSAL Technical Assistance Contract*, Clause 1-2, Section 1)

The range of activities described in the contract, range from all those related to the overall administration of AGSAL, to software development and implementation for the production, operations, planning, commercial, data processing and finance departments. It also includes the recruiting and hiring procedures, the diagnostics and action plan concerning the state of physical and hydraulic infrastructure, analyses of local market demand for water and expected growth; and the supply of all machinery for water provision, and all related procedural documentation. (*AGSAL Technical Assistance Contract*, Clause 2 Section 2)

A Master Plan resulting from an evaluation of the human and physical infrastructure conditions of the water system in Saltillo is the cornerstone of all planned activities that INTERAGBAR will complete for the duration of the contract. The Master Plan is broken into sections which include all activities needed according to time and spatial criteria. Each year, all projects drawn from the Master Plan are presented to the Board of Directors for their approval. This annual plan incorporates the schedule and budget assigned to each project. In addition “while completing the master plan, the Consultant (that is INTERAGBAR) is obliged to provide all technical support and information according to AGSAL specifications and needs.” (*AGSAL Technical Assistance Contract*, Clause 2, Section 4-6)

According to Local Authorities the Master Plan represents advances in the water management for Saltillo. They prize the continuity that “the Master Plan gives to investments in the water system, but moreover the fact that a private investor guarantees efficient management: this because of the political interests to which SIMAS was subject in the past.” (I Ramos 2005, pers.comm. 10 Aug)

Regarding, the quality standards expected from the services provided by INTERAGBAR, they are a recurrent issue in several clauses. For example one clause, which strongly stresses performance quality, mentions. “The Consultant is obligated to provide the services according to the characteristics, quality standards and periods settled on this contract” (*AGSAL Technical Assistance Contract*, Clause 4, Section 1) Later another clause states “the Consultant assumes full responsibility and guarantees the functionality, quality and results for the service provided.”(*AGSAL Technical Assistance Contract*, Clause 4, Section 4) Monitoring and supervising all services provided by INTERAGBAR is the full responsibility of the Board of Directors. They must verify the completion of the task according to the full accomplishment of all specifications demanded. In case of work being done that does not meet all the criteria, proper solutions and corrections should be made. Then the Consultant is responsible for covering all the expenses incurred by AGSAL. All activities and performance reports, contingency plans, budgets and expenditure reports, are shown to and discussed with the Board of Directors during their meetings, every three months. (*AGSAL Technical Assistance Contract*, Clause 4, Sections 6 and 7)

However, in practice the supervision of AGSAL performance also resorts to mechanisms other than those described in the contract like, for example, hiring external consultants to evaluate whether a work fulfills technical, quality or sanitary standards. Local authorities attributed this need to: “a lack of time, knowledge, or even experience on their side caused by the complexity of the water sector” (L Alvarez 2005, pers. comm, 24 Aug.); this has made the task of monitoring and supervising on INTERAGBAR, one of the most important tasks, and a very difficult one to perform effectively.

In summary, the operational coordination of AGSAL is of a flexible nature; although regulated by a Technical Assistance Contract it gives room for INTERAGBAR to

discuss it with Saltillo local government; while local authorities can modify it whether to suit their priorities on infrastructure works.

### 5.3.2 The Enforcement Mode

#### *5.3.2.1 The supervision and conflict–settlement devices*

In AGSAL, The Board of Directors is, according to the Association Contract, the body in charge of supervising the overall administration of AGSAL. No changes to the actual terms of the contract or any decision referring to the scope or status of the company can be done without Board approval. In addition, there are two Commissioners proposed by each party, who participate on monitoring AGSAL, and later report their observations to the respective shareholder but not to the Board of Directors. (*AGSAL Association Contract 2001*, Clauses 5 & 6)

The Board of Directors has 9 members, five of them representing the public side, of which the Municipal President is one. He should also be President of the Board and have the decisive vote in case of a tie voting. Of the remaining four, one should be a representative from the State government and directly appointed by the State Governor. The other three should be members of Saltillo's civic society. (*AGSAL Association Contract*, Clause 5, Sections 1 and 2).

Board of Directors membership criteria is only partially fulfilled. *First*, in practice the Municipal President performs an Honorary President's role. He is accused by several groups such as food and beverage industrialists and local chamber of commerce of not defending citizen's interest during meetings against those of INTERAGBAR. (Olguin, 2005) In addition, in all AGSAL publications, the Municipal President appears under the Honorary President heading. *Second*, there are not memorandums from Shareholder's Assembly, amending the contractual clause that asks for the Municipal President to be an Honorary President of the Board of Directors. *Third*, none of the Directors is recognized as a member of Saltillo's civic society but instead they are from the city business elite. "None of them has at least some technical expertise, nor do they own sources of information, thus in their decisions they rely only on the information provided by AGSAL". (G. Tobon 2005, pers. comm., 4 Oct.)

In case of disputes or controversies about the validity, legal interpretation, noncompliance or termination of the contract arise, the contract makes provision for two

*emergency meetings* between the Shareholders' assemblies and Board of Directors' sessions to sort out the conflict and agree on a solution. (AGSAL Association Contract, Clause 16, Sections 1-4) Once the two emergency sessions have taken place and if no agreement has been reached between INTERAGBAR and SIMAS, two different stages are distinguished along the conflict resolution process: the *impasse status* and the *final impasse status*. During the first stage, the contractors' legal representatives meet and have 30 days to clear up the impasse. In case no solution is possible, then a *final impasse status* is declared, and the assistance of a third party is possibly needed. (AGSAL Association Contract, Clause 16, Sections 5-9) The International Chamber of Commerce is the external arbitrator who will decide on the dispute based on its own Arbitration Rules. The judgment made will be final and compulsory on both sides. All costs incurred by the arbitration process will be assumed in equally percentages. (AGSAL Association Contract, Clauses 11 and 12)

Local authorities and AGSAL official opinions concerning the effectiveness of supervision and conflict resolution devices are quite positive regarding the mechanisms' flexibility, which allow them to meet and discuss several times before turning to a third party. For example AGSAL General Manager argued that,

An advantage of meeting every three months is that any question or important issue can be solved immediately. If, any plans need to be revised or modified it can be done right away. This he says saves both shareholders' time and money (J Garcia 2005, pers. comm., 4 Aug.)

In conclusion AGSAL supervisor and arbitrator roles are performed by an internal and specialized body that includes the Board of Directors and two Commissioners; however under special circumstances an external third party can be used to solve the conflict.

#### 5.3.2.2 *The incentives and sanctions scheme*

Since AGSAL was constituted through contributions in kind and capital on SIMAS and INTERAGBAR sides a mutual commitment by the two parties to observe the contract clauses has arisen. Among the safeguards that have been included in the contract to compel parties to do so is a declaration from both sides on the conditions that have brought them in the association. Thus, SIMAS declares to be a public decentralized agency created by decree on August 31<sup>st</sup>, 1993, to have all the powers, rights and authority to sign an Association and a Technical Assistance Contract. Among the warranties, SIMAS certifies that neither the signing, nor the execution of the two contracts conflicts with any section of the SIMAS Creation Decree. In addition, SIMAS declares to retain all debts acquired with the National Water Commission before



contract signing. Finally, it transfers the entire labor force and the entire physical infrastructure to work under AGSAL commands. (*AGSAL Association Contract*, Clause 15, Section 1) In correspondence, INTERAGBAR affirms to be legally able to operate in Mexico since July 2001. Additionally, INTERAGBAR states to have all rights and authority to sign the Association Contract and to possess all necessary knowledge and expertise to comply with the Technical Contract specifications. (*AGSAL Association Contract*, Clause 15, Section 2)

A detailed paragraph at the end of all statements and guarantees, given by each party includes the acknowledgment on both sides of the conditions under which the contract has been written and their mutual commitment to observe all contractual terms.

Among the incentives, granted to each party by the contract are for SIMAS the use and enjoyment of the ownership of all physical infrastructure, technical information and designs that will be developed during contract's execution. (*AGSAL Technical Assistance Contract*, Clause 1) Also, SIMAS has the exclusive right to appoint the Municipal President as President of the Board of Directors (*AGSAL Constituent Act 2001*, Chapter 4, Article 21-25). In the case of INTERAGBAR, it is compensated with a variable bonus in the payment formula according to certain performance yardsticks. (*AGSAL Technical Assistance Contract*, Clause 6) In addition, INTERAGBAR has the right to propose the General Manager and all other officials in charge of AGSAL management. (*AGSAL Constituent Act 2001*, Chapter 4, Article 21-25) Finally, for INTERAGBAR the possibility to extend the contract up to 99 years of duration exists. (*AGSAL Association Contract*, Clause 2, Section 2)

The sanctions that the contract establishes for those cases of contract non-observance depends on whether and which one of the parties declares itself bankrupt or fails to contribute to share capital; those shares have to be sold to the other party. If, INTERAGBAR is the failed party, SIMAS can opt to buy the shares at 75% of their book value. If, the opposite happens SIMAS has to pay to INTERAGBAR each of its stocks, according to their value in books plus a 0.25% premium rate per share. (*AGSAL Technical Association Contract*, Clause 11 and 12)

In conclusion, it can be said that a bilateral commitment has emerged between SIMAS and INTERAGBAR which protects their interests from each other; this results from

incurred investments on both sides in order to constitute AGSAL and from strong safeguards in the form of incentives and costly sanctions which induce parties to continue with the relation.

#### **5.4 The Remuneration and Risk Sharing Modes**

Because both SIMAS and INTERAGBAR have invested resources into AGSAL, as a result a collective remuneration scheme has been adopted. Thus, net profits are divided among SIMAS and INTERAGBAR according to the equity percentage, each of them owns; while losses, if given the case, will similarly be distributed proportionally to shares. (*AGSAL Constituent Act 2001*, Chapter 8, Article 50-51)

The sharing rule stated for the Technical Assistance given by INTERAGBAR differs from the one established in the Association Contract. In this case, INTERAGBAR payment scheme combines a flat rate of 2.75 % out of the monthly revenue plus a variable component of 0.25% out of the last year's gross annual income. However this premium applies only if four efficiency indicators are met. These indicators and the weighing percentage attached to each of them, including the goals for each of the first five years of the contract, are as follows:

- a) *Coverage rate* with a weight of 10%. Here efficiency is measured by the percentage of urban houses that have access to domestic taps. At the end of the first year, 97% of all houses are expected rely on the service with an increment of one percent for the next five years.
- b) *Commercial Efficiency* with a weight of 25 %. It demands, the recovery of at least 75 out of every 100 bills on the first year. By the end of the fifth operations year, 93 % of all bills should be collected.
- c) *Physical efficiency*, with a weight of 35%. It asks for at least 45 out of 100 liters of delivered water to be billed (45%) at the end of the first year. By the end of the fifth year this percentage should add up to 75%
- d) *Water services availability* with a weight of 30 %. This indicator is calculated through the total number of hours in a day that a house has water supply. Thus during the first year, 6 hours a day are demanded until reaching 20 hours by the end of the fifth year. (*AGSAL Technical Assistance Contract*, Clause 6, Section1)

The extent, to which INTERAGBAR has fulfilled each one of these criteria, is highly variable among indicators. For example according to AGSAL Memories, in 2004 only

67.5% of all users have daily water services as against the 97% set in the contract. Besides, a daily water service doesn't mean that people have water 24 hours a day, but what it means is for people having this service for between 1 and 24 hours each day. For the physical efficiency, which compares the volume of water delivered to the volume actually consumed, was 57% for 2004 against a benchmark 66% established in the contract. In comparison, by 2004 the commercial efficiency indicator was a high of 96.3%. (AGSAL's Annual Report, 2004:9-14)

### **5.5 The duration of the contract**

Since the contract duties of INTERAGBAR and SIMAS to AGSAL demand large investments in Saltillo, the duration of the partnership is expected to be long enough for them to recover their investments. Consequently, the Association Contract has initially been signed for 25 years. Besides, the contract allows the alternative to prolong the partnership for up to 99 years. (AGSAL Association Contract, Clause 2, Section 2). As for the Technical Assistance Contract, it also has a duration of 25 years; however specifically for this contract, no clause can be found pointing to a possible extension. According to AGBAR Mexican Representative,

(The) contract duration, was decided on two main arguments: first, after an evaluation of physical and human infrastructure, how long would it take for Saltillo to catch up with environmentally friendly technologies and practice to manage natural resources. Especially, to guarantee water availability for the next generations; second, from AGBAR's point of view the period is long enough to meet the payback period of our investments. (A. Usobiaga, pers. comm., 31 Aug.)

### **5.6 AGSAL, a hybrid contractual arrangement**

Now that the contractual elements characterizing AGSAL has been described, we can conclude that AGSAL is a hybrid governance structure. Because,

- a) Assets' residual rights are allocated between INTERAGBAR and SIMAS.
- b) Resulting from this mixed ownership a decentralized authority represented by the Shareholders' Board has arisen. This authority has set as AGSAL precise objective to provide water and sanitation services to Saltillo inhabitants. In addition,
- c) The contract provides two mechanisms: the Shareholders' and Directors' Boards, which enable SIMAS and INTERAGBAR to negotiate and modify contractual clauses as needed. Thus, the organizational and operational coordination modes can be reorganized by parties during contract execution.
- d) The Board of Directors, an internal body, is in charge to perform the supervisor and arbitrator roles.

- e) Since AGSAL was constituted thanks to capital contributions of SIMAS and INTERAGBAR; a bilateral commitment exists to adapt investments in water provision according to Saltillo priorities, so the relation between parties continues.
- f) SIMAS and INTERAGBAR divide profits or losses resulting from annual operations proportionally. A collective payment regime has been selected to share revenue.
- g) Finally, with a contract signed for 25 years and possibilities to extend it up to 99 years, a long-term contract is in place.



## CHAPTER 6

### CONCLUSIONS AND RECOMMENDATIONS

This chapter draws together the main conclusions that were made in the case of Saltillo; it also addresses the principal challenges that were encountered which should be considered when reading the paper or when carrying out future studies. Finally, the possible policy implications of this study are presented.

#### **6.1 Main conclusions and findings**

The main hypothesis derived from the theoretical framework was validated during the course of the research through the evidence analyzed. Thus, the contractual violations that have arisen in the case of AGSAL are caused by a governance structure which proved inadequate when taking into consideration the investment specificity, uncertainty and complexity; and frequency and duration attributes which are involved in water provision to Saltillo.

In fact, the analysis of the transaction characteristics points out to unified governance, or in other words a public owned water agency to be the optimal mode for water provision. The main reasons for this conclusion are three-fold:

*First*, when analyzing data characterizing water provision in Saltillo, important sources causing high specificity on the investments required are found. The most important sources are: ground water origin which accounts for 98.7% of all water's supply, thus demanding the installation of an expensive pumping system to extract water. The second source of high specificity is the irregular surface of the city, with a 500m ground elevation differential between the south side, where all supply sources are located and north, where most of the population lives; which imposes large investments on a complex distribution infrastructure needed to keep the flow across the city and to reach Saltillo highest points.

The *second* reason suggesting a *hierarchy* structure is the high uncertainty, which surrounds water provision, thus making difficult for authorities to plan accordingly and guarantee the service provision. Saltillo poses a very erratic weather behavior, that makes unpredictable the incidence of rainfall, and causes long drought periods. Thus, reducing water sources ability to replenish, hence increasing complexity of the actions needed to produce water and to know the real availability of the ground- wells. Besides

a growing water demand for human consumption and industrial uses, impacts on the already over-exploited water sources, hence increasing uncertainty on water system ability to meet such demands and making more difficult for authorities to include the population and economic growth criteria, when planning or deciding on future investments.

The *third* reason refers to the high frequency and duration that, although in a more subtle way, characterizes potable water services. Since, 85% of the total numbers of households in Saltillo are connected to water network, what's more 6 out of 10 houses or businesses receive water on daily basis, while the remaining 4 get water between 7 and 2 days a week; thus implying a recurrent performance of all set of activities related to water production, distribution and disposal. Additionally, contracts for water and sewage services, between users and service provider- are signed to last for indefinite periods, since no other real alternatives for water provision exist in Saltillo.

The misalignment between transaction properties and an optimal governance structure is further confirmed, when analyzing the *de jure* version of the Association and Technical Assistance Contracts between INTERAGBAR and Saltillo, points out to a hybrid governance, which corresponds to a partial divestiture, which has been put in place for providing water. Moreover the enforcement mechanisms, which are essential for guaranteeing the fulfillment of parties' contractual promises, have had unsatisfactory results, as predicted by TCA, and have fallen short in their implementation, according to interviewees, thus increasing the consequences of the resulting *ex post* transaction costs.

The sanctions resulting from contractual violations and modifications to contractual terms, once the audit took place, revealed a form of post-contractual opportunism, *ex post renegotiation*, which arises from an inefficient allocation of the residual control rights over an asset.

In sum, a public owned utility is the optimal mode for providing water to Saltillo inhabitants as it will greatly reduce all needs for implementing monitoring and enforcement mechanisms to protect investments and to oblige parties to behave so to maximize to benefits provided by the service. This unified form will also minimize possibilities of *ex post* transaction costs, which may have further and costly consequences for the parties.

## **6.2 Scope and limitations of the research**

Regarding the limitations that constrain this study, two main restrictions merit mention. The first refers to the time and spatial factors under which it was carried out, especially the fact that the field research period coincided with electoral campaigns and elections at local and state levels. Thus, many of the interviewees, especially from local government, were unwilling to give information regarding AGSAL's contract violations and problems that have arisen, as well as some background information on the semi-privatization of SIMAS, because it could rebound against their own interest, since some were running for new positions. However, for those cases in which information was considered inadequate, interviews were scheduled with officials from lower levels who also are concerned with the formation and management of AGSAL.

The second constraint relates to the limitations of the Transaction Cost Approach that has focused much of its theoretical argumentation on the analysis of the make-versus-buy decision of private firms, thus overlooking important factors that are unavoidably present in the public-private partnerships. These include the political influences that arise when selecting a specific mode of contractual arrangement and a contractual partner and which, as indicated for some of the interviewed actors, played an important role for Saltillo.

Notwithstanding the importance of these two limitations, the conclusions stated above strongly hold to explain the contractual problems that have resulted in the case of AGSAL, since, as this research has shown, the economics of contracting literature based on transaction costs provides a useful framework for a good economic explanation for such inefficiencies. Characteristics of transaction at stake do impose at least part of the logic on the choice for a contractual arrangement.

## **6.3 Final considerations**

One of the main contributions from this study is the fact that the Transaction Cost Approach, have resulted in a very helpful theoretical framework for explaining the causes behind contractual inefficiencies. Furthermore, TCA becomes a practical tool which can be used by development practitioners when designing contractual arrangements or deciding among the alternative modes for providing a service, because of the adaptability of its main propositions and arguments to a range of situations.

Recognizing the limitations attached to all theoretical models by which this research is constrained, further research is required into developing theoretical foundations in explaining the determinants for an optimal contract design, such as the political factor which is unavoidably present in all privatization decisions, whether of a state owned enterprise or a public utility, but which fell outside the scope of this study.

Finally, this research has been successful in filling a gap for local studies referring to private participation in service provision, and in constituting a starting point which may help others into developing further lines of investigation and for local authorities to better support their decisions when planning on city development and the provision of services.





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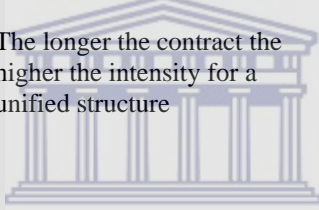


**Table 1. Hypothesis, Indicators and Measurements (Complete Version)**

Independent variable	Indicators	How it influences on transaction properties	Measurements
<p>Transaction characteristics:</p> <p><b><u>Investments Specificity</u></b></p> <p>If water service provision implies highly specific investments, then a more market governance structure would be non-optimal, leading to contractual problems expost.</p>	<p>AS1 Service area location</p>	<p>Geographical location of an area determines water availability; thus less water supply demands higher investments , then a more market-based structure is considered non-optimal</p>	<ul style="list-style-type: none"> <li>▪ Service area location</li> <li>▪ Climate type predominance</li> <li>▪ Rain/ Draught patterns</li> <li>▪ Presence of surface water bodies</li> <li>▪ Infiltration rate</li> <li>▪ Topographical characteristics of service location</li> <li>▪ Ground elevation in m. across service location</li> <li>▪ Service location growth pattern</li> </ul>
	<p>AS2 Origin of water</p>	<p>Since ground water sources imply higher investments levels than surface water sources, then a more market-based structure is considered non-optimal</p> 	<ul style="list-style-type: none"> <li>▪ Predominance of ground sources vs. surface sources</li> <li>▪ No. sources for each type</li> <li>▪ No. sources available vs. functioning</li> <li>▪ Perceived impact on investment requirements due to resources type</li> <li>▪ Depth in m. for ground water or storage capacity for surface.</li> <li>▪ Production capacity of Bulk water vs. volume extracted</li> <li>▪ Location of sources in km from distribution points and consumers location</li> <li>▪ Production equipment characteristics: pumping vs. canalizing pipes</li> <li>▪ Rate of water conduit/pressure/elevation: Stats and perceived impact on additional investment requirements</li> <li>▪ Replenishment rates vs. extraction rate:</li> </ul>
	<p>AS3 Quality properties of raw water quality</p>	<p>Origin determines quality of raw water which has an impact on purifying treatment costs. Since, low quality raw water requires higher investments level for purifying treatment, then a more market-based structure is non-optimal</p>	<ul style="list-style-type: none"> <li>▪ Predominance of raw water origin</li> <li>▪ Naturally determined quality for raw water</li> <li>▪ Type of purifying methods</li> <li>▪ Perceived impact on investment requirements due to purifying methods</li> </ul>
	<p>AS4 Physical conditions and extension on distribution networks</p>	<p>Poor physical condition and extension of distribution networks implies higher investments levels in their maintenance, replacement and/or rehabilitation, then a more market-based structure is non-optimal</p>	<ul style="list-style-type: none"> <li>▪ Length of networks in km</li> <li>▪ Age and usable life-span of networks</li> <li>▪ Building material and quality of networks</li> <li>▪ Perceived physical conditions of networks</li> <li>▪ Presence of leakages, poor maintenance condition, etc.</li> <li>▪ Perceived impact on investment requirements due to purifying methods</li> </ul>



Independent variable	Indicators	How it influences on transaction properties	Measurements
<p>Transaction characteristics:</p> <p><b><u>Uncertainty and complexity</u></b></p> <p>If, water service provision implies high uncertainty/ complex environment, then a more market governance structure would be non-optimal, leading to contractual problems expost.</p>	<p><i>UC 1</i> Type of water supply sources</p>	<p>Predominance of ground water as source, increases difficulty to calculate real water availability, consequently increasing uncertainty and complexity in planning of all stages of water provision. Thus, a more market-based structure is non-optimal</p>	<ul style="list-style-type: none"> <li>▪ Predominance of ground sources vs. surface sources</li> <li>▪ Availability of hydrologic studies and information on the aquifers conditions for the service area</li> <li>▪ Perceived level of uncertainty when planning on future activities for water provision</li> <li>▪ Crisis situations/ consequences attributed (perceived) to lack of adequate information</li> </ul>
<p>Transaction characteristics:</p> <p><b><u>Uncertainty and complexity</u></b></p> <p>If, water service provision implies high uncertainty/ complex environment, then a more market governance structure would be non-optimal, leading to contractual problems expost.</p>	<p><i>UC 2</i> Climate Variability</p>	<p>Climate variability which includes factors such as rainfalls/ draughts, climate type; among other factors affects replenishment capacity of water sources, thus increasing uncertainty about water availability and increasing complexity for all stages on water provision. Thus, a more-market-based structure is non-optimal</p>	<ul style="list-style-type: none"> <li>▪ Climate type predominance</li> <li>▪ Rainfall average rate/draughts incidence</li> <li>▪ Vaporization rate</li> <li>▪ Availability of physical storage infrastructure</li> <li>▪ Perceived level of uncertainty in planning and its effects on water provision</li> </ul>
<p>Transaction characteristics:</p> <p><b><u>Uncertainty and complexity</u></b></p> <p>If, water service provision implies high uncertainty/ complex environment, then a more market governance structure would be non-optimal, leading to contractual problems expost.</p>	<p><i>UC 3</i> Growth in water demand for human consumption and other uses</p>	<p>Ability to meet future/ growing water demands is limited by water availability, thus increasing uncertainty about capacity to satisfy such demands and complexity in the solutions to look for alternatives water supply sources Thus, a more market-based structure is non-optimal</p>	<ul style="list-style-type: none"> <li>▪ Population and economic growth for service area</li> <li>▪ Statistics describing changes in water demand for diverse uses</li> <li>▪ Production vs. extraction capacity of sources</li> <li>▪ Availability of studies on new supply sources and description of them, if available</li> </ul>
	<p><i>FDI</i> Total population and water coverage rate</p>	<p>The size of population to which water services are provided increases the frequency / duration with which activities associated with water production, distribution, and wastewater disposal are carried out. Thus, a more market-based structure for water provision is non-optimal</p>	<ul style="list-style-type: none"> <li>▪ Total population of service area</li> <li>▪ Total number of connected users in service area</li> <li>▪ Average inhabitants per household in service area</li> <li>▪ Estimated vs. actual coverage rate in service area</li> </ul>

<p>Transaction characteristics:</p> <p><b><u>Uncertainty and complexity</u></b></p> <p>If, water service provision implies high uncertainty/complex environment, then a more market governance structure would be non-optimal, leading to contractual problems exposed.</p>	<p><i>FD2</i> Water service availability at service area</p>	<p>The total number of hours / days water services are available determines the frequency/duration with which activities associated with water production, distribution, and wastewater disposal are carried out. Thus, a more market-based structure for water provision is non-optimal</p>	<ul style="list-style-type: none"> <li>▪ Total extraction volume</li> <li>▪ Average water consumption per inhabitant at service area</li> <li>▪ Availability of water according to total number of hours and percentage of users it covers</li> <li>▪ Availability of water according to total number of days and percentage of users it covers</li> </ul>
	<p><i>FD3</i> Water production and distribution activities' incidence</p>	<p>The higher numbers of users and coverage rate, the more number of times which activities associated with water production, distribution, and wastewater disposal have to be carried out. Thus, increasing impact on the frequency/ duration of water provision.</p>	<ul style="list-style-type: none"> <li>▪ Working schedule for personnel</li> <li>▪ Operating schedule for machinery and equipment</li> <li>▪ Execution of maintenance, rehabilitation and replacement duties on of physical infrastructure including machinery.</li> <li>▪ Number of times metering, billing, and collecting related tasks are performed</li> <li>▪ Metering efficiency indicator</li> <li>▪ Billing efficiency indicator</li> <li>▪ Collecting efficiency indicator</li> <li>▪ Sewerage service coverage rate</li> </ul>
	<p><i>FD4</i> Contract service duration between provider and user</p>	<p>The longer the contract the higher the intensity for a unified structure</p> 	<ul style="list-style-type: none"> <li>▪ Duration of contract service between user and provider</li> <li>▪ Real or possible existence of competitors (alternative to get water from other providers)</li> </ul>

Variable	Contract element/ Indicators	Possible Contractual Feature	Measurements
Intermediary variable			
G O V E R N A N C E  S T R U C T U R E  I N P L A C E	Authority (GR) as having ownership of residual control rights over assets	Public, Mixed- public and private, Private	Shares distribution
	Strategic coordination (GA) as mechanisms to define parties duties and rights/ contract's objective	Fixed and clearly defined, Flexible and vaguely defined.	Presence –or not- of contractual clause precisely setting company's objective, delimiting served area/ beneficiaries/ and delimitation of served area Right to determine tariffs
	Organizational coordination (GB) as (re) negotiation mechanisms	Fixed and stable, Flexible	Presence -or not- of contractual clauses specifying such mechanisms and their description
	Operational coordination (GC) as procedures to define services/goods to be delivered in quantity, time and spatial terms	Flexible, Fixed.	Operation and performance goals, such as quality, quantity, efficiency, effectiveness of service delivery. Existence of schedules and activities plan
	Enforcement Mechanisms:  Supervision and conflict-settlement mechanisms (GE)	Self enforced contract, External and non specialized, Internal and specialized, External and specialized.	Contractual clauses specifying supervisor and arbitrator roles
	Incentives and Sanctions scheme (GD)	Absence of incentives, Unilateral hostage, Bilateral hostage.	Contractual clauses specifying origin of investments. Clauses specifying sanctions applied in case of parties failing to meet contract terms. Clauses specifying incentives such as exclusive rights granted to parties, premium bonuses for performance, etc.
	Remuneration and risk sharing scheme (GF)	Customized basis, set <i>ex ante</i> Collective basis, set <i>ex ante</i> Flat rate basis, set <i>ex ante</i> Intensity used basis, set <i>ex post</i>	Contractual clause specifying payments due conditions
	Contract Duration	Spot contract Short term contract Long term contract	Contractual clause specifying period for which contract has been signed

Dependant variable	Indicators	Measurements
<b>Contractual violations</b>  Contractual inefficiencies which arose are the result of a governance structure which does not fit the transaction characteristics'	CV1 - Contractual violations	Description of the contractual violations
	CV2- Modification to contractual terms or sanction applied	Sanctions derived from violations: monetary or non monetary  Contractual terms' modifications



**Table 3 Conclusions on Theoretically Based Hypothesis**

Independent variable	Indicators	How it influences transaction properties'	Actual features in Saltillo water service provision
<p>Transaction characteristics:</p> <p><b><u>Investments Specificity</u></b></p> <p>If water service provision implies highly specific investments, then a more market governance structure would be non-optimal, leading to contractual problems expost.</p>	<p>AS1 Service area location</p>	<p>Geographical location of an area determines water availability; thus less water supply demands higher investments , then a more market-based structure is considered non-optimal</p>	<p><b><u>High Investment Specificity</u></b> because: Saltillo is located in a valley, flanked in its four sides by mountains. It has a semi-desert climate, thus having few heavy storms throughout the year. There is a vertical difference of 500m. from water sources to the consumer location; so making water distribution difficult</p>
	<p>AS2 Origin of water</p>	<p>Since ground water sources imply higher investments levels than surface water sources, then a more market-based structure is considered non-optimal</p>	<p><b><u>High Investment Specificity</u></b> because: 98% of water sources are underground, which require an expensive pumping system to lift the water. On average wells depth is of 500m. Annually 53.2 mcm are extracted vs. a 28 to 39 mcm of annual recharge capacity. Water sources' distance to distribution points vary from 0 to 50 km. Hence requires long extension of pipes. 145,753 m<sup>3</sup> of water are daily carried out to supply Saltillo demand, due to pressure variation across the city large investments are required in hydraulic infrastructure to keep water flowing</p>
	<p>AS3 Quality properties of raw water quality</p>	<p>Origin determines quality of raw water which has an impact on purifying treatment costs. Since, low quality raw water requires higher investments level for purifying treatment, then a more market – based structure is non-optimal</p>	<p>Saltillo raw water is of a good quality but for health and sanitary requirements disinfection is needed. Purification methods consist of adding chlorine. This stage for water provision represents but a small percentage of the total investments.</p>
	<p>AS4 Physical conditions and extension on distribution networks</p>	<p>Poor physical condition and extension of distribution networks implies higher investments levels in their maintenance, replacement and/ or rehabilitation, then a more market –based structure is non-optimal</p>	<p><b><u>High Investment Specificity</u></b> because Primary and secondary distribution network cover long distances (103 and 1740km long). The age of pipes in the primary network varies between 12 and 30 years and for secondary pipelines from 20 to 100 years. Poor maintenance has caused obstruction and leakages of the network. Thus, large amounts are necessary to invest in distribution network rehabilitation, replacement, extension and maintenance</p>

Independent variable	Indicators	How it influences transaction properties'	Actual features in Saltillo water service provision
<p>Transaction characteristics</p> <p><b><u>Uncertainty and complexity</u></b></p> <p>If, water service provision implies high uncertainty/ complex environment, then a more market governance structure would be non- optimal, leading to contractual problems expost.</p>	<p><i>UC 1</i> Type of water supply sources</p>	<p>Predominance of ground water as sources, increases difficulty to calculate real water availability, consequently increasing uncertainty and complexity in planning for all stages of water provision. Thus, a more market-based governance structure is non-optimal</p>	<p><b><u>High uncertainty and complexity</u></b> exist because 98%of available supply sources are underground; so it is difficult for authorities who don't know the actual amount of water available, to plan for actions such as expansion of the services or to grant licenses for settling new industries. The high costs of exploratory studies for new sources resulted in few of them being carried out which led to overexploitation and drying up underground wells.</p>
	<p><i>UC 2</i> Climate Variability</p>	<p>Climate variability which includes factors such as rainfalls/ draughts, climate type; among other factors affects replenishment capacity of water sources, thus increasing uncertainty about water availability and increasing complexity for all stages on water provision. Thus, a more market-based governance structure is non-optimal</p>	<p><b><u>High uncertainty and complexity</u></b> exist because Saltillo has highly erratic weather behavior which increases uncertainty for predictions about precipitation phenomena; thus it makes difficult for water managers to rely on such predictions, and plan in consequence.</p>
	<p><i>UC 3</i> Growth in water demand for human consumption and other uses</p>	<p>Ability to meet future/ growing water demands is limited by water availability, thus increasing uncertainty about capacity to satisfy such demands, and complexity in the solutions to look for alternatives water supply sources Thus, a more market-based governance structure is non-optimal</p>	<p><b><u>High uncertainty and complexity</u></b> exists because Saltillo's population has grown at 3.5% on average the last 5 years and its consumption has increased 1.3 times, while water demand for industrial uses has doubled in the same period. Because of the mismanagement of water, it has been difficult for authorities to meet such increasing demands. Moreover studies show that possible new sources are very far from the city.</p>
<p>Transaction characteristics</p> <p><b><u>Uncertainty and complexity</u></b></p> <p>If, water service provision implies high uncertainty/ complex environment, then a more market governance structure would be non- optimal, leading to contractual problems expost.</p>	<p><i>FD1</i> Total population and water coverage rate</p>	<p>The size of population to which water services are provided increases the frequency / duration with which activities associated with water production, distribution, and wastewater disposal are carried out. Thus, a more market-based governance structure for water provision is non-optimal</p>	<p><b><u>High frequency and duration exists because</u></b> Coverage rate was for Saltillo in 2001 near of 86% for all regular human settlements, reaching more than 122,000 households. Service frequency was daily available for near of a 5 out of 10 of these households, and water ran on average 10 hours a day</p>
	<p><i>FD2</i> Water service availability at service area</p>	<p>The total number of hours / days water services are available determines the frequency/duration with which with which activities associated with water production, distribution, and wastewater disposal are carried out. Thus, a more market based governance structure for water provision is non-optimal</p>	<p>In order to keep the coverage rate and service availability indicators at such levels is necessary a high frequency in the functioning of the machinery and working of personnel to carry out all tasks related to water provision across its different stages from production to bills collection.</p>

<p>Transaction characteristic s:</p> <p><b><u>Uncertainty and complexity</u></b></p> <p>If, water service provision implies high uncertainty/ complex environment, then a more market governance structure would be non- optimal.</p>	<p><i>FD3</i> Water production and distribution activities' incidence</p>	<p>The higher numbers of users and coverage rate, the more number of times which activities associated with water production, distribution, and wastewater disposal have to be carried out. Thus, increasing impact on the frequency/ duration of water provision.</p>	<p>Moreover for Saltillo, sewerage service cover 98% of all population, which implies the daily disposal of residual water into local streams since only of 10% of all waste water, is recycled. Additionally, the absence of small-scale water providers guarantees contracts of a long duration since consumers don't have other options to get the service.</p>
	<p><i>FD4</i> Contract service duration between provider and user</p>	<p>The longer the contract the higher the intensity for a unified structure</p>	



Variable	Contract element/ Indicators	Feature		Actual contractual features in the case of Saltillo
<b>Intermediary variable</b>				
<b>G O V E R N A C E  S T R U C T U R E  I N  P L A C E</b>	Authority (GR) as having ownership of residual control rights over assets	Public, Mixed- public and private, Private	Shares distribution	<b>Mixed</b> 51% Saltillo Municipality / 49% INTERAGBAR
	Strategic coordination (GA) as mechanisms to define parties' duties and rights/ contract's objective	Fixed and clearly defined, Flexible and vaguely defined.	Presence –or not- of contractual clause precisely setting company's objective, delimiting served area/ beneficiaries/ and delimitation of served area Right to determine tariffs	<b>Fixed</b> Precisely defined as: To provide water services for Saltillo inhabitants living within the urban area
	Organizational coordination (GB) as (re) negotiation mechanisms	Fixed and stable, Flexible.	Presence -or not- of contractual clauses specifying such mechanisms and their description	<b>Flexible</b> Possibilities for negotiation through Shareholders and Board of Directors Meetings; with a decision making process based on simple majority or unanimous voting results
	Operational coordination (GC) as procedures to define services/goods to be delivered in quantity, time and spatial terms	Flexible, Fixed.	Operation and performance goals, such as quality, quantity, efficiency, effectiveness of service delivery. Existence of schedules and activities plan	<b>Flexible</b> Services are set by a Technical Assistance Contract. Existence of 4 performance and efficiency indicators. Time and spatial planning contained for the long term in the Master Plan while for the short run in the Annual Operating Budget. Negotiable through Board of Directors Meetings'
	Enforcement Mechanisms:  Supervision and conflict–settlement mechanisms (GE)	Self enforced contract, External and non specialized. Internal and specialized, External and specialized	Contractual clauses specifying supervisor and arbitrator roles	<b>Internal and specialized</b> Monitoring and Arbitration roles performed by Board of Directors, Commissioners and AGSAL internal auditor  Possible participation of International Chamber of Commerce when disputes can't be solved by ordinary procedures



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<p>Enforcement Mechanisms:</p> <p>Incentives and Sanctions scheme (GD)</p>	<p>Absence of incentives,</p> <p>Unilateral hostage</p> <p>Bilateral hostage</p>	<p>Contractual clauses specifying origin of investments.</p> <p>Clauses specifying sanctions applied in case of parties failing to meet contract terms.</p> <p>Clauses specifying incentives such as exclusive rights granted to parties, premium bonuses for performance, etc.</p>	<p><b><u>Bilateral Hostage</u></b> SIMAS's contributions to AGSAL: physical and human infrastructure and rights to exploit water.</p> <p>INTERAGBAR's contributions to AGSAL: \$81,900 million pesos, expert knowledge and technology</p> <p><b><u>Incentives, for:</u></b> SIMAS, Ownership of all infrastructure and technical information developed during contract's life-span Right to select President of Board of Directors</p> <p>INTERAGBAR: Rights to exploit water for 25 years and up to 99 years. Bonus % as annual income if performance indicators are met. Right to propose AGSAL Management Personnel</p> <p><b><u>Sanctions</u></b> If SIMAS fails to meet contractual terms it pays a premium of .25% to INTERAGBAR for each share owned by the private investor.</p> <p>If INTERAGBAR fails, SIMAS buys all its shares at 75% of its total value in books</p>
<p>Remuneration and risk sharing scheme (GF)</p>	<p>Customized basis, set <i>ex ante</i></p> <p>Collective basis, set <i>ex ante</i></p> <p>Flat rate basis, set <i>ex ante</i></p> <p>Intensity used basis, set <i>ex post</i></p>	<p>Contractual clause specifying payments due conditions</p>	<p>Collective basis Benefits and losses are shared proportional to capital distribution.</p>
<p>Contract Duration</p>	<p>Spot contract</p> <p>Short term contract</p> <p>Long term contract</p>	<p>Contractual clause specifying period for which contract has been signed</p>	<p><b><u>Long</u></b> Signed for 25 years with possibilities of having it extended by a further 74 years</p>



Dependant Variable	Indicators	Contractual Violations/ Derived consequences as modifications to contract terms or sanctions
<p>Contractual inefficiencies which arose as result from governance structure which does not fit the transactions characteristics</p>	<p>CV1 Contractual Violations</p>	<p><b>Technical and Public works area:</b> \$2 million pesos were invested without having the consent of either the Local Government or the Board of Directors.</p> <p>A discrepancy of more than \$3,871,000 pesos was found between what was reported to Board of Directors as paid for the execution of works and the invoice presented for such works.</p> <p>\$11 million pesos were spent on vehicles without requesting public tenders for their supply as it is stated by Coahuila Acquisitions, Procurement and Contracting Law.</p> <p><b>Financial area,</b> There was late payment of amounts owing to SIMAS totaling more than \$18.5 million pesos, which were recovered by INTERAGBAR. This firm that received these amounts simply handled them as income. These amounts were never reported in the financial statements as an asset on SIMAS behalf. The salaries paid to Spanish expatriates were never consulted, neither approved by the Board of Directors;</p> <p>The increments of water tariffs were from 20 to 30% above of what is stipulated in the contract, which limits increments to the rate of inflation, about 6 %</p> <p><b>Legal area</b> More than four meetings of Board of Directors were held without having the required minimum quorum. There were no evidence of training and development courses in order to replace expatriates with Mexican personnel, from AGSAL's second year and onwards, as stated by contract Not enough convincing evidence that INTERAGBAR was in fact giving technical assistance to SIMAS; and that commercial efficiency and water services availability were working according to performance indicators set by the terms of the contract at that time.</p>
	<p>CV2 Modifications to contractual terms and sanctions applied</p>	<p><b><u>Contract had to be modified at least three times:</u></b></p> <ol style="list-style-type: none"> <li>1) To review and revise those clauses that were modified without the consent of Saltillo authorities;</li> <li>2) To include a new monitoring body together with the Board of Directors and Commissioners, which already were in place;</li> <li>3) To include an additional paragraph to clearly state the eventualities—climate or natural disaster related events—under which the Board of Directors can authorize tariff increments, which should always revert to its normal level, once the “state of emergency” has passed</li> </ol>

Dependant Variable	Indicators		Contractual Violations/ Derived consequences as modifications to contract terms or sanctions
<p>Contractual inefficiencies which arose as result from governance structure which does not fit the transactions characteristics</p>			<p style="text-align: center;"><b>Sanctions</b></p> <p>A public “attention call” was issued against the AGSAL General Manager, warning him no to commit the same mistakes again.</p> <p>INTERAGBAR must return the money from the overcharge tariff s, no later than December, 2006</p> <p>There is a society organized claim to break the contract</p>



## Questionnaires for Interviews

### Interviews with Local Authorities

#### **Explaining the Determinants of Contractual Inefficiencies: The Case of Water Provision in Saltillo, Mexico**

**Name** \_\_\_\_\_

**Position** \_\_\_\_\_

**Relation with AGSAL** \_\_\_\_\_

#### Intermediary Variable

##### **Enforcement Schemes (Supervision and Conflict- Settlement Mechanisms)(GE)**

1. Who are the representatives for the government on the Board of Directors in AGSAL?
2. Which are their main responsibilities?
3. In which way they differ from the private side ones?
4. Which other parties from the society seat at the Board?
5. When and how does the General Manager should inform the authorities from the results the company is getting?
6. On the regular activities perform by AGSAL, how do you monitor their activities?

##### **Operational Coordination Mode (GC)**

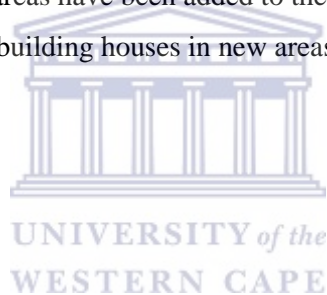
7. Have been set targets to measure how good/bad they perform?
8. How were they set?
9. Do they regularly meet the government expectations?
10. In case they/you don't, which mechanisms are set to solve/ penalize this situation?
11. And when they exceed the targets, how are they/you rewarded?
12. Are there external companies monitoring or supervising the work done by the company?
13. When important decisions (increment on tariffs, new investments, cut of the service), have to be made, how do you normally reach an agreement?
14. Can you tell us of one experience/ important one/ difficult one?
15. In case an agreement or a decision seems at a dead point, who decide? What do you do?
16. Which are the roles of CEAS/ CNA/ AUAS/ state congress?

17. Do you think the different mechanisms' effectiveness to solve conflicts, are with regard to their effectiveness: Low \_\_ Fair\_\_ High\_\_\_\_ Too High\_\_\_\_, Why?
18. Are there any polemics/ complicated topics that difficult taking decision? What does the company does in such cases?
19. During this past years that AGSAL has been functioning, have been there any moment where the Administration (you) has felt hinder in performing its actions?
20. Can you tell us more about such times?
21. Among the contract clauses, is there some that specifies what to do if one of contracting parties, wishes to finish the contract before due date?
22. Under which conditions does this can happen?

### **Independent Variable**

#### **Economic and population growth in Saltillo and future trends (UC2, UC3)**

23. How have been the economic activities of Saltillo in the last years? (General)
24. Which have been the most important investments (money, jobs, immigration?)
25. Have new investments been identified? Which?
26. How many new housing areas have been added to the city in the last 5?
27. Are any new projects for building houses in new areas (with no water services?)
28. Where?



**Explaining the Determinants of Contractual Inefficiencies: The Case of Water Provision in Saltillo, Mexico**

Name \_\_\_\_\_

Position \_\_\_\_\_

Relation with AGSAL \_\_\_\_\_

**Dependent Variable**

**Strategic coordination (GR) and Organizational Coordination (GB)**

1. Which are your main responsibilities as General Manager of AGSAL?
2. Are your responsibilities clearly specified in the contract?
3. How does the Administrative Board take decision, how are votes allocated?
4. Which other the mechanisms that have been put in place to establish relationships with government?
5. When the company needs to make a decision, how you have to consult with?

**Independent Variable**

**Asset Specificity (AS1, AS2, AS3, AS4, AS5)**

AS1) Service area location

1. What type of users are the most important for the revenues of the company?
2. Which areas does the market that you served comprehend?
3. Are there any possibilities for the company to expand its market (in terms of service)?
4. How many users are there in the user census?

**AS1, AS2, AS3, AS4) On Investments**

1. What types of investments are required in the provision of water?
2. Which are the most significant from the economic point of view?
3. From the one mentioned above, which are the ones that imply the highest risks? Why?
4. Will you say the risk, is : Low \_\_\_\_\_ Fair \_\_\_\_\_ High \_\_\_\_\_ Too high \_\_\_\_\_
5. From the ones that you mentioned above, which are those that imply bigger fixed costs?
6. Does recovering those investments, implies?
7. Short run (1-5 yrs) \_\_\_\_\_ Medium run (6-15 yrs) \_\_\_\_\_ Long run (15 or more) \_\_\_\_\_
8. Which are the types of investments, which actually AGSAL has undertaken?
9. Do the different works that need to be done (additional investments) are outsource?
10. How often do you need to contract out? Very often \_\_\_\_\_ Often \_\_\_\_\_ Sporadically \_\_\_\_\_ Almost never \_\_\_\_\_

### **AS2, AS3) Origin of water and Quality properties of raw water**

1. From the 2 types of water supply sources available, which are the predominant in Saltillo?
2. Which is the depth of these underground sources/ storage capacity for surface sources?
3. Are these wells considered surface or underground?
4. Are they enough to satisfy the demand of Saltillo? Y/N Why?
5. Does this depth imply additional (larger) investments, if yes; Do you consider this investments are Low \_\_\_ Fair\_\_\_ High\_\_\_ Too High\_\_\_, Why?
6. Where are these wells located regarding to consumer location?
7. Do these distances; imply additional (larger) investments on transporting water to the users (houses, industry, commerce) for the company? Do you consider these investments are: Low \_\_\_ Fair\_\_\_ High\_\_\_ Too High\_\_\_, Why?
8. Are the conditions in Saltillo geography/ topography that require additional investments when producing water/ distributing water?
9. Is the existing supply (availability of water), able to satisfy the demand of water for the future periods? How long? Why?
10. Does the company have plans to explore alternative sources to extract water? Y/N, if affirmative, which ones? What does the study show? If negative Why? \_\_\_
11. How many liters are extracted a day/ year from sources?

### **AS4) Physical conditions and extension on distribution networks**

12. What were the conditions of the city network, when you take charge of water provision? Bad\_\_\_\_\_ Not to good\_\_\_\_\_ Good\_\_\_\_\_ Excellent\_\_\_
13. Have additional investments been done in the network?
14. Are the maintenance costs of the existing network? Low \_\_\_ Fair\_\_\_ High\_\_\_ Too High\_\_\_
15. Are any conditions in Saltillo's underground that deteriorate the network quicker than normal?
16. Are the conditions in Saltillo geography/ topography that require additional investments when installing new pipes (extending the network)? If yes; Do you consider this investments are Low \_\_\_ Fair\_\_\_ High\_\_\_ Too High\_\_\_, Why?

### **AS2, AS3) Quality property of raw water and purifying treatment**

1. Which is the quality of raw water which exists in Saltillo?
2. What types of treatments are used to purify it?
3. Are the investments on purifying methods significant for the company?
4. Is there any point at which the water can result contaminated? If yes, what is done in such cases?
5. Has the numbers of water- cubic meters increase in the last four years? \_By how much?

### **Frequency and duration**

FD1, FD2, FD3)

1. Which is the service coverage rate for Saltillo? Which population does it includes?
2. Which is/ has been the availability of service in terms of days and hours?
3. In reference to the number of cubic meters of water that are daily consumed are all them metered?

4. Is all the metered consumption, billed?
5. How are carry out these tasks?
6. What is done in the case that some users refuse to pay?
7. Has the company invested in equipment to measured water consumption?
8. Has the company invested in modernizing the billing system?
9. Are there possibilities for competition on the water market?
10. How long a user service contract' can last?

### **Uncertainty**

#### UC1, UC2) On Climatological Conditions

1. Is the geographical location of Saltillo a factor which affects water provision? How?
2. How does Saltillo's climatological conditions of Saltillo, impact on water provision?
3. Given Saltillo climate type, Is it harder to supply water, than may be in other cities;?  
In which way?
4. Does it impact the on future expectative for city development?
5. If answer is affirmative, up to which extent?
6. Are the rainfall conditions of Saltillo, appropriate for the replenishment of wells? Why?  
Is the rate of extraction higher than rate of replenishment? If yes, what is done?

#### UC3) On Saltillo's Economic Development Present and Future

1. Does the present economic activity of Saltillo's impose extra burden water demand?
2. What has been done in the last years to meet city water demand?
3. Has the company made any research on the possible economic expansion of Saltillo?

