

GOVERNANCE OF THE DRINKING WATER SUPPLY SERVICE:

A case study of three Mexican communities

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Abstract

Governance theory emerged in the early 1990s. Since then, it has been seen as an approach to unveil the existing relationships in systems of management with two often-conflicting governing systems, namely formal and informal. Governance theory attempts to understand the implications of decisions made by formal and informal institutions in order to find suitable ways of management.

The theoretical problem this thesis responds to embraces water institutions governing and managing the DWSS. This thesis contributes to conceptualise drinking water governance as the rules, decision making and the plurality of actors interacting to provide the DWSS and recognising customary water institutions and authorities in the management, operation and maintenance of the DWSS at community level.

This research uses the concept of governance defined by Chhotray and Stoker (2009: 3) as ‘the rules that guide collective decision-making in settings where there are a plurality of actors or organisations’. This concept is systematically applied in an analytical framework taking into account three main components of governance namely rules, collective decision-making, and plurality of actors to analyse water governance with a focus on the drinking water supply service (DWSS) in three peri-urban communities in Mexico’s central highlands: San Mateo, San Francisco and Santiaguito.

The principal research question this thesis aims to answer is how do customarily-organised institutions address water governance to manage the DWSS at community level? Using qualitative methods and techniques this research explores the interactions between formal and informal institutions and actors when managing drinking water at community level. Informal institutions and actors are water committees, water vendors, and domestic water users. Formal institutions are decentralised water institution and well proprietors.

This research highlights the importance of legal plural institutions involvement in the governance and management of drinking water and its interaction at community level. This thesis contributes to better understanding of rules, decision making and the plurality of actors interacting within the governance and management of the DWSS. It highlights the importance of the legal plural institutions involved in the governance and management of water and the way in which they are legitimised either by formal or informal institutions. This thesis also contributes to recognising customary water institutions in the governance of water resources. I approach water governance and analyse society participation, water markets and customary and official institutions involved in the DWSS provision. Theoretical insights are also provided into the on-going dynamic of drinking water access by domestic water users and actors. Finally, the thesis is also rich in contributing with substantial empirical information collected through semi-structured interviews, deep interviews, focus groups, observation and informal talks with domestic water users and vendors.

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List of Acronyms

AyST	<i>Agua y Saneamiento de Toluca</i> (Water and Sanitation of Toluca)
CAEM	<i>Comisión de agua del Estado de México</i> (State of Mexico Water Commission)
CONAGUA	<i>Comisión Nacional del Agua</i> (National Water Commission)
GEM	<i>Gobierno del Estado de México</i> (State of Mexico Government)
IFISs	International Funding Institutions
IFOMEGEM	<i>Instituto de Fomento Minero y Estudios Geológicos del Estado de México</i> (Mining and Geological studies Institute of the State of Mexico)
IMTA	<i>Instituto Mexicano de Tecnología del Agua</i> (Mexican Institute of Water Technology)
INEGI	<i>Instituto Nacional de Estadística y Geografía</i> (National Institute of Statistics and Geography)
LAN	<i>Ley de Aguas Nacionales</i> (National Water Law)
PAN	<i>Partido Acción Nacional</i> (National Action Party)
PND	<i>Plan Nacional de Desarrollo</i> (National Development Plan)
PNH	Programa Nacional Hídrico <i>National Water Programme</i>
PRI	<i>Partido Revolucionario Institucional</i> (Revolutionary Institutional Party)
SARH	<i>Secretaría de Agricultura y Recursos Hidráulicos</i> (Ministry of Agriculture and Hydraulic Resources)
SEMARNAT	<i>Secretaría de Medio Ambiente y Recursos Naturales</i> (Ministry of Environment and Natural Resources)
UAEMex	<i>Universidad Autónoma del Estado de México</i> (Autonomous University of the State of Mexico)
UNAM	<i>Universidad Nacional Autónoma de México</i> (Autonomous National University of Mexico)

List of abbreviations

BP	British Pounds (£)
m.a.s.l.	Metres above sea level
NE	Northeast
NW	Northwest
PM	<i>Pesos Mexicanos</i> (\$) (Mexican pesos)

List of Spanish Terms

Ayuntamiento: Municipal city council.

Bombero: Man that operated the water pumping system. In some communities is also called *pocero*.

Cabildo: Local county council decision makers.

Faena: Labour corresponding to a working day.

Fiscal: Community member in charge of a traditional or religious festivity.

Pipa: Water tankers container.

Pipero: Driver of water tankers.

Pocero: Man responsible of managing the water well (*pozo*). He is responsible of the operation of the water pumping system from the well to the household.

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“...and I realised that I did not only have to study all this but I also had to live it - enjoy it-, made it mine; so, after that, at the moment of creating it could become something not only intellectual but also something full of life” (Amalia Hernández, 2012).

“...y me di cuenta, que tenía no solamente que estudiar todo eso, sino también vivirlo, hacerlo propio, para que después a la hora de crear resultara algo que no fuera fríamente intelectual, sino algo lleno de vida” (Amalia Hernández)

“The right to water is an indispensable element of human dignity” (Fauchon, L., 2006) (4th world water forum, Mexico).

“The infrastructure coverage of the water service does not necessarily mean drinking water is available or delivered” (Guardiola *et al.*, 2010).

“When the well is dry, we know the worth of water” (Ben Franklin, 1746)

“(…) todos los pueblos, cualquiera que sea su etapa de desarrollo y sus condiciones económicas y sociales, tienen derecho al agua potable en cantidad y calidad acordes con sus necesidades básicas” (Mar del Plata conference, 1977).

This thesis is dedicated to domestic water users from *San Francisco Tlalcilcalpan*, *San Mateo Oztacatipan*, and *Santiaguito Tlalcilcali* communities who shared their experiences when dealing with water shortages and the continuous challenges they face for obtaining drinking water for the daily life.

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CHAPTER 1

Introduction

CHAPTER 1. Introduction

1.1 Introduction

Governance theory emerged in the early 1990s as a new approach to understanding social and political changes. In natural resource management, governance theory helps to unveil existing relationships in systems of management with two, often-conflicting, governing systems, namely formal and informal. Through governance theory, this thesis attempts to understand the implications of formal and informal institutions' decisions in their search for suitable ways of management.

This research explores governance through the analysis of formal and informal institutions governing natural resources, with a specific focus on customary institutions' governance of the drinking water supply service (DWSS) in three peri-urban case study Mexican communities. In these cases, the informal institutions are community institutions organised by custom or convention to assume control over water governance and manage the distribution of the DWSS. Special focus is applied to the wide array of customary institutions and their roles in the DWSS in the communities. This research calls formal institutions those governed by State-based institutions. Formal institutions are involved in the DWSS at national, state and municipal level. In this thesis I distinguish State institutions as those governing at Federal level from state institutions, which are those institutions comprised at state of Mexico (county) level.

This study provides important insights into water governance and the ongoing dynamic of domestic water users' access to drinking water. Its theoretical contribution is its investigation of the administration of informal institutions that provide the DWSS to community households.

My analytical framework is based on three elements of the governance concept defined by Chhotray and Stoker (2009), which involves: rules, decision-making and the plurality of actors. This analytical framework is also complemented with community management approach, which takes into account the involvement of

community members and customary institutions in the control of water resources to provide the DWSS at community level.

Each of these three governance components is analysed in a separate chapter, with each chapter answering a specific research question about the governance and management of the DWSS at community level. The analysis carried out throughout the thesis aims to answer the main research question that guides this research: how do customarily-organised institutions address water governance to manage the drinking water supply service at community level? I further explain the research questions that guide every chapter in section 1.4 and chapter 3.

The analytical framework is designed and applied through the thesis to understand water governance of the DWSS in three peri-urban communities in Mexico's central highlands: *San Francisco Tlalcilcalpan*, *Santiaguito Tlalcilcali* and *San Mateo Oztacatipan*. Here after, these communities will be called San Francisco, Santiaguito and San Mateo respectively. Each concept obtained from governance definition shapes the analytical framework that will be theoretically and empirically analysed by chapters. For example, chapter two theorises the main concepts and each concept is empirically analysed in a different chapter. In this sense, chapter four characterise and analyse rules and legal pluralism. Chapter five characterise and analyse main actors involved in governance of the DWSS. There is a plurality of actors in all three communities who continuously interact to manage, operate and maintain the DWSS and its infrastructure. The main actors involved in water governance at community level include customary institutions, local private markets, official institutions and water users. Then, chapter six elaborate about decision making, and chapter seven analyse the main struggles faced by the actors as well as their capacity to adapt and bring solutions to drinking water-related problems.

The characteristics that make the chosen communities particularly interesting for the study of DWSS governance are as follows: first, while water is not naturally scarce, there is strong evidence of water insufficiency related to DWSS management problems; second, the communities obtain water from the region's aquifers, rather than from a surface source; third, the three communities are

classified as peri-urban areas and are similar in terms of population growth; fourth, all three have a customary water committee that is responsible for the governance and management of the DWSS for providing drinking water to community households; and finally, the communities own property rights of the wells from which they extract the underground water that feeds the DWSS. Nevertheless, each has its own particular way of managing the financial resources collected from users' payments for the DWSS. More about these characteristics are detailed in chapter three section 3.3.3.4, called: choice of research site. The selection of these three communities takes into account the need to fill a knowledge gap in studies related to community management of the DWSS and water governance at community level.

Peri-urban communities are located outside or near to large urban areas. The definition of 'peri-urban'¹ has not reached a strict consensus. Though, the concept is used when rural and urban characteristics coexist within and beyond city limits (Allen, 2003). Population growth in peri-urban areas and the changes in population size of its communities are mainly created by urban expansion and the reduction of rural space, also because of a decrease in agricultural activity and employment reduction in rural activities. The outcome of this process is the new 'peri-urban' space. There have been inadequate planning to deal with environmental and development processes in spaces characterised by the urban-rural dichotomy. Peri-urban areas do not always receive appropriate public services, even where a large number of inhabitants coexist there (Torres Lima 2006). In the communities studied, inadequate and insufficient provision of the DWSS are the main and persistent problems that affect domestic water users. This research investigates the DWSS at community level.

This research involves the extensive collection of primary and secondary data during the fieldwork stage. The empirical data include qualitative information about written law governing water resources in Mexico, with specific emphasis on the DWSS as provided by water institutions; the involvement of private actors in

¹ Other explanations of peri-urban regions describe them as 'new' emerging small towns and intermediate-size cities that are the result of either the deconcentration of a metropolis or migration from rural to more urban areas. The character of peri-urban growth is the creation of polycentric urban spaces and fragmented landscapes in which agricultural activities, industry, residences and a

the sells and distribution of drinking water; and domestic water users' efforts to deal with an insufficiency of drinking water. The thesis also analyses qualitative insights into the disjuncture between official and customary governance systems and domestic water users' difficulties in receiving the DWSS and/or paying for it. The conceptual and empirical insights gained and the methodological approach seeks to better understand the governance and management of the DWSS in customarily-organised communities, and how legal plural institutions interact within the drinking water supply system.

1.2 Governance and the drinking water supply service

Governance has been explored from different perspectives in the literature on legal anthropology, political sciences, economics, international relations, and development studies. However, governance concept has not reach a strict consensus to define it. Topics about the governance of natural resources, legal pluralism and who should manage the provision of the DWSS are also addressed in the governance literature. In some Mexican cities the DWSS is administered, organised, allocated, distributed and delivered by official water institutions, while in others, self-organised communities have adopted responsibility for providing this service. However, not only formal and informal water institutions but also private local actors, such as well proprietors and water vendors, also participate in the provision, management and sometimes administration of the DWSS. The interaction of this wide array of actors and individuals creates a complex scenario, which explains why governance serves to explain the outcome of institutions and actors performance in decision-making, operation, and management of provision of the DWSS, especially to communities and households. A better understanding of informal governance can serve to a better water management according to the sensitivity of community context.

The question of who should manage water resources is the subject of considerable academic discussion in the field of development studies. Some authors suggest that Federal government should be the one responsible for administering natural resources, including water, through its set of official institutions (Whittington *et al.* 2009). Other perspectives support the increasing participation of multiple actors

such as civil society, the private sector and individuals in the governance and management of natural resources, specifically water resources (Kyessi 2005; Mukherji and Shah 2005; Vásquez *et al.* 2009). Some scholars claim that social actors such as individuals and institutions at community level know what their communities need and are therefore best placed to manage their own natural resources, including provision of the DWSS (Bah 1992; Doe and Khan 2004; Ferguson and Derman 2005; Derman and Hellum 2007; Harvey and Reed 2007). The present research uses governance theory and legal pluralism approach to understand water governance; the research includes insights about institutions and issues of legal pluralism (Von Benda-Beckmann 1995; Von Benda-Beckmann *et al.* 1998; Zwarteveen *et al.* 2005).

One of the characteristics of water governance is the way in which decisions are made and legitimised, and who is responsible for doing this. This study sheds light upon the complex interactions between the different legal actors involved in the provision of the DWSS, particularly those that take place between formal and informal institutions. It offers understanding of how community institutions and individuals are involved in these interactions and how their participation is affected by water institutions' decisions and operation of the DWSS.

Community involvement in the governance and management of the DWSS has been observed through three main institutions: water committees, community members and local private water vendors. The water committee is the main customary institution responsible for governing and managing the DWSS at community level. Private water vendors may or may not have official permission to extract underground water and sell it for profit. Community members are the householders or domestic water users in a community; some of them are involved in the water management of their community. Besides community institutions, formal water institutions are also involved the management of the DWSS. In the communities studied there is financial involvement of formal water institutions.

Community management has mainly been studied in small communities rather than in medium-sized and large ones. Studies about community management are characterised by the presence of customary institutions within the provision of

water (Doe and Khan 2004; Nyarko 2004; Kyessi 2005; Harvey and Reed 2007; Nyarko *et al.* 2007). This study investigates medium-sized peri-urban communities in Mexico with a strong customary system for providing the DWSS. Issues about rules, decision-making, actors, and struggles of community institutions are empirically analysed in Chapters 4 to 7, each of which also answers a research question displayed in section 1.4.

1.3 Research aim

This research aims to analyse water governance and community management to understand the way in which communities are organised to govern and manage the complexity of the DWSS at community level. This research aims to understand the multiple actors involved in the water governance process and the legitimacy of actors to make decisions. This study investigates the difficulties faced by domestic water users because of an insufficient drinking water supply service.

1.4 Research questions

The analysis of water governance and the management of the DWSS in the three case-study peri-urban communities in Mexico provides insights into the interaction of different actors involved in the delivery of the DWSS at community level. I explore the difficulties faced by customary water institutions in providing the DWSS and investigate through this main research question how do customarily-organised institutions address water governance to manage the DWSS at community level?

To answer the main research question above, this thesis proposes four secondary questions, which are based on the three main elements: rules, actors, and decision making emerged from the analytical framework and Chhotray and Stoker's (2009) conceptualisation of governance. The following questions guide the structure of this thesis, and each is addressed in a separate chapter:

- 1) What are the disjunctures between official and customary water institutions governing the DWSS?

- 2) How and why does the wide array of actors influence the governance of the DWSS in Mexico?
- 3) What is a property rights system, and why is this important for decision making about the provision of or use of ground water for the DWSS?
- 4) What difficulties do domestic water users and water institutions encounter regarding provision of the DWSS?

Chapter 4 addresses the first question. It seeks to understand the main differences in terms of rules between two legal systems of different origin, the official and the customary – also called formal and informal respectively –. This question also seeks to understand how formal and informal water institutions frame the provision of the DWSS. It investigates the differences between these plural legal systems in the governance and management of the DWSS and explores the extent to which official and customary water institutions adopt formal law in addressing the dynamics and the rules currently governing this service or implement a customary law to manage drinking water. This question also looks at the disjuncture between official and customary water institutions in charges for the DWSS according to the area and householders' economic status.

The second question, addressed in Chapter 5, deals with the array of actors interacting in the governance of the DWSS and explores how they work within the water governance and management system at community level, and the level of involvement of each one. This chapter analyses the different actors participating in not only the governance of water but also the management of the DWSS in the three case study communities. It explains how each actor involved influences the DWSS.

The third question, discussed in Chapter 6, analyses decision-making issues of the actors interacting in the water governance system. Decision making is analysed according to the property rights and water rights of actors within the property rights system, which enables them to access water either through direct ground water extraction or through the provision of the DWSS.

Finally, the last question analyses the main difficulties faced by customary actors such as water committees and community members with the DWSS. These difficulties are addressed in Chapter 7. Water committees face specific difficulties in providing the DWSS and collecting community householders' payments. Householders' community members have to deal not only with water insufficiency but also with their payments for the DWSS. There are two main difficulties to pay addressed in this research: householders' willingness to pay and ability to pay. Some householders are not willing to pay for the DWSS they receive. However, some others find difficult to pay; this means, even when some community householders are willing to pay they are not able to pay because they do not have the financial resources to pay with. Both difficulties cause serious effects in the quality of the DWSS. The following section addresses the structure followed in this thesis.

1.5 Thesis outline

The analytical framework developed for this research outlines the structure of the thesis. Chapter 2 is a theoretical chapter that defines the concept of governance and then applies it, with a focus on water governance, to explain the processes through which the DWSS is provided. The rules, decision-making and the plurality of actors that shape the governance concept are conceptualised in Chapter 2 and analysed in the empirical chapters of the thesis.

Chapter 3 explains the methods and techniques used to carry out this research. Empirical information from the case studies was gathered using a wide array of research methods and techniques including semi-structured interviews, focus groups, field observation and analysis of secondary sources. The respondents included decision-makers and representatives of water institutions at national, state, municipal and community levels, as well as domestic water users, local water-well proprietors and water vendors, academics and professionals working with water-resources.

Chapter 4 analyses the rules governing access to and management of the DWSS using a legal pluralism approach to highlight how both formal and informal rules

govern the use of ground water resources. These formal or informal rules are followed by the actors involved in the governance of the DWSS and by domestic water users. Water institutions' implementation of rules and domestic water users' participation in following the rules are important processes in water governance and improvement of the DWSS.

Chapter 5 analyses the wide array of actors interacting in water governance and the management of the DWSS. The main actors are formal and informal water institutions, local private well proprietors and water vendors, and domestic water users. Together they represent the different politico-legal institutions in the water governance process. These actors participate in the management, operation, and distribution of the DWSS and in maintenance of the water infrastructure. In the communities' case study, customary water institutions are involved in the management, operation and maintenance of the DWSS, official water institutions in the financial management of payments collected, while local private actors are involved in the sells and distribution of drinking water. The actors interact through rules to make and implement decisions. The main focus of this research is the interactions between politico-legal water institutions and domestic water users regarding provision of the DWSS.

Finally, Chapter 6 focuses on water institutions' and actors' decision-making in the governance and management process of the DWSS. Decision-making in this case study associates the property rights system with the socio-legal position of the actor, also called holder, to the legitimate property rights that have been conferred to them. According to Schlager and Ostrom (1992), a property right holder may be classified as an owner, a proprietor, an authorised claimant, an authorised user and/or an authorised entrant. However, some may be classified as unauthorised entrants. Each position gives the actor a right to benefit from water. The types of rights to obtain drinking water analysed in Chapter 6 are access, withdrawal, management, exclusion and alienation. The interaction between water rights holders and the types of rights available are defined as the property rights system (Schlager and Ostrom 1992; Ostrom 2001).

Chapter 7 discusses domestic water users' and water institutions' struggles related to the provision of the DWSS. Three main struggles were identified: water institutions' difficulties with collecting domestic water users' payment for the DWSS; community members' difficulties paying for the DWSS; and the community's difficulties in trusting the water institution. These struggles hold back improvements to the governance and management of the DWSS at community level.

Chapter 8 includes the main findings of this research and sets out the conclusions. I found that the emergence of water committees, that are informal institutions, depends on the creation of a historically-contingent process in which informal structures are the product of specific conflicts or particular governmental decisions.

This study provides important insights into how the concept of governance is applied to governance of the DWSS at the community level. It offers significant theoretical insights into water governance and the on-going dynamic of domestic water users' access to drinking water, and contributes to understanding the role of informal institutions in the management of the DWSS at community and household levels.

Finally, I propose some policy recommendations that may be useful to decision-makers seeking to improve not only the governance and management of the DWSS by the water authorities involved at different administrative levels but also the quality of the DWSS at community level.

CHAPTER 2

Theoretical Framework for understanding water governance and the drinking water supply service

CHAPTER 2. Theoretical Framework for Understanding Water Governance and the Drinking Water Supply Service

2.1 Introduction

This chapter addresses the main governance literature and applies Chhotray and Stoker's (2009) governance concept to analyse the problem of water governance in the drinking water supply service (hereafter DWSS) in Mexico. Governance theory is becoming increasingly important for better understanding of the governance of the DWSS and its transport, delivery, and administration, not only in urban but also in peri-urban and rural settings.

To understand water governance at community level it is necessary to engage with the precepts of legal pluralism, which recognise the plurality of actors interacting within the same governance system. Each actor follows its own rules and settles the norms that regulate what is or is not allowed at the point of providing the DWSS.

Based on the analysis of the relevant literature and theoretical approaches to governance and legal pluralism it was elaborated the analytical framework that guides this research. The analytical framework outlines the methodology and the empirical information that is required about water governance in the DWSS. This information was collected during the fieldwork. The structure followed within this thesis is based in the analytical framework developed.

The theoretical contribution of this chapter focuses on the conceptualisation of water governance and how this is applied to the DWSS in three Mexican communities. The research also contributes to understanding water governance and the ongoing dynamic of domestic water users' access to drinking water. This study provides important insights about the administration of informal institutions that provide drinking water to community households. The current chapter mainly focuses on customary governance of the DWSS in medium-sized communities.

This chapter contains seven main sections. The first introduces the chapter; the second reflects on the main approaches of different disciplines regarding

governance theory and the conceptualisation of governance; beginning with Chhotray and Stoker's (2009) concept of governance, which includes three main elements: rules, decision-making and plurality of actors.

Rules, decision-making and plurality of actors are used in the fourth section as the axis to elaborate the analytical framework of this thesis. The analytical framework is explained in subsections. Each subsection analyse one of the following elements: rules, decision making, and actors, which were obtained from governance concept.

The first subsection analyses legal pluralism and the rules governing water resources. Through the legal pluralism approach it is acknowledged there are rules governing water resources and the way these are differently legitimised by specific institutions. One of the most important issues that this section tackles is the recognition of formal and informal institutions in the conceptualisation of governance of water resources. Though, this thesis gives special attention to customary community institutions involved in water governance.

According to the literature, relatively little is known about the institutions governing the DWSS and the policies that govern the use of groundwater. The analytical framework section illustrates how understanding issues of legal pluralism in the governance of water requires that the governance concept expand its frontiers beyond formal administration. It explores the informal or customary rules and laws adopted by water institutions at community level and the mechanisms generated to govern those resources. Through this section, this thesis identifies and acknowledges there is interaction of State, traditional-customary and private institutions in a governance system focused on providing the DWSS at community level.

In the second subsection of the analytical framework, the chapter theorises about the multiple actors involved in the water governance and management of the DWSS. Actors in this thesis are classified as politico-legal institutions and water users. The third subsection focuses on decision-making to access and obtain water; decision-making of actors is based on the property rights system. Communities

need to have and to recognise property rights over the water they manage to provide the DWSS. In this sense, governance can also be developed under a multiple normative construction of property rights. The characterisation of rights proposed by Schlager and Ostrom (1992) and Ostrom (2001) is key to recognising that different actors have specific rights according to their possession of the resource. These rights are embedded in a property rights system (PRS) that determines access to a specific natural resource – in this case, drinking water, therefore a discussion about water rights is also relevant in this chapter.

The fifth and sixth section analyse the importance of water governance and community management in the DWSS. A deep literature review found that more is known about technical aspects of the distribution of ground and surface water and the pipes and pumping system infrastructure than about the social aspects of water management (Mukherji and Shah 2005; Kumar and Managi 2010). By contrast, little is known about the performance of customary institutions that assume responsibility for providing a DWSS.

There are not many studies about the social organisation of communities to shape water committees. Neither is deeply studied the social aspects of the provision of drinking water, pricing, payments collection, and customary community management. There are more studies about formal institutions managing water services. There is little in the water governance and community management literature about the performance of water committees (see Nyarko 2004; Harvey and Reed 2007; Whittington, Davis *et al.* 2009; Nayar and James 2010). For these reasons this chapter emphasises the importance of water governance and community management in the DWSS. Finally, governing and managing water resources are not easy; therefore, last section (2.7) ends with an analysis of the difficulties faced by customary institutions in DWSS provision.

2.2 Theory of governance

Governance theory emerged in the early 1990s in the public administration and political sciences disciplines (Chhotray and Stoker 2009). It was a new way of thinking derived from the changes experienced in governing. The growing interest

in governance issues mirrors social and political changes; governance theory attempts to understand the implications of these changes and find an appropriate way of managing them. Researchers from different disciplines adopt different perspectives to governance to explain the social, environmental, political and economic problems that they observe (Neaera Abers 2007; Biswas and Tortajada 2010). In order to define a working concept of governance that can be applied to water governance at community level it is first necessary to engage with notions of governance and the ways in which different disciplines approach it.

Governance is a concept that has been studied from a wide array of disciplines such as political science, economics, international relations and politics, development studies, geography, and socio-legal studies (Benda-Beckmann *et al.* 1998; Liverman 2004; Batterbury and Fernando 2006; IEEM 2006; Bobbio 2009; Chhotray and Stoker 2009) and has been influenced by literature related to environmental management, participation and corporate governance (Falkner 2003; Batterbury and Fernando 2006; Chhotray and Stoker 2009).

Within the political sciences discipline it is possible to find the work of Camou (1993); González-Villarreal *et al.* (2006); Solanes and Jouravlev (2006); Allouche (2007); Franks and Cleaver (2007); González-Villarreal (2008); Roy (2008); Alvarado-Pechir (2009); Duit *et al.* (2010); Tortajada (2010); Van de Meene *et al.* (2011). The works of Falkner (2003) have emerged from the international relations perspective.

Development studies has engaged with governance issues since the early 1980s (Biswas and Tortajada 2010b). This discipline benefits from the approach of other disciplines to construct its own governance approach. Development studies focuses on the way in which organisation and decision-making push development projects to achieve specific goals (Roy 2008; Biswas and Tortajada 2010; Biswas and Tortajada 2010b). Despite the continuous discussions within these disciplines there is not yet a consensus on a single definition. However, development studies adopt the principles of participation, accountability, transparency, management and budgetary practices suggested by the World Bank to achieve 'good

governance' (Kaufmann and Kraay 2002; Kaufmann and Kraay 2007; Tortajada 2010).

Good governance seeks greater autonomy for community institutions from the bureaucratic apparatus and enable communities to organise and control their property rights (Roy 2008; Tortajada 2010). It involves the participation of civil society and community institutions participation for proper allocation and management of resources in order to solve collective problems according to what is good for people and the environment (Biswas and Tortajada 2010; Tortajada 2010).

Despite the World Bank's efforts to define governance and the inclusion of formal institutions in the concept it does not refer to alternative ways of governing (Kaufmann and Kraay 2002; Kaufmann and Kraay 2007: 6). Most of World Bank literature about governance centres its attention on the wide precepts of governance limiting it towards formal administrative levels. This literature mainly takes into account governance at international, national, state levels or even local (municipal) level. However, it does not centre attention on governance carried out at community level where different legal plural institutions participate and set its own laws and rules.

Currently, governance approaches still shape many studies of political science and public administration. Bobbio (2009) highlights it is important to take into account the collective decision making and the continuous governance challenge to allow governments to mediate through a complex net of institutions and networks. Institutions attempt to cope with the complex political and socio-economic changes observed in governance as well as the multiplicity of governing institutions' interests and decisions. This complexity is addressed by, among others, Allouche (2007); Franks and Cleaver (2007); Roy (2008); Tortajada (2010). For Camou (1993), governance is a set of rules that determine who governs in a system where there are real elements of power that guarantee stability as well as the institutions uncertain profiles that are still emerging and growing. The following section addresses the concept of governance used in this research to understand water governance at the community level.

2.2.1 Defining a working concept of governance

As discussed above, governance has been defined from different disciplines. Though, there is not a single consensus to integrate all elements involved in this concept in one definition that embraces the variety of interests from different institutions and actors. The concept of governance is concerned with the way people construct and practice collective decision-making to reach outcomes that benefit society, the economy and the environment. This conceptualisation is found in contributions from Neaera-Abers (2007); Lozano González (2009); Biswas and Tortajada (2010); Kurrild-Klitgaard (2010); Larson and Petkova (2011). Usually, governance is associated with a government system where an authority or a group of people work together to come to common decisions as mentioned in the literature of Batterbury and Fernando (2006); González-Villarreal (2008); Alvarado-Pechir (2009); Duit *et al.* (2010); Van de Meene *et al.* (2011).

Chhotray and Stoker defines governance as ‘the rules that guide collective decision-making in settings where there are a plurality of actors or organisations and where no formal control system can dictate the terms of the relationship between these actors and organisations’ (Chhotray and Stoker 2009: 3, 228). This is the concept I will use in this research. This concept denotes there are more legal plural institutions and actors than only formal actors. Plural actors are especially identified in decision making regarding the governance of natural resources.

In governance the commitment of institutions is the key element to reach consensus among the main social and political actors, resulting in agreed collective decision making (IEEM 2006; Kurrild-Klitgaard 2010). However, reaching a consensus is not easy. The concept of governance itself poses the problem that in governance there are conflicting agendas, different priorities of actors and thus actions and institutional interventions cannot be carried out straightforwardly (Chhotray and Stoker 2009: 218; Wilder 2010). Instead, informal institutions face community problems that require a quick solution, such as provision of the DWSS. These become part of a customary governance system.

The entire governance process requires continuous improvement to deal with the changes, challenges, experiences and problems faced in social, political and economic environments (Solanes and Jouravlev 2006). According to Rogers (2002), governance embraces the relationship between a society and its government. The governance process is not restricted to enforced laws or rules when the reality follows different legal rules legitimised through informal institutions (González-Villarreal 2008).

At the community level, informal governance and management systems – called customary systems – also play a relevant part of decision-making, the election of authorities, legitimacy and the participation of civil society (Kyessi 2005; Roy 2008; Bobbio 2009). This kind of governance usually exists at community level. Community governance is being recognised as an increasingly important aspect of the provision of infrastructure and the management of natural resources in urban, peri-urban and rural areas (Kyessi 2005). Nevertheless, sometimes, a customary governance system may be merged with an official governance system and may work together as a hybrid system.

Self-governance such as community governance tries to maintain its autonomy despite pressures from the globalised economic system that support formal institutions, processes, and decisions. In some communities self-governance may have the acceptance of a legitimate and valid government, which might not be a formal one (Falkner 2003). This concept of governance entails a change of management approach from official to non-official governance systems to allow permanent re-evaluation of collective decision making and actions (Sandoval-Minero 2007). Thus not only local but also community institutions seek to strengthen the ways they organise themselves to face the challenge of governance at local and community levels (Kyessi 2005; Mukherji and Shah 2005; Roy 2008; Jiménez and Pérez-Foguet 2010). This section focused on broad governance concepts. These concepts are relevant to find key elements that can be applied to define water governance at the community level. See section 2.5.

Governance frequently implies the interaction of a plurality of actors and institutions that are not necessarily formal; thus, it is necessary to engage with

legal pluralism approach in order to understand different ways of governing and legitimating decisions and where authorities and institutions might not be formal, but informal or hybrid. The following section defines and explains legal pluralism.

2.3 Legal pluralism: taking into account customary law to manage natural resources

In nearly all contemporary rural areas in less economically developed countries that were colonised it is possible identifying some form of legal pluralism in terms of the management and exploitation of natural resources. Legal pluralism refers to different legal (valid) rules and laws emerging from different origins (*i.e.* State, custom, convention, religious, etc.) and legitimation in historical usages (Benda-Beckmann *et al.*, 1998), community meetings recognition or a payment. Legal pluralism has been also identified in some of those rural areas that grew in population and become peri-urban areas or those rural areas planed and transformed into part of the urban landscape but in a rural-urban area. This means that in these kinds of communities the rights to maintain political and administrative control over natural resources and those rights to use and transfer them are not only regulated by State institutions and applied by courts. By contrast, there are customary institutions creating and applying their own customary law.

In colonised countries it is common finding there are prior colonisation and after colonisation legal systems. Prior colonising powers ruled less economically developed countries and established colonial States communities had their own political and economical structure, their own organisation and laws, as well as their own procedures to manage conflicts. Communities and some local institutions had, and some of them still have, a plural legal system ruling the management of natural resources. On the one hand, the State ruling system in colonised countries establishes the rights over those natural resources colonial rulers intended to exploit (Benda-Beckmann *et al.*, 1998). These rules are settled in a written formal law. On the other hand, there is an unwritten customary law generally orally transmitted in public ceremonies (*Ibid*). Legal plural communities mainly use this customary law.

In Latin American countries, as colonised territory, for decades, government interventions approved policies that looked for the substitution of customary legal and management systems by a 'modern' State law and resource management. In colonised Latin American countries this legal transformation was to be achieved by declaring natural resources, such as land, water, forest, State property. For example, Mexican government declared that land and water located within Mexican territory is State property (Cámara de Diputados, 2010). Since water resources in Mexico were declared as national property the State has the rights to control them through a State law. Though Mexican State has formal rights to control national waters there are still communities that under a customary regime control waters located within their community. Nevertheless, scholars have identified that for State government local and traditional customary laws, if recognised at all, were catalogued as an obstacle to achieve economic development because it is thought property regimes with a strong community and customary characteristics are the cause of inefficient resources exploitation and use (Benda-Beckmann *et al.*, 1998). Therefore, the more the State was involved in the control and exploitation of natural resources, in colonised countries, the more traditional legal systems (also called customary or indigenous) were officially substituted by State law.

Opposite to neoliberal thinking, scholars (Lynch and Talbott, 1995; Benda-Beckmann *et al.*, 1998) have studied and concluded that communities, community-based rights, and communities customary law is a positive element in resource management because these approaches support that community norms and rules are an expression of people values and needs. These scholars suggest that any formal legislation should avoid measures that weaken or contradict people's way of organising, ruling and managing its resources. The validity and recognition of non-State laws may have limited influence in official law. However, people's law – either in community or as individuals – are still an important part of rural life and some peri-urban areas. These customary laws continue existing in most of less economically developed countries.

In some communities from colonised countries there are multiple legal plural rules that may be interacting at the same time. Therefore, researchers, individuals, communities, and State institutions are not only confronted with a single legal system but with a co-existence and the complexity of multiple normative legal systems and rights over control, management, and operation of specific natural resources, especially when it comes to water resources.

2.3.1 Customary law

Customary law, also defined as customary rules or traditional rules, is used in two meanings. The first meaning only refers to ‘rules’; those customary rules that have been accepted and used by communities for a long time. The second is to refer to a system of rules that is called ‘customary law’ not only by local people but also by law makers, judges, and law experts. There is more than one construction of ‘customary law’. In my research, customary law refers to the rules created and enforced by community population through their customary institutions and that have been used for a long time.

In customary communities there may be more than one legal law ruling the water management system. Customary law may not be the only one applied within the community. Customary law probably has always been combined with other legal laws and norms derived from other sources of power and authority generated outside the community; for example, State and government agencies law, religious groups law, project law, and organizational law (Benda-Beckmann *et al.*, 1998). The coexistence and interaction of multiple laws within a social environment is the so-called legal pluralism. In a legal plural domain these different legal orders interact and influence each other rather than isolated from each other. The same happen with government institutions that manage water resources. Sometimes also happen that State law may be combined with traditional leadership and councils. These mixed law are known as ‘compound law’ (Von Benda-Beckmann, 1983; Benda-Beckmann *et al.*, 1998). In the three case study communities there is a customary and an official legal system ruling the governance and management of water resources used to provide the drinking water supply service. The main legal system in the three communities is the

customary. However, State law becomes part of the legal elements used by water committees to obtain water rights and property rights to access ground water.

Scholars also argue that in communities ruled by tradition there are older and newer versions of traditional or customary property relations and laws co-existing. However, not all customary laws account the difference between the various kinds of practical norms existing within every community. This means that the customary rules that are used at community level are far more complex and dynamic than it is expected because each community, each customary system have its particular characteristics and social dynamics and each community might have its own particular norms adapted to their practices which are sensitive to their context. Therefore, in order to differentiate the multiple levels and sources of rules in a social process it is also necessary to understand the concept of 'local law'.

Local laws are not customary law/rules. Local laws are the locally dominant interpretations and transformations of legal plural rules. And mixtures of interpretations of those legal rules might integrate local laws. Local law refers to those used rules that guide daily customary practices; it constitutes the present reality shaped by actual social relationships (Spiertz, 1992). The practical use of local law does not mean that customary law could be replaced. However, many elements of the local law may be customary in terms of the continuity of a legal tradition. Local law might but not necessarily need to be incorporated into the customary law.

By contrast, "customary law, or different constructions of customary law, is part of the legal pluralism which constitutes the environment in which local laws are generated in different localities" (Benda-Beckmann *et al.*, 1998: 60). It depends of the context and place in which people deal with elements of the customary law that become part of the particular and dynamic local law. Therefore, according to Meinen-Dik and Pradhan (2005) the way in which these different legal orders interact and influence each other in specific social contexts depends on social and power relationships between holders/possessors of different laws. The following section analyses power relations.

2.3.2 Social and power relations in the use and coexistence of different laws

The coexistence of multiple laws does not mean all of them are equally powerful. State law is usually, in most of contexts, more powerful than customary law or other laws. In terms of water resources State law is used in allocating water from rivers, aquifers, and other reservoirs not only for agricultural but also for non agricultural activities. Government institutions, powerful outsiders or weaker community groups supported by external agencies usually use State law for claiming rights over natural resources that are denied to them by other powerful groups. Though State law is used to claim rights it does not mean it is accepted, legitimised, or implemented by all users. In legal plural communities, individuals or groups of people can make use of more than one law or parts of different laws adapted to their particular context to legitimise their decisions. According to Meinzen-Dik and Pradhan (2005) the law that is accepted and enforced at community level mainly depends on power and social relationships between the different claimants.

According to Zwarteveen *et al.* (2005) water topic is about power and interests, power and ideologies, water is politics and it requires a deep analysis because the nature of water is very contested. The dynamics around water politics, including water rights and laws, cannot be understood without analysing the power relationships, discourses, and practices that guide the perception of problems and likely solutions (*Ibid*). It is not just about rights and laws in a narrow sense. It is also necessary a broader analysis of water rights and laws that includes resource access and control because these mirror social relationships and power of actors. The analysis has also to take into account not only water capture, but also technologies, organisation, culture, economy, and ecology.

2.3.2.1 Understanding water rights to distinguish power relationships

Water rights, like property rights, are understood not as a single right to use a resource but as a ‘bundle’ of rights that includes several types and levels of rights. The first classification of water rights proposed by Schlager and Ostrom (1992) offered a main division into three broad categories: rights of use, decision-making rights, and the right to generate a profit. Into these main categories are contained

the five types of rights included in their ‘property rights system’: access, withdrawal, management, exclusion, and alienation (Schlager and Ostrom, 1992). The rights of use include access and withdrawal, while decision-making rights ‘regulate and control water uses and users’ (Benda-Beckmann *et al.*, 1997; Roth *et al.*, 2005: 240; Schlager and Ostrom, 1992) such as management and exclusion rights. To these broad groups of rights may be added the right to earn income or to generate a profit from the resource even without using it directly; for example, through selling water or collecting water fees. This is the case of government, private, or customary institutions that collect revenue from water users or communities that also collect a fee from others water users.

The type of right that every actor holds depends on the position they have within the property rights system; for example, each actor hold a different right if they are owners, proprietors, authorised claimants, authorised users, or authorised entrants (Schlager and Ostrom, 1992). Water rights and laws are also seen as expressions of social and economic relationships between people. Thus, changes in laws and rights will happen if there are changes in those socioeconomic relationships (Boelens and Zwarteveen, 2003). Though there are rights conferred and hold by different users it is also possible finding, in practice, there are users that have not been allowed by any authority to access, withdraw, and use water. However, they have access to water and use it. These non-authorised users have no rights over water. Instead they have a tolerated access to water (Meinzen-Dik and Pradhan, 2005) but not water rights. In communities where there are conflicts over water it is not clear who has rights and who does not. In legal plural communities it is especially difficult because “what may be considered tolerated access according to one law may be considered rights according to another” (Meinzen-Dik and Pradhan, 2005: 242).

The recognition of this complex set of interactions and relations do not only involves those individuals or groups with formal powers of legislation, decision making, and management but recognition also involves dialogues and social struggles of different actors with different interests, perspectives, needs and powers. As previously mentioned water issues, especially water rights and laws,

are political and contested; Zwarteven *et al.* (2005) identify four main ways in which they are contested. First, water rights are contested because they deal with decisions about distribution and allocation. Decisions about how water is distributed, and how access is negotiated and obtained, are not only the result of how norms, rules, and laws from different origins and different degrees of legitimacy interact but decisions are also influenced by economic and political power. Some individuals or groups get less water than others. Frequently happen that those receiving less water are those inhabitants from rural and peri-urban areas. In this sense it is necessary to redefine water laws and rights but sensible to the context.

Second, not only access to water but also conflicts and disagreements for water use are contested. Disagreements occur over the content of rules, norms, and laws that determine water distributions and allocation in terms of how water should be proportionally distributed. Criteria for allocation are definitely contested because answers cannot be unilateral. Answers should not be only based on economic interests and power positions, neither on technology efficiency. It should also take into account communities history, cultural values and traditions dealing with water.

Third, water rights and laws are contested because there are struggles over who decides about water distribution and who is entitled for decision making. Decision making spaces are often exclusive of some actors. Exclusion to participate on it may depend on gender, ethnicity, or caste. This means that some people are allowed to participate on formulating rights and laws but not everyone. Individuals allowed to speak, to make decisions, and to influence decisions are not necessarily formally designated. The ones allowed, at community level, are mainly determined as by social relations of power and dependency as by cultural norms that associate specific behaviour with knowledge and authority. At community level “gender is one important axis around which attribution of powers of speech and norms of behaviour often occurs” (Zwarteven *et al.*, 2005: 258). In many communities gender relations are imbalanced; these are determined according to rights to land and water. Gender inequality in customary

communities is mainly based on the fact that decision making over control of management, operation, and maintenance of water and its infrastructure which is related to water rights of access is mainly lead by males. Therefore, when there are conflicts and disputes related to water women are in a weaker position because men tend to be the intermediaries in terms of communications and interaction with external institutions to the community (Benda-Beckmann *et al.*, 1998).

In the communities studied gender is one of the variables that attributes power to specific community members responsible of legitimating water rights of users as well as allocation and distribution of the drinking water supply service. Nevertheless, these gender variables are not often seen as part of the customary law governing and are therefore usually neglected (Benda-Beckmann *et al.*, 1998). Therefore, it is important questioning how are power positions around water governance and management given and legitimised by local law. And who profits from the existing arrangements to manage drinking water in the communities studied. According to diverse studies, people from rural communities are regularly oppressed and economically exploited (Benda-Beckmann *et al.*, 1998; Boelens, 1998) because they end up paying more money in order to receive drinking water. Their payments are not necessarily paid to one actor, or to the water authority, but to different actors because they additionally have to buy bottled and tanked water; therefore, they have to budget not only the monthly payment for the drinking water supply service, but for those extra payments to obtain water.

In addition, at community level, public meetings to make decisions have historically served to symbolically differentiate powerful from powerless actors. Powerless have definitely far more difficulty in mobilising law and legal institutions, either or both State or other community institutions, than powerful groups (Benda-Beckmann *et al.*, 1998). In the three case studies it is in public meetings where the main decisions are done involving community members participation. In public meetings are established the main responsibilities and activities to be carried out as well as the agreement to charge and collect users payment to legitimate their water rights.

One more element that attributes specific rights over water depends on the property rights of actors according to their status as right holders. This means that owners, proprietors, claimants, users, entrants have different rights according to the status they hold and the payments they have done to legitimize their property rights. However, if someone belongs to a higher or more powerful class they may obtain more rights because they may be able to pay more for these rights to obtain more drinking water.

The fourth contested area is expressed in the discourses and specific language used to articulate water problems and its solutions. There is a relation between the way in which water problems and solutions are defined and conceptualised and the political agendas they promote. Specific language stresses specific water realities, and not others, in terms of technology, cultural, and normative content. Language represents the water reality of specific groups, interests and their purposes. At community level and in indigenous movements individuals prefer using terms that express the need for collective action and reciprocity. Opposite, State institutions prefer currently using a neoliberal water discourse. In both cases specific language is required to shape their own water law (Zwarteveen *et al.*, 2005).

Legal plural communities are usually more interested in other forms of power and sources of law and legitimacy than only the formal power. At community level where water resources are frequently governed and managed by custom having access to and control over drinking water is an important source of power and influence. Conflicts, fights, and struggles over water resources expose its importance in people's livelihoods and in determining their influence and status according to their possibilities to control and access water. This behaviour has been observed in the three case studies where water committee members, integrated by male members, have won power over, control, and distribution of groundwater through the drinking water supply service provided to members of their community.

Though legal plural forms of power authorise some community members to voice people interests and make decisions, there is also evidence that communities often

face situations of unequal power relationships (Benda-Beckmann *et al.*, 1998). These situations affect the way in which water resources are distributed and managed because those with power may bring more advantages to community members that support the water committee or those that give them compensation money because of the work they do.

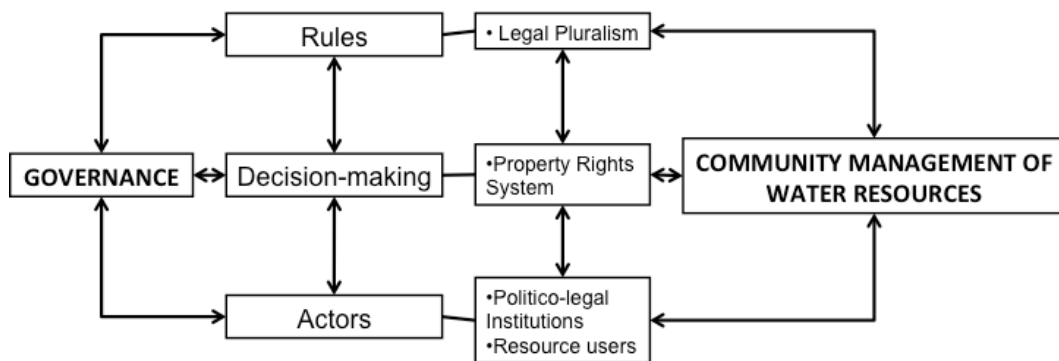
In the case studies it has been identified there are facts of social life that need to be taken into account to understand how water is allocated, distributed and managed at community level. In the three Mexican case study communities' local law and norms and social stratification combined with differences in economic wealth and social power, rather than political, influence the possibilities of householders to access water and participate in the distribution of the drinking water supply service. It has also been identified that differences in water ownership according to the property rights system of Schlager and Ostrom (1992) define differences in access to drinking water at community level. Rights to water in legal plural communities are closely related to the socio-political organisation rather than to the formal law. This topic will be further analysed in section 2.4.3. The following section addresses and analyses the analytical framework leading this thesis.

2.4 Analytical framework

In rural and peri-urban communities in Mexico it is common for the population to consume drinking water from different sources such as bottled water, boiled water, filtered water, or water bought from water tankers (Guardiola *et al.*, 2010). This happens because of the insufficient water domestic water users frequently receive through the DWSS. The drinking water consumed from different sources is independent to the DWSS water institution provides to householders. Domestic water users have to pay not only for the DWSS but also for the water they buy from local private actors. Using and managing drinking water involves multiple actors differently legitimised. Therefore this research uses governance and community management as the main theoretical approaches to understand how groundwater is governed and managed at community level to provide the DWSS.

The analytical framework this research is based on takes into account the three main components of the governance concept defined by Chhotray and Stoker (2009): rules, collective decision-making and the plurality of actors. This also addresses community management concept to contribute with to understand the way in which customary institutions are organised to provide the DWSS, rule it, and manage it and situate my work on community-managed drinking water systems in Mexico. This analytical framework is applied throughout the thesis considering the three components; each component is defined and analysed in a separate chapter to understand water governance, which can then be applied to the governance and management of the DWSS in the case study communities. Figure 2.1 shows the analytical framework that encloses the main theoretical postulates on which this research is based.

Figure 2.1 The analytical framework



The existence of a wide variety of governance concepts facilitates identifying common variables, such as rules, decision-making, actors, government, legitimacy, that can be adapted, in this research, to define water governance and governance of the DWSS. Wilder (2010) suggests as necessary to generate a coherent governance strategy that is sustained over time and place to generate local participation and bring about consensus. This analytical framework is designed as the axis leading this research and to integrate these concepts into a useful definition according to the main objectives of this research.

The concept of water governance from the Global Water Partnership (GWP) (2003: 2), complement Chhotray and Stoker’s (2009) governance concept that I have used in this research to understand the governance of the DWSS at

community level. Both concepts contribute in this research to define governance of the DWSS as the rules, decision making and plurality of actors and institutions – *i.e.* public sector, civil society, private institutions, customary authorities, and individuals – involved in the development and management of the DWSS, recognition of water institutions and its authority, and their decisions about the management, operation and maintenance of drinking water and its infrastructure to provide a public service, specifically the DWSS.

Governance of the DWSS concept highlights the importance of legal pluralism in governing water resources because formal institutions and actors are not necessarily the ones assuming the responsibility of ruling, making decisions and controlling drinking water resources to provide a service; instead, there are informal actors involved. In the governance of water there are legal plural institutions interacting within customarily organised communities to provide the DWSS.

At the community level three main issues require special attention: 1) the rules that govern, 2) the property rights system that enable decision making, 3) and the actors: politico-legal institutions and domestic water users interacting in the governance system. The importance of these three components and the way in which they work in the water governance and community management systems are addressed and analysed in the following subsections.

2.4.1 Recognition of the plurality of rules interacting in a customary water governance system

The rules of governance are related to legal pluralism approach. As mentioned in section 2.3, legal pluralism refers to different legal (valid) rules and laws emerging from different origins (*i.e.* State, custom, convention, religious, etc.) and legitimation in historical usages (Benda-Beckmann *et al.*, 1998), community meetings recognition or a payment. For example, there are customary social norms and institutional norms as well as official laws (Boelens and Zwarteveen 2005; Boelens 2008). These norms and rules might coexist within the same locality where a plurality of actors also interacts within the same system.

Scholars (Von Benda-Beckmann 1995) have studied the precepts of legal pluralism to understand different ways of governing and have distinguished governing bodies from formal, informal, private and market-based institutions. Formal rules mean the official rules established by official or State authorities and institutions, including written law, and government structures at the international, national, state and municipal administrative levels (Welch 2002). Other official institutions such as private or market-based institutions interact within the same formal regime and rules. By informal rules, I mean customary rules and agreements settled by custom or convention by a group of individuals, community members, community or traditional institutions that do not necessarily take into account the mandates and regulation of official institutions. This research mainly focuses on informal institutions and their rules and agreements.

Helmke and Levitsky (2004) affirm that informal institutions emerge for three main reasons. The first is that formal institutions are incomplete and cannot cover all contingencies, so informal rules are created to address the problems not covered by formal rules. The second is that informal institutions may be a 'second best' way of solving problems that cannot be achieved by formal institutions. Formal institutions may be recognised in a written document; however, this does not mean they are able to solve all problems these institutions were created for; so, they might be ineffective in practice for bringing solutions to specific problems. In such scenarios substitutive informal institutions exist because of the limited achievements of formal institutions and because formal institutions rules and rule-making process lack of authority and effectiveness to implement solutions, lack of commitment to do their job, and therefore they are ineffective to succeed and achieve positive outcomes, and lack credibility of people. The third reason is based on the pursuit of specific goals and activities that are not considered acceptable by the population but are legitimate by formal institutions. Therefore, instead of following formal institutions rules population prefer organising themselves through the creation of an informal one to set informal rules to control what is or not allowed within society (Helmke and Levitsky 2004).

In this research it has been found that informal institutions have also emerged as part of the customary organisation of the community. At community level, informal institutions have emerged to govern and manage specific natural resources. This is the case of the DWSS. This organisational structure represents the customary traditional participation of community members to maintain the management of the drinking water supply service and the wells owned by the community. With community members' participation, the customary system has been strengthened by the custom and convention of community members.

Due to the absence of written law in informal institutions, the rules and activities that govern the DWSS are learnt and communicated by example and oral communication. Social learning related to water governance is also learnt by observation and experience. Experience is obtained through trial and error. Thus it is social networks that transmit informal rules. Helmke and Levitsky (2004) affirm that informal rules evolve into sets of shared expectations. Therefore, the governance and management of the DWSS by informal institutions is a process of learning by example in which a plurality of actors continuously interacts.

Analysis of governance of the DWSS through the lenses of legal pluralism is relevant to understand the wide array of legitimate institutions interacting within the same governance and management system. Analysis of formal and informal institutions provides a better understanding of the ways in which legitimate legal-plural institutions organise themselves to govern a space or a specific natural resource such as water.

Scholars of legal anthropology suggest that legal rules, institutions and socio-legal relationships are part of a context in which any interaction occurs within a plural legal regulation. This means that local legal systems themselves may be plural (Von Benda-Beckmann, 1995). Legal pluralism in the field of property pays attention to how individuals and institutions distinguish or merge elements of different normative subsystems, attempt to impose their own constructions on others or defend themselves against others (Von Benda-Beckmann, 1995).

In order to adapt to the different requirements of the actors, Chhotray and Stoker (2009) suggest, governance should take into account three questions: how should the power² be distributed? Who should be involved in decisions? And how should the rules be enforced? In a customary system, the power is not only distributed but also rotated among community members to administrate the DWSS. In this case participation of as many of the community members as possible is expected to legitimate decisions. Collective decision-making, then, is relevant to legitimate the rules to follow when governing DWSS.

On the one hand, a formal governing system, for example, is shaped by legal or statutory rights and regulations elaborated and enforced by official institutions, mainly of the State, through statutory law. An official State authority governs by shaping the rules, elaborating public policy and providing agreed public goods and services to different social sectors (Batterbury and Fernando, 2006; Cristobal Pérez, 2006; Wilder and Romero Lankao, 2006; Alvarado Pechir, 2009; Bobbio, 2009). By contrast, at community level, customary institutions take on the responsibility for providing public goods and services.

On the other hand, customary governance involves the participation of community authorities or groups within a community that is organised, recognised and legitimised by its members. Customary water authorities play an important part in community organisation of the provision of the DWSS. The population democratically elects customary institution representatives at community meetings. Community members can also inherit the leadership from the previous governing group if there is consensus among community members. Scholars (Doe and Khan, 2004; Chimhowu and Woodhouse, 2006; Harvey and Reed, 2007; Miranda *et al.*, 2011) find that the customary authority is frequently represented by a community leader such as a major or by members of a religious group.

² Power here is understood as the socio-legal explanation of the nature of the law (Chhotray and Stoker: 134, 135). The law is the instrument of the state power. This power may be ideological or actual, and may be held by the State or the law. The law, whether official or unofficial, is a form of cultural expression that operates as a potential socio-economic and political force of power, constraining and enabling social practices (*Ibid*).

Water resources and water services operated at community level are often managed, protected, allocated, used and distributed by customary or local private institutions. This management is legitimised by society through social rules, mechanisms of action, or infrastructure (Welch, 2002; Boelens and Zwarteveen, 2005; Franks and Cleaver, 2007; Matsinhe *et al.*, 2008).

Local private actors usually follow market-based rules (Boelens, 2008) to assign prices to water and commercialise it. They are allowed to use waters for which they have a formal concession. Water formally authorised to private actors, such as local well proprietors, has to be necessarily used for businesses purposes; and according to the permission they hold they have specific rights to make use of specific amounts of water and decide where to allocate it, how to sell it, and how to distribute drinking water. For local private actors, the grant to hold private property rights over water set the rules they will follow to use groundwater. Grants are still provided by an official national institution. Thus interactions and relationships among rules, actors and level of involvement continuously occur within a water governance system. Nevertheless, interaction among official, customary, private, and individual rules may recurrently create friction in the management of the DWSS; specially, when two or more actors use the same source of water (Gupta *et al.*, 2010).

In societies where plural legal institutions interact, access to natural resources continuously involves conflicts at multiple administrative levels (Sikor and Lund, 2009) because opponent institutions are trying to dominate the administration and management of natural resources; for example, the drinking water.

Scholars dealing with community-based institutions agree that in some communities the State-based government is losing power, and with it, its ability to govern society (Moser, 1989; Linares, 2000; Doe and Khan, 2004; Harvey and Reed, 2007; Matsinhe *et al.*, 2008; Bodin and Crona, 2009; Duit *et al.*, 2010; Farrelly and Brown, 2011; Van de Meene *et al.*, 2011). Instead, customary government is taking its place in settling or choosing the rules that legitimise the exercise of their authority. This shift additionally suggests that problems of

governance are becoming so complex that it is difficult for only one government to solve them alone (Duit *et al.*, 2010).

The difficulties in solving water governance problems are caused by the lack of authority to bring about consensus on who should manage water resources, who should make decisions, who should collect users' payments, how the governance system should be organised and by whom, and then how to enforce the rules. Bell and Hindmoor (2009), scholars of legal pluralism, explain that in customary communities, society-centred actors, rather than local formal institutions, are assuming this governance responsibility. Alternatively, community institutions can assume the roles of organising, bringing consensus, decision-making and promoting participation and inclusive resolutions to the problems inherent in the management of water resources. This occurs with water committees providing the DWSS.

2.4.1.1 Mechanisms to govern: legal plural institutions governing water resources

In water governance, institutions are mediated through mechanisms which are the 'particular context specific arrangements for organising access to water' (Franks and Cleaver, 2007: 295). Community governments are often the actors responsible for the care of these natural resources (Sikor, 2008). The governance will depend on the community organisation and the distribution and use of natural, technological, economic and social community resources. Nevertheless, the conventional notion of formal governance remains firmly rooted in the majority of countries with the idea of a state-centric location and insistence of State authorities, as key elements, in implementing international regimes (Falkner, 2003: 76). Though, State-based notion is not always the solution for providing drinking water to communities. Repeatedly, communities prefer organising themselves for governing groundwater and managing the DWSS.

Governance should not be restricted to official government or enforced laws and rules, it may be based in a different system (González-Villarreal, 2008). Governance is moving towards a more decentralised system aiming to distribute

power to share it with lower governmental levels or to informal water institutions (Romero Lankao, 2001; Wilder and Romero Lankao, 2006).

Some scholars (Ostrom, 2001b; Kurrild-Klitgaard, 2010) support the idea that there should be a plurality of governance centres that interact. This might strengthen the governance system and diminish negative effects when a policy has not been adopted well. Therefore a multiplicity of centres is expected to deal with the inconsistencies of centralised government and to create a stronger and resilient governance system. Other perspectives suggest not multiple centres but community-based systems capable of managing and administrating the provision of services around a specific resource such as water (Doe and Khan, 2004; Kyessi, 2005; Harvey and Reed, 2007).

It is common to find customary institutions participating in the governance of water, forests, mining and so on. They use mechanisms considered legitimate by the community to make the resource available for the local population; for example, community meetings to decide schedules of pumping, timing, and pumping directions. These mechanisms that the domestic water users consider legitimate do not necessarily involve formal legislative authorities at the national level, statutory legislation, or official institutions (Boelens, 2008). The following section discusses about the actors that access water and governs the DWSS.

2.4.2 Actors: politico legal institutions and water resources users

In this research, actors are classified as politico-legal institutions and water users participating in the governance of drinking water. Those most involved in the water governance process are official, customary and private water institutions. The actors involved in the water governance process are connected at a number of horizontal and vertical governance levels. They all working and interacting to achieve development (Chandhoke, 2003; Mukherji and Shah, 2005). On the horizontal level official governance interacts with actors such as civil society and the market, and the vertical level involves hierarchical interaction between transnational and self-government institutions (Mukherji and Shah, 2005; Roy, 2008).

The politico-legal institutions such as water committees and AyST as decentralised water institution, and resource users, specifically, domestic water users and local water vendors, are the focus of this research. These actors are involved in the management, operation, distribution and maintenance of water; and they interact following either formal or informal rules to make decisions. In this way formal and informal water representatives exercise authority in the governing of water resources to provide a service such as the DWSS.

Once a water authority – represented by the water committee – is elected and the period of governance is defined, the customary water committee assumes full responsibility for enforcing the rules and bring consensus for common decisions. These rules become legitimate through community agreement and by gaining community members' trust in the water authority (Leahy and Anderson, 2008). In order to continue understanding the relation of rules, decision-making and actors the following section analyses the importance of politico-legal institutions as components of the water governance system.

2.4.2.1 Politico-legal institutions

In a governance system there is a plurality of actors with different origin and degrees of legitimacy, power and authority (Bobbio, 2009). According to Bobbio (2009) the institutions represent the legitimate power. The actors in the governance system, such as domestic water users, water committees, community groups, local water sellers, and decentralised water institutions, represent the different politico-legal institutions. The different politico-legal institutions need to be recognised by society in order to allow them making decisions that benefit community members. In the recognition and legitimacy of these politico-legal institutions by social actors it is based their autonomy to make decisions.

Community members or groups of individuals emerge from the society or from specific groups within it to constitute informal customary groups that are traditional, or community-based institutions – though they are not formal institutions because official institutions do not legitimise them. Franks and Cleaver (2007) found that community-based institutions frequently come from a

religious group, a women's group, or a youth group backgrounds. The main characteristic of individuals from a community and group members is that they are connected and engaged in collective labour in their communities and participate in the decision-making process (Nyarko, 2004; Kyessi, 2005; Franks and Cleaver, 2007; Roy, 2008).

Institutions involved in the DWSS and the way the service is administered play an important role in the interactions among actors involved in water governance. For example, governance of customary and official institutions generate a series of channels through which people can make their claims and to some extent gain access to water resources. In this way people can legitimise their claims to water rights with different politico-legal authorities (Franks and Cleaver, 2007).

Recent studies of institutions and the participation of actors under a drinking water context-specific claim the importance of promoting the devolution of authority to the lowest government level in managing water resources (Gregersen *et al.*, 2007; Boelens, 2008). However, the lowest level of government is not necessarily the lowest hierarchically-constituted institution able to make claims. Self-governments still make decisions in their own communities, such as occurs for the DWSS. According to Ferguson and Derman (2005), at the local level water is better managed by local representatives and politico legal institutions than by state and national central government. This could also be applied to community level institutions. The following subsection considers water users in the governance of drinking water.

2.4.2.2 Water resources users

Water resource users interact as part of the plurality of actors in a governance system. Drinking water users are important actors involved in DWSS because they frequently enable or obstruct the implementation of decisions. This is because water users' payment for the DWSS might enable or not the implementation and operation of decisions related to this service and the improvements of the service through the infrastructure maintenance. Also, water users are key actors because they are the ones who legitimate decisions made in

community meetings and they are the actors who will consume drinking water and will face the advantages and disadvantages of the service and related decisions. The users considered in this research are domestic users of drinking water, also referred here as householders. They are members of the case study communities whose rights and duties allow them to participate in the decision-making about election of water representatives and sometimes maintenance of the drinking water infrastructure.

As part of the involvement of domestic water users in the DWSS it is relevant investigating domestic water users' ability and willingness to pay for the drinking water service because payments are a central element to enable working the piped water network and then the service; and the measures carried out by domestic water users to adapt when there is insufficiency of water resources.

At small scales; for example, at community level, water users as community members participate in the organisation to keep control over ground water. They organise themselves to govern and manage its drinking water resources that are provided to community households. This water is only used domestic consumption rather than for irrigation or industrial production because for these last activities actors have special water concessions from different wells. Governing and managing water resources at community level make the decision-making process faster and easier for community members who are also water users. Decision making, through the property rights system that allows specific actors and users to access water and governs the DWSS will be analysed in the following subsection.

2.4.3 Decision making and the property rights system

According to the natural resource management literature, local institutions in postcolonial countries seem to be more involved than upper administrative levels in the administration of local natural resources. However, following the thinking of Sikor (2008), giving this responsibility to lower levels of government is not enough. A coordination of effort and responsibility by the customary and official institutions involved is required to make and implement decisions (*ibid*).

Governance implies collective decision-making, especially in customary governance where community institutions take into consideration the plurality of actors involved in the DWSS – for example householders, domestic water users, well proprietors, water vendors, official water institutions and water committees – in order to better govern and manage the distribution of the DWSS. This characteristic is common in post-colonial countries. Customary governance legitimises these actors' decision-making and actions. Customary community governance of the DWSS aims to benefit water users through good service coverage, service provision, flexibility in its collective decision-making and implementation.

Although governance implies collective decision-making, there are struggles that make this process vulnerable. Conflicts emerge when there is not consensus in the decisions making and these are exacerbated by competition for the distribution of natural resources among actors coexisting in the same area. The main problem of governance, as perceived by the different disciplines, indicates that 'enfor[c]ement and regulation failures mean that agreements when reached cannot be implemented' (Chhotray and Stoker, 2009: 224; Wilder, 2010). The solution may lie in strengthening the authority without excluding the voices and participation of individuals and stakeholders (Bakker *et al.*, 2008; Roy, 2008; Bobbio, 2009).

Individuals who come together to make decisions in customary communities are not usually members of official institutions and they are not necessarily state representatives. Customary authorities rely on their autonomy and custom or social convention to solve community problems such as the provision of the DWSS. Customary institutions are recognised as legitimate by the members of the community to which they belong, and their decisions are recognised and validated by the community.

In communities organised by custom, water authorities usually work under a governance system that is frequently characterised by autonomy and plurality. This means they make decisions without waiting for the approval of an official institution. Decisions are made according what is required and approved by a

majority of community members. Despite this autonomy, some customary communities additionally maintain managerial agreements with the municipal decentralised water institution, or even a local private water well proprietor.

In Latin American countries from the Andean region; for example, Ecuador, Bolivia, Peru and also Mexico, customary institutions hold the rights to manage and provide the DWSS at community level (Boelens, 2008; Hoffmann, *et al.*, 2003). These institutions are frequently recognised by community members as the main authority in the community with the power for carrying out DWSS projects. This thesis claims as important the recognition of communities' power to maintain control over water resources and their administration. To understand the legitimacy of these customary institutions it is important considering not only the rules encompassed within legal pluralism but also the legitimate recognition of their water rights.

Decision-making, also related to the way in which a customary community is organised – in terms of authority, credibility, and legitimacy – is related to the property rights system, which associates holders' positions with their property rights either legitimate or not as well as their right to access water even when they do not hold any of the property rights proposed by Schlager and Ostrom (1992). The position a water user or any other actor holds range from owner, proprietor, authorised claimant, authorised user and authorised entrants. Each position gives the actor a right to benefit from water: access, withdrawal, management, exclusion and/or alienation to sell water. The interaction between rights holders and types of rights is defined as the property rights system (PRS) (Schlager and Ostrom, 1992; Ostrom, 2001). This PRS is analysed below.

2.4.3.1 Property rights systems

'Property is part of a larger picture of access to resources, whether legally recognised or not' (Sikor and Lund, 2009: 2). Property refers to those claims that are considered legitimate by legitimate social actors. Actors are linked through social relations, and property is shaped by enforceable claims to the use or benefit of something (*ibid*). Property relations involve different types of social actors such

as individuals and social groups or institutions (Von Benda-Beckmann, Von Benda-Beckmann *et al.*, 2006; Sikor and Lund, 2009).

There are two main struggles related to property in this context: first, the constitution of authority; and secondly, access to resources. In postcolonial countries, whose organisation usually involves the participation of legal plural institutions, water users and water institutions attempt to ‘secure rights to natural resources by having their access claims recognised as legitimate property by a politico-legal institution’ (Sikor and Lund, 2009: 1). Property is recognised as such if socially legitimate institutions sanction it. The recognition of water users and institutions property involves the institutions that recognise its property and its authority over water (Sikor and Lund, 2009). In addition, customary politico-legal institutions are legitimised to govern or to manage water if social institutions perceive they are able to interpret the social norms – for example the property rights.

Rights are the ‘legitimate social and economic interests’ regarding control over and access to specific resources (Von Benda-Beckmann, 1995). In this sense, property rights are seen as the normative and actual conceptualisation of property relationships between groups of persons and property holders (Von Benda-Beckmann, 1995; Agrawal, 2001; Roth *et al.*, 2005). In the case of DWSS, the main dynamic of water users is securing their access to natural resources by claiming recognition of their water rights and the service management as legitimate property. This recognition of property is sanctioned by a politico-legal institution which consequently recognises water users’ authority (Sikor and Lund, 2009).

To understand property rights, I consider the Property Rights System (PRS) proposed by Schlager and Ostrom (1992) and Ostrom (2001), which provides an understanding of the function of five types of rights – access, withdrawal, management, exclusion and alienation. These are associated with diverse rights holders including authorised entrants, users, claimants, proprietors and owners in a plural legal system (Schlager and Ostrom, 1992: 249). Table 2.1 shows the types

of property rights granted to right holders regarding the use and management of DWSS.

Table 2.1 Types of rights associated with holders' positions: the Property Rights System (PRS)

PR S	Owner	Proprietor	Authorized claimant	Authorized user	Authorized entrant
Access	X	X	X	X	X
Withdrawal	X	X	X	X	
Management	X	X	X		
Exclusion	X	X			
Alienation	X				

Source: Schlager and Ostrom (1992); Ostrom (2001).

This scheme is used to understand and analyse property rights over DWSS at community level. According to the literature, the PRS included above has been identified in official water institutions structure. However, in customary institutions there are also rights in action that are not included in table 2.1 neither legitimised by water authority but that let unauthorised users access water in reality. This point will be explained and proved later on in chapter six of this thesis. Thus, it is relevant to recognise there are rights in action of community members and water committees to use water, which are differently recognised by customary institutions, as it was explained in section 2.3.2. Holders/actors can exercise these rights according to their position. This property rights scheme offers different terms to use for analysing the realities of rights in use in customary communities that manage and govern drinking water.

Property rights over water resources and water rights issues have gained attention in governance discourse generated at international conferences about water resources (Rogers, 2002; World Water Council, 2005; Smets, 2006; Wilder and Romero Lankao, 2006; Yuling and Lein, 2010). The World Water Council and WHO consider that the world population should have right to water (World Water Council, 2005; WHO, 2007). There is also discussion about the economic and human aspects of water. These international institutions wonder whether water should be considered a human right, an economic resource, or an economic and social good to make DWSS available to the households (Gleick, 1996; Briscoe,

1997; Brikké and Rojas, 2001; Gleick, 2003; Biswas and Tortajada, 2010; Tortajada, 2010). This section theorised about property rights system; thus, the following subsection theorises about water rights.

2.4.3.2 Water rights

In order to conceptualise water rights it is necessary to first explain that rights are actions authorised by a legitimate water institution or acknowledged by water users (Schlager and Ostrom, 1992). A right is also defined as the product of rules. Rights involve actions supported, enforced or condoned by the government or by society through law, custom or convention (Ribot, 1998). Linking the definition of rights to water resources, water rights are conceptualised as the ‘right or permission that provides its holder with the authorization to take water from a particular source’ (Beccar *et al.*, 2002: 11). Water rights also define the authorised right to use water and/or the water infrastructure. This also includes the right to the system of water allocation (Roth *et al.*, 2005; Boelens, 2008).

For authors working with concepts of common property or legal anthropological perspectives, water rights can be seen as ‘bundles of rights’ that include several types of rights (Von Benda-Beckmann, 1995; Agrawal, 2001). Water rights diverge across property regimes, legal orders or mechanisms, and cultures with specific meanings and values regarding water resources (Roth *et al.*, 2005). Water rights are also defined as the ‘claims to use, derive income from, or control water by individuals or groups that are recognised as legitimate by a larger collectivity than the claimants and that are protected through a form of law,’ either official or customary (Roth *et al.*, 2005: 241). Based in the definitions of previous concepts, this research acknowledge water rights as the claim or permission that authorises holders rights to take water from a particular source, to use it, or to obtain economic benefits from it.

The rights, rules and duties related to drinking water are linked to a diversity of socio-legal frameworks at the community, local, national and international level, which are embedded in a plurality of local and community organisational forms for regulating and distributing the DWSS (Boelens, 2008). In this sense, water

rights are not necessarily regulated by a written law; some actors have gained water rights through the continuous physical labor they have provided or through historic use of the water (Boelens, 2008).

Water rights have emerged over many years of negotiations about the historical use of labour investment (Boelens and Zwarteveen, 2005; Boelens, 2008). Nevertheless, in neo-liberal thinking, water rights are closely associated with discourses of privatisation, which consider that drinking water should be transferable and marketable in order to be economically efficient. These market-based demands allow water to be priced. According to these neoliberal trends water rights are gained through payment for those rights rather than through many years of labour or negotiations between the society and the authority (*ibid*). In countries like Mexico the political and economic power structure has an important influence on the allocation of rights; specially, formal water rights. However, there are also legitimate property rights accepted at community level. It will be important analysing the types of water rights accepted in communities (Boelens, 2008).

There are communities where socio-legal institutions legitimise community water rights. The water rights of a community are generally recognised by the politico-legal institutions related to water governance, allowing customary institutions and users to manage water either to provide the DWSS or to irrigate their lands. Holding water rights does not mean that the same institution is always allowed to adopt full responsibility for organising, managing and collecting user payments. By contrast, differently legitimised institutions might share some activities.

Scholars have found two main types of rights that legitimate the mechanisms to govern; first, territorial rights, which are related to the organisation of water users and the distribution of water amongst them (Beccar *et al.*, 2002); for example community sense, water committee organisation, and proprietors of a water well. Second, historical and cultural rights gained through labour investment and cultural resources in the construction of the water infrastructure; for example knowledge, skills, self-esteem, property arrangements, power relations and obligations (Von Benda-Beckmann, 1995; Beccar *et al.*, 2002; Chimhowu and

Woodhouse, 2006; Boelens, 2008; Sikor and Lund, 2009). Labour investment, has been helpful in many cases for identifying who in a community has the right to use water and who can influence the decision-making process (Boelens and Zwarteveen, 2005; Boelens, 2008). With this differentiation and when dealing with water governance, it is possible to refer to an alternative classification of rights: collective and individual – or household – rights. Collective rights refer to the rights of a group of users. By contrast, individual rights denote the rights held by single householder water users (*ibid*).

Water rights holders may be individuals or groups of people, who obtain legitimacy from a variety of legal plural mechanisms such as official permission or concession title to withdraw water from a natural water body, payment for the water they consume as users, or community meetings to legitimate rights of a water institution member; such as a water committee member. When a community member is a legitimate one s/he agrees to work for the community as water committee member. The community population through customary or religious law or through social and political law recognise and accepts water committee members or external suppliers as individual water providers. Though, when there is no recognition it is difficult for an individual or an external group of suppliers have access to water resources to provide a community service because community members prefer keeping water rights under community control rather than open it to external inhabitants. This is because community members care about the ownership sense and property of water, wells, and the infrastructure.

In many contexts, water rights go beyond ‘formal’ practices (Helmke and Levitsky, 2004; Boelens, 2008; Matsinhe *et al.*, 2008). This means, there are also ‘rights in action’ that could be classified as the unauthorised use of water resources. Such rights are not usually legitimated by either customary or official authorities but may be legitimated by community members. Rights in action are the ‘actual’ or ‘real’ social relationships and particular contexts played out in a territory not connected to official permission. The institution that authorises rights to water does not usually regulate rights in action, which are socially accepted by custom or convention (Boelens, 2008: 486).

The following section discusses the concept of water governance and its relationship to decentralisation, community management issues and difficulties in governing water.

2.5 Water governance

With the increasing use of notions of governance, the governance concept has also been applied to the water sector through the conceptualisation of water governance. The Mexican president Vicente Fox, in the period 2000-2006, stated in his inaugural discourse at the Fourth World Water Forum that water should be considered a public good (Fox-Quesada, 2006a). According to the official and water experts' perspective (Savenije, 2002; Savenije, 2002b; Mugabi and Njiru, 2006; CONAGUA, 2008b), providing drinking water as a public good may be achieved not only through allocation and distribution of DWSS but also through water governance, which implies coordination, decision making and the operation of institutions at different hierarchical levels.

Diverse attempts have been made to define water governance. However, there is no agreement on a single definition. Water governance concepts vary according to the institutions and scholars working with water resources. Nevertheless, they all have common variables such as rules, decision making, the plurality of actors, management, water resources, provision of water services and hierarchical levels.

Water governance emerged to meet the challenges of management and administration of water resources faced by the State (Cosgrove and Rijsberman, 2000; Martínez Omaña, 2002; Mukherji and Shah, 2005; Allouche, 2007; Franks and Cleaver, 2007; Alsharif, Feroz *et al.*, 2008; Biswas and Tortajada, 2010; Jiménez and Pérez-Foguet, 2010; Tortajada, 2010; Wilder, 2010; Biswas and Tortajada, 2010b), which was conventionally recognised as responsible for the provision of public services. The Global Water Partnership (GWP) states that 'water governance refers to the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society' (GWP, 2003: 2).

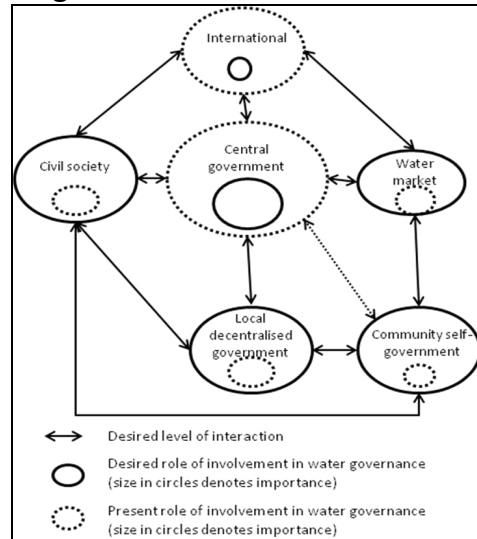
The GWP concept of water governance involves the participation of different actors who shape the roles and responsibilities of the public sector, civil society, private sector and individuals in the management and development of water resources at different levels (Sandoval Minero, 2007). In the concept of governance of the DWSS used in this thesis there are also actors from the public sector, *i.e.* AyST -the decentralised water institution; civil society are those community groups that organise and govern the provision of drinking water, *i.e.* water committees and community members organised in groups; private sector is represented by local water vendors and well proprietors; and individuals are those domestic water users. The reason to name differently the actors identified by the GWP and those identified in my fieldwork depend on the precise actors identified at community level that can also be labelled and located in a category of those proposed by the GWP. The actions carried out by the different actors should be adapted to specific political context, laws, regulations, institutions, rules, financial mechanisms, civil society development and consumer rights (*ibid*).

As defined governance and water governance concepts involves the participation of multiple actors. Mukherji and Shah (2005) propose a scenario in which every actor should have a specific level of involvement within the water governance system to achieve positive outcomes. This proposed scenario suggest the recognition and allocation of more power to small communities and the reduction of power to large institutions; this perspective is also shared by Gregersen *et al.* (2007) who suggest governing by giving and recognising more power to lower levels. Rogers (2002), by contrast, sees governance as part of the physical and institutional infrastructure without considering the level of involvement of official and customary institutions at community, state, or national level.

Thus, based on the local governance perspective, Mukherji and Shah (*Ibid*) illustrate that local governments, civil society and markets might have more participation in the water governance to obtain positive governance and management results. By contrast, they suggest central government should reduce its functions and share some responsibilities with other actors. The same scenario could be applied to the governance of the DWSS taking into account the

particularities of individual cases (Mukherji and Shah, 2005). The following figure shows the recommended involvement for the DWSS at community level.

Figure 2.2 Desired water governance for the DWSS at community level



Source: Adapted from Mukherji and Shah (2005: 340) taking into account those actors related to the water governance and management of the DWSS at community level within the case studies.

Figure 2.2 is useful for understanding current relations in the governance of water. The dotted circle lines show the present relationships between the actors in water governance. The unbroken circles denote the desired level of involvement of every actor interacting at any hierarchical and horizontal level of water governance. This figure suggests an alternative way of involving the institutions governing the DWSS with a reduction in decision-making and management responsibility at the international and national level and a greater level of involvement by civil society, local government, community self-governments and markets for better outcomes (Mukherji and Shah, 2005). In addition, it suggests greater level of involvement and communication between civil society and community self-governments. Civil society and markets need to relate to national central government, and central government and community self-government need to relate to each other.

There are two main problems constraining the interaction of the actors involved and limiting the possibility of reaching the desired scenario framed in figure 2.2. The first limitation is the strong hierarchical structure currently governing water in most Latin American countries, where international and national governments

have a greater level of involvement in decision-making than local and community level. This is because national governments are required to fulfil international requirements of institutions such as the World Bank or the InterAmerican Development Bank as a condition of the budgetary loans borrowed by each country.

In Mexico, the World Bank asked as a condition of a loan to elaborate a national water law complying with international policies in which water had to be considered an economic resource and therefore priced. Nevertheless, some Mexican communities decided to maintain free of price their water resources even when international policies asked for it. The communities studied decided to price and charge for the DWSS. And groundwater within them is entirely governed, managed and legitimised by custom. National institutions also looked for the installation of a piped water network. Though, the adapting capacity to a piped water network has been slow; not all Mexican communities were immediately adapted to this requirement because their structure and needs were different to the ones established at national and international level. Some of them seem to better manage their groundwater when community householders had their own water well at home.

The second is the extent of involvement of community institutions in governing and making decisions. Community self-governments are frequently less incorporated than local and national governments in the water governance because there is no total recognition by the official-central government of their role in organising the DWSS. However, in Mexico there are cases where community self-governments take the responsibility of the total or partial management of the provision of the DWSS to community households and to maintain a water committee legitimised by custom. From this perspective, self-sufficient community institutions need to be recognised as able to govern and control the water available and provide the DWSS. An important factor of water governance is the community management of drinking water. It is important to recognise the participation and decision-making of individuals, society groups and customary

institutions in order to achieving positive outcomes in the governance and management of it.

In this way, water governance and water management discourses have emerged to facilitate different users and stakeholders' understanding of the organisation, allocation and distribution of responsibilities for surface and underground water. Water governance has been proposed as a solution to multiple challenges to the organisational structures that define a community, a region, or a country and involves different politico-legal institutions. Governing water is not easy because there are as many interests as actors in a water system.

Rogers (2002) sees water governance as just part of the physical and institutional infrastructure that is also part of the general aspect of social cooperation. According to this perspective the governance of water is part of a complex system of interactions among stakeholders, local actors and institutions. It is also part of the ability of these groups of actors to communicate with each other, classify the input and output of resources and energies and use their skills to make decisions that most benefit both the actors and the environment (Rogers, 2002). However, even with all the tools used in the governance process there can be overlaps or omission of information and activities among institutions (*ibid*).

There is a wide range of conflicts related to the ways in which water is governed and managed, especially when national sovereignty, social values and political ideology interact and there is no consensus on decisions. These conflicts can have a significant impact on the achievement of good water governance. Good governance of drinking water, as understood in this research, takes into account not only appropriate decision making considering users participation but also fast institutional answers to users' enquiries; for example, providing water with timeliness, quantity, appropriate infrastructure and methods for payments collection. The barriers to good governance usually grow when water rights are involved in the process of defining water allocation and distribution and when corruption is involved in the use of water resources (Gregersen *et al.*, 2007).

Official, customary and private politico-legal institutions play an important role in water governance and water management responsibilities. Institutions at different administrative levels are responsible for water governance (Rogers, 2002). Water institutions make decisions, allocate responsibilities to specific individuals, institutions or people responsible at lower governmental levels, and customary institutions. They also organise water and financial resources to develop water-related activities such as provision of the DWSS. Recent studies about politico-legal institutions claim that analysis of the institutional context can enhance institutions' ability to govern and promote the devolution of authority for managing water resources to the lowest government level (Gregersen *et al.*, 2007).

Gregersen *et al's* (2007) Australian case study reports that official government does not determine how water is allocated or distributed. Instead, it allows local and community governments to organise how water is used and by whom, recognising that local and community actors have a greater understanding of the local context and particularities of the resource's availability which allows them to allocate and use the resource accordingly. Thus recognition of customary institutions created by community members is relevant to understanding the governance of the DWSS at community level.

It is important to take into account that in the governance of water, the proposal of decentralising water institutions and privatising has resulted not necessarily in decentralisation but quite often in the re-allocation of responsibilities to lower governmental levels and also to community level (Liverman, 2004; Wilder and Romero Lankao, 2006). In Latin American countries, decentralisation has not necessarily been achieved in most of the cases even when it was proposed as part of national public policies and decentralisation discourses. Instead water institutions have been decentred. This means that water institutions maintain the official way of working and making decisions of central government but at different hierarchical levels and decentred institutions keep the same organisational structure.

In the 1990s some Latin American countries from the Andean region, as well as Mexico, decentralised natural resources management and some of these countries

privatised them. This is the case of Bolivia that aimed to promote property rights as a way to protect scarce resources such as water, forest, land, biodiversity and fisheries (Boelens and Zwarteveen, 2005; Boelens, 2008; Lehoucq *et al.*, 2005). The way these Latin American countries used to protect natural resources and justify decentralisation or privatisation was with the acceptance of neo-liberal models. The market was a priority; thus, pricing natural resources with the label of environmental sustainability was the approach used to utopically protect natural resources (Liverman, 2004). This section focused in water governance and decentralisation. The following section complements this chapter and focuses in the management of the DWSS by community institutions.

2.6 Community management of drinking water

‘Community management, a central part of community development, has gained wide acceptance among service providers as a result of the failure of the top-down approach to community development’ (Doe and Khan, 2004: 360). Community management is a bottom-up development approach where community members take the decisions and have control of the management, operation and maintenance of their community’s water system (Doe and Khan, 2004; Harvey and Reed, 2007).

Boelens (2008) lists the main characteristics that influence the use of water resources as control of the technical, organisational or socioeconomic and political domains. Some scholars’ (Bah, 1992; Doe and Khan, 2004; Harvey and Reed, 2007) support the view that community management may be the most convenient way to decentralise responsibility for the operation and maintenance (O&M) of the DWSS from central government to community management. Furthermore, these scholars argue, communities should own the water facilities and infrastructure for its O&M (Boelens, 2008). A relevant aspect in the recognition and encouragement of community management and adoption of responsibility to provide the DWSS is that community members should demonstrate a genuine need to and interest in assuming these responsibilities. According to this perspective, people should be motivated to organise themselves to manage their own DWSS (Bah, 1992).

Gregersen *et al.* (2007) suggest that the community management of water requires to be addressed by water governance studies to better understand the ways in which water resources are organised and distributed. In some communities the governance body, represented by a customary water committee, assumes total responsibility for DWSS itself and its management, infrastructure maintenance and repairs (Kyessi, 2005), and frequently the State government remains uninvolved in the service.

At the community level, the legitimacy of the governance model largely depends on the quality of the DWSS provided to community members by the water committee, the frequency of this provision, and the way in which the service is supplied to cover the requirements of the population (Von Benda-Beckmann, 1995; Welch, 2002; Roth *et al.*, 2005).

In community management legitimacy is important because it brings recognition of the water committee, as customary institution, by community members. If there is no representation and legitimacy it is difficult for the community governing institution to control and regulate the management of economic and non-economic water resources (Von Benda-Beckmann, 1995; Welch, 2002; Roth *et al.*, 2005; Bobbio, 2009). According to Welch (2002) better outcomes can be achieved at the local level if local governments are open to including participation and thus being inclusive of diverse groups or actors. This also applies at the community level. However, water governance at the community level has its own difficulties, as discussed below.

2.7 Difficulties faced in community water governance

Scholars have suggested that governments look for new governance strategies that challenge the new social, ecological and economic dynamics, especially regarding the provision of services around specific natural resources (González-Villarreal *et al.*, 2006). In the provision of drinking water the challenges frequently faced by community institutions relate to social, economic, and sometimes political community dynamics, as well as the dynamics of the institutions that govern and manage the DWSS at state, municipal and community level.

One of the main problems related to water governance is associated with the extent of actors' involvement in every administrative level as well as in the interaction among actors. The levels of involvement are conceptualised as vertical and horizontal (Chandhoke, 2003; Mukherji and Shah, 2005; Duit and Galaz, 2008; Armitage, 2008; Pahl-Wostl, 2009). In the institutional analysis of water governance of Ostrom (2005: 59), three levels of action are identified at community level: 1) operational, where individuals' actions regarding water use have to be analysed; 2) collective choice, where groups of individuals collectively develop common rules and strategies of water use; and constitutional, where formal rules for the use of water become law (Ostrom, 2005: 59).

Generally, central governments are characterised as being more important in terms of power and decision making than local and community governments. However, in practice power is not always held by central governments (formal) but by a community government (informal). A community government plays an active role in decision making. In this case, community members and its customary institutions assume responsibility for making common decisions and leading the operation of those decisions, especially when it comes to the provision of public services; for example, the DWSS. There are several cases in which not only the local level but also the community sphere is active in providing the DWSS to community members' households. This is the case of San Francisco, Santiaguito, and San Mateo, where members of these communities are organised in customary community institutions to adopt the challenge for governing a networked piped DWSS. Adopting this challenge, customary institutions maintain the property rights over water resources and its management.

Most water sector problems occur in the 'misallocation of roles and responsibilities assigned to various organizations that are in the business of governing groundwater [and surface water]' (Mukherji and Shah, 2005: 339). Good governance would consider the appropriate allocation of responsibilities, decision making, and the quick response to users' demands. Unfortunately, when it comes to the provision of a quality DWSS the achievement of positive outcomes remains partially unsolved. A high-quality DWSS is understood as

offering water with enough pressure, volume, continuity and water-quality, making fast repairs to the system, when necessary, in order to quickly respond to users' demands (Bourguett Ortíz, *et al.* 2007). Therefore, good quality operations include timeliness in the delivering process, maintaining the water infrastructure in optimal condition, maintain updated the system for pricing and bill collection for prompt recovery of water users' payments which consequently improve the quality of the DWSS received by domestic water users (Bourguett Ortíz *et al.*, 2007).

In addition, Babel *et al.* (2010) recommends taking into account the quality of water pipes, leakage reduction, penalties for illegal connections and keeping tariffs at a reasonable price to maintain or improve quality in the DWSS . The quality of the DWSS should not only benefit householders but also improve financial management of the water institution and then infrastructure maintenance of the DWSS.

Quality of the DWSS usually implicates considering the allocation of quantities of water to cover users' needs. Quality of the DWSS is not the same as water quality. Therefore, one more difficulty faced by customary water institutions is related to the quantity of water provided through the DWSS. A minimum amount of 50 litres per person per day is recommended to cover basic needs (Gleick, 1996; Abrams, 2001). Kumar and Managi (2010) suggest considering the hours of water supply, sufficient water pressure, predictability of the DWSS and purity of the water (Kumar and Managi, 2010) as indicators that might affect the amount of water delivered and then the quality of the service.

At community level, it is a challenge the DWSS because it requires both, quality and quantity. If there is quality in the service it means water is provided with enough quantity and maybe the necessary characteristics of pressure and timeliness. However, the provision of only quantity does not mean the service has quality. Generally, the communities' case studies have sufficient groundwater resources; nevertheless, the provision might not be guaranteed everyday. In these cases quantity of water available and provided does not mean there is an appropriate provision of a quality and good DWSS. Thus, domestic water users

have dealt with this challenge (quality-quantity of the DWSS) buying drinking water or obtaining it from different sources.

Low-quality of DWSS is exposed by cisterns and roof water reservoirs installed or built to store drinking water and make it available with enough pressure (Bourguett Ortíz *et al.*, 2007). The installation of these reservoirs generates extra expenses for householders. Bourguett Ortíz *et al.* (2007) point out consumption of bottled water for drinking as another indicator of the low quality of the DWSS. All the extra expenses that domestic water users have to pay for water are therefore reflected in their willingness to pay for the DWSS. Thus, governance of the DWSS gets the attention of water institutions to organise and work towards appropriate allocation and distribution of drinking water to users. The analysis and discussion of the governance of the DWSS at community level is addressed in the subsequent empirical chapters. The following chapter explains the research methods and techniques used for the data collection and analysis.

CHAPTER 3

Research strategy: approaches and methods

Chapter 3. Research strategy: Approaches and Methods

3.1 Introduction

This chapter explains the methodology used in this research to collect and analyse data related to the governance of the DWSS in three case study communities. The chapter is divided into five main sections. First, it focuses on the importance of the use of multiple case studies as a research technique; next, it introduces the selected case study area, including the geographical location. It then describes the methods and techniques used for the primary and secondary data collection, followed by discussion of the data analysis; and finally some conclusions are drawn.

The case studies focus on three communities – San Francisco, San Mateo, and Santiaguito – that are located in a peri-urban area. The reasons for choosing these communities were based on their customary organisation, operation, maintenance, management, and decision making in the governance of the DWSS.

In these communities its members have entrusted their water institution with responsibility for organising how drinking water is supplied to every household. The customary authority, integrated in a water committee, has the community's consent to govern and manage ground water. Even though customary authorities have domestic water users approval both actors maintain communication to agree basic topics such as the water tariff, periods of payment, days of service, and the period in which the water committee will be heading the DWSS that usually is for an average period of a year.

3.2 The research practice: use of a multiple case study approach

Case study research is a distinctive method for obtaining empirical data for social research (Yin 2009). 'A case study is an in-depth description and analysis of a single bounded system' (Merriam 2010: 456). This system might be a unit, a community or a government institution. A qualitative case study seeks to understand how individuals construct the meaning of an event or activity that occurs within their surroundings (*ibid*). Case studies of governance research have

been based on in-depth research into real-world events. Governance theory can be better understood when the research is based on detailed analysis of case studies, that can provide insightful evidence of relevant governance principles (Jentoft 2007).

On the one hand, doing case study research requires time and enough money to undertake the necessary visits, operations, and other required techniques. Jentoft (2007) suggests limiting the number of operation settings to be studied and compared in researches that use case studies. Case studies allow for the comparison of complex settings: for example, type of community organisation, the main authorities related to water administration, the availability of drinking water, problems with payment for a service, and the actors involved in a DWSS. Triangulation is an important way of comparing and contrasting different elements, environments, or realities (Lewis 1998; Pawluch 2005). Jentoft (2007) suggests an iterative triangulation where there is a large quantity of literature, case evidence, and intuition (Jentoft 2007). Triangulation of data allows refining conceptual definitions and strengthens the validity of the research and the testability of the theory under investigation. In this research triangulation was required to compare information provided by water representatives from an official institution, customary water committee members, domestic water users and small private vendors of drinking water.

On the other hand, too specific and detailed analysis can lead to difficulties when generalising individual case studies. The consideration of multiple cases let identifying similar patterns and decisions in water governance (Pahl-Wostl 2009). Therefore, this research required multiple case studies to understand the governance of the DWSS at community level. I decided on a multiple case study analysis focusing on three communities in order to contribute with to understand the way in which customary institutions are organised to rule the DWSS, provide it, and manage it. The selection of three communities helps to collect sufficient information about the provision of drinking water to do an accurate analysis of information and additionally situate my work on community-managed drinking water systems in Mexico.

The advantage of doing case study research in qualitative studies is its ‘ability to deal with a full variety of evidence [sources] – documents, interviews, and observation’ that allow to data triangulation (Yin 2009: 11). Yin states that, ‘a good case study will...use as many sources as possible’ (Yin 2009: 101). As mentioned, in qualitative studies the case study technique is useful because it involves data collection from different sources. Before I explain the relevance of case studies to understanding governance, Table 3.1 shows the strengths and weaknesses of the sources of information considered in the development of this research.

Table 3.1 Sources of evidence: strengths and weaknesses

Source of evidence	Strengths	Weaknesses
Documentation	Stable – can be reviewed repeatedly Exact – contains exact names, references, and details of an event Broad coverage – long span of time, many events, many settings	Retrievability – can be difficult to find Biased selectivity if data collection is incomplete Access may be deliberately withheld Overabundance of data
Interviews and focus groups	Targeted – focuses directly on case study topics Insightful – provides perceived causal inferences and explanations	Bias due to ‘poorly’ articulated questions Response bias Inaccuracy due to poor recall Reflexivity – interviewee says what interviewer wants to hear
Direct observations	Reality – covers events in real time Contextual – covers context of ‘case’	Time consuming Selectivity – broad coverage difficult without a team of observers Cost – requires hours of human observers’ time

Source: Adapted from Yin (2009: 102)

Considering strengths and weaknesses of data sources facilitate to take advantage of the time to obtain sufficient and reliable information from the considered sources, and to avoid or reduce inconsistencies in data collection. Using multiple sources of data to do this research let me find the evidence about governance of the DWSS and community-managed groundwater systems. In parallel, using multiple sources let me triangulate information in order to contrast, deny or accept the reliability of data.

3.2.1 The relationship of governance to these case studies

Understanding community-managed water institutions dynamics to provide drinking water allows to contrast information and to comprehend how these institutions interact not only with society but also with other formal institutions. Through triangulation of information from these case studies it is then possible to relate water resources management, actors interacting, decision making and consensus in order to better understand governance of the DWSS.

The methods used for this case study research were mainly qualitative. Four research techniques were used: interviews, focus groups, observation, and documentation. Each method has its own advantages and disadvantages depending, among other variables, on the research question. Data were collected from publications, official documents, and written reports. In this case study the researcher had no control over the events that occurred in the administration and distribution of water resources. The research focuses on contemporary real-life cases in a peri-urban context.

The richness of the case study approach was provided by the variables used to analyse governance theory. The definition of governance was approached from a political sciences perspective. Specifically, the research focuses on customary governance of the DWSS provided to peri-urban communities. Information was collected from multiple sources to obtain a reliable understanding of the concept and problems of governance, and of community and government organisation of the DWSS.

This study sought a wide understanding of the contextual conditions of the water supply service: how water is distributed, to whom, by whom, when, and for how long (Yin 2009). The methods used for data collection allowed me to understand the water authorities' decisions about the DWSS they provide to the communities they represent and real-life decisions and behaviours of the actors involved. Also, data collected allowed me to understand domestic water users' thoughts related to the quality of the DWSS that the water committee provides to community households.

The peri-urban research area is politically divided into municipalities – the lower administrative level –, which is further divided into communities. The three case study communities were San Francisco, Santiaguito, and San Mateo (see Map 3.1). The rationale behind the choice of these communities was that they: a) have similar domestic drinking water consumption practices; b) have similar organisation – through a customary water committee – of the administration, distribution and maintenance of their DWSS; c) obtain ground drinking water from wells; d) are settled in an the area characterised as hydrologically rich, allowing them to obtain enough ground water; and e) community members frequently do not receive the DWSS that covers their basic needs.

Water resources are mainly contained in surface water bodies and underground aquifers, the latter being the main source of water extraction for human consumption. According to studies by DDF (1951); DGCOH (1992); and CNA (2001), ground water is of high quality and meets the required standards for human consumption and food production.

There are differences among the three case study communities. In San Francisco and Santiaguito customary water institutions are responsible for the full management, operation, and maintainance of the piped water infrastructure, while in San Mateo a customary institution is responsible for the operation and maintenance of water infrastructure while an official decentralised institution manage prices and users' payments collection. This difference is important to understand the interactions and level of involvement of formal and informal institutions and actors in the management and governance of drinking water and the authority to make decisions about the service they provide in the community they represent. Another difference is the level of community members' trust in the customary water institution responsible for their DWSS. The inhabitants of Santiaguito and San Mateo trust their water committees more than those of San Francisco because their respective water committee better administer users' payments.

Analysis of a community context, using some statistics, makes it possible to comment on and analyse the dynamics of the regional context. This research

focuses on the analysis of DWSS dynamics at the community level, leading to an understanding of the main problems faced in the provision of the DWSS by governing water committees from customary communities. The following section explains the advantages of using different sources of information.

3.2.2 The use of documents, interviews, and direct observations in case studies

Data were collected from documents, interviews, and direct observations. The types of documents included were written reports about water extraction sources and the official concession titles granted by official government; minutes of decision makers and water committee meetings; administrative documents such as agreements between community members and their water committees; and scientific papers about water governance, community-management, governance of natural resources and water supply. The collection of accurate and reliable information from documental sources and from fieldwork would help as evidence to understand how theory about water governance, community management and legal pluralism are linked. Also, evidence gathered from fieldwork is useful to corroborate information published in documental sources. Data obtained from reliable interviews are useful to verify field observation, information found in documents, and to understand theory behind this research.

Interviews are one of the essential sources of information from case studies because valuable information can be obtained through in-depth guided conversations, which are generally flexible, depending on the kind of open-ended or closed questions asked, and follow a specific line of investigation according to preset guidelines (Chase and Alvarez 2000; Myers and Newman 2007; Marvasti 2010; Morgan and Hoffman 2010; Massey 2011). Interviews can be formal with a specific structured format, informal, or unstructured around a topic question (Frey and Fontana 1991). In the case study communities, semi-structured interviews with multiple actors – official representatives, community water committees, domestic water users, and local private vendors – were the main source of empirical data collection.

The snowball technique was useful for identifying key informants, with whom in-depth interviews were essential to obtain not only the facts but also their personal opinions about specific events. They also provided relevant information about specific sources of evidence. To avoid possible biases or the personal influence of key informants it was necessary to corroborate and contrast their information with that obtained from focus groups and individual interviewees. Though, a bias that might influence this research is the limited quantitative evidence because, often, quantitative information is not either generated or up to dated by water institutions and users.

Case studies research benefits from the theory that guide data collection. However, there is a concern attached to the use of case study technique: there can be a lack of rigour (Westbrook 1994) if the researcher misses systematic procedures that then generate equivocal evidence or biased understanding of the events, affecting the findings and conclusions. Therefore, triangulation is an important tool to solve, to reduce, or to avoid biases or misunderstandings because it allowed contrasting information from diverse useful sources.

By contrast, case study research also presents advantages when information is obtained via formal to casual observation (Westbrook 1994; Bryman 2004; Yin 2009). In this research I did casual direct observation on field visits and occasional fieldwork visits when I did interviews. I observed the quality of the drinking water supply infrastructure, the presence of cisterns, top reservoirs, water containers, bottled water, the quality of the DWSS provided and the traffic of water tanker containers.

During the fieldwork period I collected evidence not only through formal and informal conversations but also through direct observation of households, infrastructure, the DWSS and community members' activities in the three peri-urban communities of San Francisco, Santiaguito, and San Mateo. Observation provided additional information and evidence about the DWSS. In order to know the relevance of each research questions to methodology I address the following subsection to characterise the useful techniques per research question. Research questions, methods, and techniques are the key to collect the evidence that will

help to understand issues about water governance in the three studied communities.

3.2.2.1 Relevance of research questions to methodology

As mentioned in chapter one, four research questions guide the development of this thesis. These questions are relevant to methodology because each one is applied to the three case studies and designed to collect qualitative information. Each research question required the use of a specific research technique to collect accurate and reliable information. In this sense, question one about what are the disjunctures between official and customary water institutions governing the DWSS? used research techniques such as: semi structured interviews, document analysis, focus groups, informal talks, community meetings attendance, and observation.

The second question about how and why does the wide array of actors influence the governance of the DWSS in Mexico? used techniques such as: semi structured interviews, focus groups, and observation in order to collect information about the main actors interacting to provide drinking water at community level. The third question about what is a property rights system, and why is this important for decision making about the provision of or use of ground water for the DWSS? required information that was collected also using semi structured interviews, focus groups, and observation with the actors involved either in the management of drinking water or the use of it. Finally the last question about what difficulties do domestic water users and water institutions encounter regarding provision of the DWSS? was answered by collecting data through semi structured interviews, focus groups, informal talks, field observation and contrasting sources of information in order to understand the main problems faced by the main actors when it comes to the provision of the DWSS and the consumption of it.

3.3 The selected research case studies

The communities selected to explore governance of the DWSS were San Francisco, Santiaguito, and San Mateo (see Map 3.1 for their location). All are located in peri-urban areas that share some characteristics. First, all three are characterised as having a customary water institution. This customary authority is the water committee responsible for governing and managing the DWSS. Three main individuals usually form this water committee: the president, the secretary, and the treasurer. The second common characteristic is that all three communities withdraw ground water from wells that they own. Thirdly, they are all responsible for basic maintenance of the drinking water supply infrastructure.

One characteristic not shared by the three communities relates to water payment. Water payment is not necessarily collected and administered by the customary water committee but by an official water institution. In San Mateo, it is a decentralised institution called ‘Water and Sanitation of Toluca’ (Here after AyST) the one collecting and managing water payments; whereas in San Francisco and Santiaguito the customary water committee prices, collect, and manage the payment for the DWSS. Water tariffs in San Mateo are set by Toluca municipality city council that is responsible of water tariffs approval. Payments collection for the DWSS is responsibility of AyST. Analysis of these similarities and differences in the governance of the DWSS helps in understanding the strengths and challenges of customary institutions governing and providing this service to community households, and how these customary institutions are organised to prevail even in the face of pressure from formal institutions. Table 3.2 summarises the similarities and differences between the three communities.

Table 3.2 Similarities and differences among the community case studies

Community		Santiago	San Francisco	San Mateo
Characteristics				
Similarities	Customary water committee governs and manages the DWSS	Yes	Yes	Yes
	Water wells are property of the community	Yes	Yes	Yes
	Withdrawal of ground water	Yes	Yes	Yes
	Customary water committee assumes small and medium maintenance of water infrastructure	Yes	Yes	Yes
Differences	Water tariffs and payment collection are responsibility of the water committee	Yes	Yes	No
	Water tariffs and payment collection are responsibility of the official water institution	No	No	Yes
	Official water institution assumes large repairs and maintenance	No	No	Yes
	Community members and water committee assume large repairs	Yes	Yes	No

Source: Fieldwork

As with other services, the DWSS is influenced by urban growth, water governance and the management of water resources. Frequently, urban areas under expansion have had to wait for decisions and economic support from the official water institutions to create or expand the infrastructure for provision of their DWSS. Unfortunately, the DWSS is not often considered as high priority while other public services receive greater priority (Unikel 1978; Anthony 2007).

3.3.1 Positionality: relation to the study site communities

One of the externalities this research takes into account is the positionality of the researcher. Positionality is a concern that might have special influence in the interpretation of the empirical evidence; hence, in order to achieve a better and more reliable information management is necessary to take into account the relation the researcher has with the research setting/community (Hillesheim, and Mechtel, 2013). My positionality as a researcher is framed by my experience and contact with the studied communities.

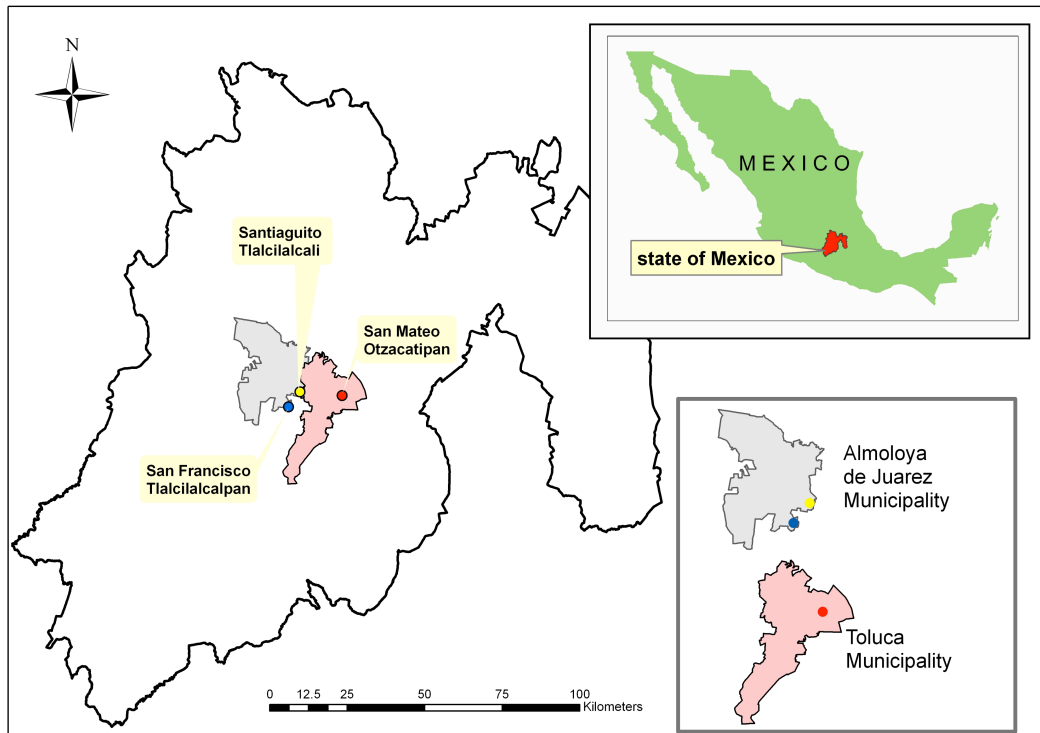
Taking into consideration that the research area is the place I lived since I was born and is the place my parents grew up I have a deep knowledge about social

dynamics and processes in the study site. I considered my positionality as an advantage to better understanding governance and management processes at local level. Also, I had access to obtain direct information from local representatives; especially from Santiaguito because this is the community I grew up. Additionally, I was allowed to easily enter to the community without major difficulties because I was a member of it. However, I faced a potential weakness as a female researcher because water committee representatives are get used to deal with male community members when it comes to discussions about water infrastructure and the specificities of the provision of the DWSS. This difficulty was faced by identifying myself in every interview and focus group as a student from a university. Also, justifying the objectives of my research and the dynamics I would carry out within the communities I was studying.

I am aware that being a community member might influence my preconceptions and that value judgements might have biased data collection; however, I was aware of this position and I managed to avoid it through the theoretical analysis of the empirical information collected. As a consequence/consequently, this research generated novel and objective results.

3.3.2 Geographical location of the case study area

The case studies are situated on the periphery of the Almoloya de Juárez and Toluca municipalities in the state of Mexico. Santiaguito and San Francisco lie in the political territory of the Almoloya de Juárez municipality, and San Mateo is in the political territory of the Toluca municipality. Almoloya de Juárez municipality is located to the northwest of the Toluca municipality. Toluca is the capital city of the state of Mexico, which is one of the 32 states into which the country of Mexico is politically divided. Map 3.1 shows the geographical location of Santiaguito, San Francisco, and San Mateo.

Map 3.1 Geographical location of the case study communities

Source: Self elaboration according to fieldwork information

Santiaguillo is to the northwest, San Francisco to the west and San Mateo to the northeast of Toluca city. San Francisco and Santiaguillo are located on the north face of Xinantecatl or Nevado de Toluca volcano, a water-rich area due to its volcanic geology. San Mateo is northeast of the north face of this volcano. The geological and geographical characteristics of the locations of these communities cause natural ground water storage. The region has both surface and ground water resources, which are used not only by the ecosystem but also by the population and for industrial activity. The hydrological characteristics of the area let water institutions use ground water to provide the DWSS. The aquifers of the area are also used to cover the water needs of different actors; *i.e* local private proprietors and vendors – via ground water extraction –, and domestic users – via the DWSS–. Ground water is also used for economic activities.

The study area is in the Upper Lerma Basin.³ The Upper Lerma region begins in the headwaters of the Lerma River, east of the basin, near Toluca City and 55 km west of Mexico City (Wester 2008). Lerma River begins in state of Mexico territory and ends on the border between the state of Mexico and Guanajuato state (This border crosses the Solís dam in Guanajuato state).

Contreras Dominguez *et al.* (1989) estimated that in the 1980s the state of Mexico had potential water availability of 3929.1 million m³. Of this, 18.06 percent (709.8 million m³) is available in aquifers and surface-water bodies that are located in the upper Lerma region (GEM 1984), which also is water-rich. Underground water is the main source of drinking water for human consumption and industrial activity, while surface water feeds the ecosystem and unfortunately also receives industrial wastewater. In the Lerma region there are two main aquifers, Toluca and Ixtlahuaca-Atlacomulco, which receive their names because of the area around them. The main surface water bodies are the Lerma River, the Lerma Lakes, the Antonio Alzate reservoir and the Ignacio Ramírez reservoir. The study area is in the Toluca aquifer area, which receives water from the slopes of the Nevado de Toluca and also has underground water reserves. The following section describes the main geographical variables of the area.

3.3.3 Geographical variables

3.3.3.1 Geology

The Toluca river basin is an important catchment area because of its geological structure and mountain-surrounded topography. Extrusive igneous rocks cover 57.5 percent of the regional area and predominate in the region (Contreras Dominguez *et al.* 1989), 23.6 percent is covered by alluvial, residual and lake soil, and 18.9 percent by sedimentary rocks (SARH 1983). These characteristics enable the accumulation of surface and groundwater resources. The area is located in a volcanic system.

³ The whole river basin is called the Lerma-Chapala-Santiago basin and has been divided into three large regions: Upper, Middle, and Lower Lerma. The Upper Lerma flows through the highland region around Toluca city which varies from an altitude of 1900 metres above sea level (m.a.s.l.) to 2600 m.a.s.l. (Wester, 2008).

In terms of the topography, 40.8 percent of the region is mountainous, 34.5 percent is flatlands, and 24.7 percent is hilly. The altitude varies from 2580 m.a.s.l. in the flatlands to 4680 m.a.s.l. at the summit of the Nevado de Toluca volcano (CNA 1992; IMTA 2002).

The climate in Toluca region and along the Lerma river basin is semi-arid to sub-humid, with 90 percent of the rain falling between May and October. The rainfall is variable. Statistics show an average rainfall of 722 millimetres per year (mm/year) between 1991 and 2001. The minimum registered was 494 mm in 1999 and the maximum, 1022 mm in 1958 (IMTA 2002). Monthly temperatures vary from 14.6°C in January to 21.3°C in May (Wester 2008). This information shows that between May and October there is greater water availability due to the natural recharging of the aquifers. During the dry season from November to April there are frequent DWSS problems, which raise the price of water on the local private market.

3.3.3.2 Social Variables

Historically, the upper Lerma region has been densely populated and the Toluca valley less so. Population growth is an important variable when analysing the provision of DWSS, especially because water infrastructure requires frequent maintenance and continuous expansion to include new urban developments (DDF 1951; DGCOH 1992; CCRECRL 1993; Albores Zarate 1995; CCRECRL, Aguilar Santelises et al. 1997; Wester 2008). Employability and income in the region vary according to area and the qualifications of the inhabitants. The quality of public services such as the DWSS also varies according to the water institutions' level of re-investment in infrastructure maintenance, management and water institutions representatives training.

3.3.3.3 Size of the study cases

The case study communities' populations and households have increased over the last decade, as shown in Table 3.3. The 1995 national census classified San Mateo

and Santiaguito as small localities⁴ with a rural population, while San Francisco was classified as a community with a mixed rural-urban population. In the next decade the populations of all three communities increased, there is population explosion in San Mateo, increasing its population by seven times, Santiaguito nearly doubling its population and San Francisco by 1.5 times by 2005 and double it by 2010. By 2005, Santiaguito was classified as a rural-urban community.

Table 3.3 Population growth of the case study communities, 1995-2010

Community Variables	San Mateo			Santiaguito			San Francisco		
	1995	2005	2010	1995	2005	2010	1995	2005	2010
Total population	2,253	18,871	22656	3,909	7,636	8761	8,797	13,721	16509
Number of households	409	3,868	5455	741	1,229	1633	1,671	3,035	5869
Average household size	5.5	4	4.7	5.3	5	4.5	5.3	5	4

Source: INEGI (1996); INEGI (2005); INEGI (2011).

By 2005, the urbanisation of the territory and the water requirements of these communities – classified in 2005 as ‘small cities’ because of their population size and mixed rural-urban population – had changed. By 2010, field observation and statistical projections had produced evidence of further population growth and urban expansion in these peri-urban cities (INEGI 2011a). Therefore, demand for natural resources increased. The population also required more infrastructures to provide public services such as the DWSS, drainage, electricity and roads. This thesis only focuses in the provision of the DWSS. Drinking water is an indispensable resource for human consumption (Gleick 1996; Gleick 2007) which requires the governance and management of water institutions according to population requirements.

There were problems for formal and informal water institutions with supplying a drinking water service to these expanding areas due to the rapid population growth and urban expansion. Suppliers could not meet the increased demand and water committees and even municipalities were unable to adapt to external urbanisation changes fast enough (Aguilar and Ward 2003; Mulwafu, Chipeta *et*

⁴ The terms locality and community are used interchangeably to name communities that share similar characteristics.

al. 2003). Urbanisation patterns were rapidly modified because of massive housing development. New housing development companies failed to meet their legal responsibility to ensure a DWSS to every newly-built house. These private developers should only be given building permission after demonstrating that they can ensure that the upcoming urban population will be provided with a drinking water service for at least ten years. They have failed in this through mismanagement and corruption. The municipal water authority recognises that:

“There are illegal payments in urban residential developments. Illegal payments are offered by residential developers to government employees to get permission to continue building houses” (Municipal water representative (AyST), Toluca, May 2009).

Peri-urban communities have frequent and recurrent problems to receive the DWSS because of the inconveniences such as the above. There are also managerial problems in the provision of the DWSS that are directly related to the financial constraints and administrative procedures of the water institutions concerned.

The number of houses in Santiaguito and San Francisco nearly doubled between 1995 and 2005, resulting in further demand of the DWSS. In San Mateo it increased nine fold because of the attractiveness of its location close to the industrial area, not only for people working in the Toluca-Mexico industrial corridor and industrial parks in the area but also for construction companies (Martínez Omaña 2002). While the number of houses increased, average household size decreased in all three communities. The following section introduces the rationale to choose the case study communities.

3.3.3.4 Choice of Research Site

The study area is known for its variety of natural resources – water, soil, forest, grassland, and mountain vegetation –, and because its weather, soil, and water conditions make it a rich area for agriculture. It is located in one of central Mexico’s water-rich areas (SARH 1980; CNA 1992; Rudolph *et al.* 2006; Rudolph *et al.* 2007). Its water resources not only make it suitable for the

development of economic activities but also attractive for population settlement (Contreras Dominguez et al. 1989; Camacho Pichardo 2007).

The main criteria for choosing this geographical space for my research include, *inter alia*, five relevant factors. Firstly, the aquifer formation and the mountain system surrounding the area facilitate the concentration of large quantities of water in the region. This is relevant to understanding that water supply problems are not always due to a natural water scarcity problem but can be anthropogenic (Mehta 2003) due to limitations in the management of the DWSS. The area's geological structure and climate variables enable aquifer recharge, facilitating water availability and its withdrawal.

Secondly, the area was chosen because it contains cities under expansion and urban growth requiring drinking water to sustain the population. The case studies act as samples in the quest to understand how the main components of the governance concept interact in peri-urban cities. In the study area actors, decision making and rules continuously interact in the governance of the DWSS.

Thirdly, the site is attractive for research because of the governance systems currently in place for the administration, operation, and maintenance of the underground water resources. There is not only an official but also a customary water governance regime. Customary systems are particularly used for governing the DWSS at community level. They are responsible for drinking water administration and supplying to community domestic users. Official and customary water institutions maintain a managerial relationship, which varies in every community. Therefore, it is important to understand the extent of the involvement of both water institutions in community decision making.

Fourthly, this study site is relevant because even when the area has enough water resources to supply drinking water there are still problems in providing the DWSS. Inhabitants of peri-urban communities frequently face non-provision of the DWSS and low water pressure, and consequently water insufficiency problems with multiple causes. The main problem is the economic constraints faced by the customary water committees to pay for expenses generated by the operation of the

DWSS to every household in the community. Additionally, every water committee have little experience of governing and managing the DWSS because they are changed in average once a year. Therefore, after one-year experience of water committee in providing the DWSS a new committee starts and it has to learn everything in one year.

The problems described above are mainly related to governance and management of drinking water; specifically, to the rules and their enforcement. Additionally, the economic situation of the communities studied can stress water problems because of the low recovery of the payments for the DWSS. The communities chosen for this research have a customary water authority responsible for the provision of the DWS. Each water committee has their own rules to provide the DWSS. The water committee authorities governing the service make decisions based on population demand and the strategy they consider appropriate for providing this service.

Finally, this research focuses on the community level to understand the processes of governance and social organisation dealing with problems in the DWSS. Therefore the research site selection is also based on communities facing DWSS problems caused, not by insufficient drinking water in their household, but by water administration problems.

3.3.4 The DWSS in the case study communities

In the case studies there is a relationship between community members and the authorities that govern the DWSS. In the first half of the 20th century, when the communities started to grow, domestic users freely collected water from the river. However, in the second half of the century the situation changed and the customary governance and management of drinking water began. In Santiaguito and San Mateo the drinking water management started with a common cistern in the centre of the localities from which householders were allowed to collect drinking water for domestic use. In Santiaguito, it had a one-inch tap and water was shared with a neighbouring penitentiary centre. This scheme worked four

years. San Francisco householders had their own private water-wheels from which to withdraw water.

The use of common cisterns and water-wheels rapidly changed from the 1970s onwards because the Mexican government aimed to modernise the country and the DWSS become one of the targets to modernise. In Santiaguito, a drinking water infrastructure and taps system was installed by community members' labour, sponsored by the state. Once the infrastructure was working it was governed by the community through a water committee, which has been governing the DWSS since January 1989. The other communities studied have a similar story.

San Francisco has had a DWSS since approximately 1970. Before this, the majority of households had private water-wheels to obtain sufficient water to cover basic needs. Drinking water was used for food production, cooking, washing, cleaning dishes and floors, bathing, drinking, and sometimes watering animals. Houses without a water-wheel would collect water from neighbouring houses, usually those of close neighbours able to share. However, over the years this system changed. With the installation of drinking water infrastructure, common and private water-wheels fell out of use and were covered over by their owners, resulting in water supply problems later. San Francisco's inhabitants started to face a lack of the DWSS due to repeated infrastructure and management failure. Water became an anthropogenically scarce resource, not because of the availability of the resource but because of managerial issues (Mehta 2003). When people realised that the DWSS was going to be intermittent they tried to restart their water-wheels. However, many had dried up because the water had found other courses to follow.

In the 1960s, the area surrounding San Mateo began to undergo physical changes. This peripheral area of Toluca City was expanding due to industrial development and consequently population growth (Unikel 1978; DGCOH 1992). Toluca airport had also been built in this space. As part of the airport development, and to compensate for any likely impact, the airport provided San Mateo community with a well and the necessary material to install drinking water supply infrastructure for a community DWSS. San Mateo started receiving the DWSS in

the 1960's. Before this, the majority of domestic water users had collected their water from a common well owned by the community or from private water-wheels. The implications of these changes are relevant for water governance to understand the implications of decisions-made by water institutions to face urban growth and drinking water demands. The institutions responsible for supplying San Mateo's DWSS are discussed below.

The population of San Mateo sometimes lacks drinking water supply even though the community owns the well. Governance and managerial issues cause water delivery problems. San Mateo has two different legal water authorities interacting in the governance and management of underground water: a customary authority that plans how the water is distributed and schedules the delivery of the service, and a decentralised institution called Water and Sanitation of Toluca (AyST, Spanish acronym) responsible for collecting payments for the DWSS from householders. The money collected is generally used for major repairs but not for service delivery, maintenance, or minor repairs. These two differently legitimised governing systems interact in the community to manage the provision of the DWSS.

The following table connects the community case studies to the main concepts emerging from the governance of the DWSS. These concepts form the basis of the research questions that guide the structure of this thesis.

Table 3.4 Connecting the case studies to the governance of drinking water

Concept Community	Formal water institution	Informal water institution	Governing water institution	Owner of the water rights	Actors/ Stakeholders	Water users' problems
San Francisco	No	Yes	Water committee	Community	Water committee, water users, local private vendors	Water shortages, water insufficiency, debt, extra payments buying water, ability to pay
Santiaguito	No	Yes	Water committee	Community	Water committee, water users, local private vendors	Water shortages, water insufficiency, debts, extra payments for drinking water, ability to pay
San Mateo	Yes	Yes	Water committee	Community	Water committee, water users, Formal water institution (AyST)	Water shortages, extra payments for buying bottled and water tanker containers

Suitable research methods and techniques were selected to answer the research questions and establish the relationship between the method and the information obtained by the researcher. Also, multiple sources of data were used to answer each research question. The following section then addresses the methods and techniques used to collect data.

3.4 Research methods and techniques for data collection

This research used qualitative methods to collect information related to the DWSS provided to the peri-urban case study communities. Qualitative research allows the researcher to adopt a critical position, avoiding value judgements, when exploring a research topic in depth (Arzate-Salgado and Arteaga-Botello 2007).

The qualitative methods implemented to collect primary data included techniques such as unstructured direct observation, snowball sampling to identify key informants, semi-structured interviews, and focus groups. The data collection in the three case studies took into account uniform criteria to classify general information about water governance and management in the peri-urban communities studied and then obtain particularities (Arzate-Salgado and Arteaga-Botello 2007), such as the quantity of water supplied to domestic users, timeliness of the service provided and received, quality of the service, and water payment collection, as indicators of how the drinking water service is supplied.

The use of multiple qualitative techniques such as interviews, focus groups, and observation allowed triangulation of information and helped to remove bias. Obtaining information from different sources made it possible to contrast different opinions and to corroborate information to support and validate arguments. The sampling techniques used to remove bias included not only random domestic water users but also key informants from government and water committees, community members and private water vendors in each community studied.

3.4.1 Qualitative techniques

3.4.1.1 Semi-structured interviews

Semi-structured interviews were used to interview government representatives and ex-representatives from different official water institutions at state and municipal levels as well as female and male domestic water users. The main topics were: the amount of water required to satisfy basic needs; main uses of drinking water; the quality of the service received; users' willingness and ability to pay for the DWSS; their perceptions of the water committee's performance; actions carried out by domestic users to deal with water inconsistencies; water prices; difficulties in recovering operation and maintenance costs, the extra expense of obtaining drinking water from water vendors and buying bottled water, proposals to improve the DWSS, and water authorities' perceptions of the DWSS they provide. See annex 1 called: 'sample of semi structure interviews design' that guide the development of the interviews.

In-depth interviews were carried out with some private well proprietors and local water vendors; well proprietors are local private businessmen who hold a concession granted by an official institution such as CONAGUA that allows them to open and manage water wells. These well proprietors and local private vendors were interviewed about the success of the local private market and the main problems they identify in the DWSS that communities and their water authorities face in providing the DWSS. They explained the reasons that prompted them to open a business selling drinking water to domestic users. The interviews also took into account the legal requirements that a water well proprietor needs to fulfil in order to obtain permission to open a well for business. Private well proprietors' opinions were important, because they provided information about the advantages of developing a private water market to provide the DWSS.

Based on the information obtained from interviews to private water vendors I approached a better understanding of the rules that govern the DWSS at community and municipal level. Through interviewing local private water vendors and well proprietors, it is possible to take a detailed approach to finding out information about the provision of this service that it was hidden or I had missed

in talking to members of formal and informal water institutions and domestic water users. Data obtained via this source was used to triangulate and validate information.

3.4.1.2 Focus Groups

Focus groups are a relevant source because they allow the collection of precise information from a homogeneous group of informants. I attended meetings of previously established discussion groups of stakeholders, academics, legislators and representatives from official institutions interested in main water sector problems, and I also organised small focus groups of four or five people from water committees or domestic water users in the case study communities. In these small groups women, as daily water users, were a key source of information.

3.4.1.3 Field observation

Observation is an important part of data collection. Very detailed observation is necessary in order to enrich research (Guthrie 1950). According to Bryman (2004); Arzate-Salgado and Arteaga-Botello (2007), research can include using not only structured but also unstructured observation. I collected information through from unstructured observation in the case study communities and the peri-urban area. Special observation was focused on each community and local private water wells; it was also important to carefully observe the drinking water infrastructure, and tap installations and their maintenance. Additional observation was carried out in the official institutions visited. Such observation allowed me to contrast the water management practices of water institutions governing the DWSS through detailed observation of daily life events.

In case study research, observations and written and photographic accounts are used to document the evidence obtained. The information collected provided further arguments to support the thesis that there are customary water institutions governing the DWSS at community level. Using case studies revealed that less than 100 percent of households have a properly installed tap system, and not all have storage facilities such as a cistern, top or ground reservoir, metal water containers, 20 litres bottles, etcetera, in which to store the litres of water provided

by the water institution. I also observed that in peri-urban areas in expansion marginal support from municipality and state government is maintained, which affects the management of the DWSS and the quality of this service provided by community water institutions consequently affecting community development due to water insufficiency.

3.4.1.4 Analysis of documents and secondary sources

Information from secondary sources was collected in order to analyse official water institutions' decisions and their implications for the governance of the DWSS in customary communities. Sources used included scientific reports, books, published and unpublished social, physical and environmental studies, official statistics on climate, underground water extraction and population growth, customary agreement documents and written laws. Data were obtained from the following institutions: the Mining and Geological Studies Institute of the State of Mexico (IFOMEGEM,), the Mexican Institute of Water Technology (IMTA), the National Water Commission (CONAGUA), the Engineering Institute from the Autonomous National University of Mexico (UNAM), the Faculty of Geography, the Faculty of Engineering and the Regional and Urban Planning Faculty of the Autonomous University of the State of Mexico (UAEMex).

The secondary data, which for the purpose of this research are mainly qualitative, are used to support the primary evidence and arguments. In some cases it was necessary to include quantitative information for more accurate and precise analysis. This research required quantitative information about the number of houses that receive and do not received piped water, water tariffs, and the quantities of water received and consumed by water users.

The following Table 3.5 connects the research questions to each analytical category together with the methods and techniques used for data collection. It shows how the key concepts, the actors, the methods and techniques used and the types of data obtained relate to one another. The table summarises how each research question, which is also linked to the analytical framework, was taken into

account in developing the thesis analysis. After the table, I explain how I collected the data.

Table 3.5 Linking theory, research design, methods and techniques

Research question	Key theoretical concepts	Participants: individuals and institutions	Research methods and techniques	Categories of analysis	Type of data obtained
What are the disjunctures between official and customary water institutions governing the DWSS? (Chapter 4)	<ul style="list-style-type: none"> • Legal pluralism • Formal (official) water institutions • Informal (customary) water institutions • Water governance 	<ul style="list-style-type: none"> • Government institutions (AyST & CONAGUA) • Members of the water committees • Well proprietors • Water vendors 	<ul style="list-style-type: none"> • Semi structured interviews • Document analysis • Focus groups • Informal talks • Contrasting sources of information • Observation • Community meeting attendance 	<ul style="list-style-type: none"> • Rules • Water tariffs • Operation and maintenance • Payment collection methods • Difficulties in collecting payments 	<ul style="list-style-type: none"> • Qualitative: interview notes, document information, • Fieldwork notes that let contrasting information from the three case studies.
How and why does the wide array of actors influence the governance of the DWSS in Mexico? (Chapter 5)	<ul style="list-style-type: none"> • Plurality of actors • Politico legal institutions • Domestic water users 	<ul style="list-style-type: none"> • AyST • Water committees • Domestic water users • Well proprietors • Water vendors 	<ul style="list-style-type: none"> • Semi structured interviews • Focus groups • Documents 	<ul style="list-style-type: none"> • Politico legal institutions • Water users 	<ul style="list-style-type: none"> • Interview notes • Documental notes
What is a property rights system, and why is this important for decision making about the provision of or use of ground water for the DWSS? (Chapter 6)	<ul style="list-style-type: none"> • Property rights system • Water rights • Decision making 	<ul style="list-style-type: none"> • Water committees • Well proprietors • Water vendors • Domestic users 	<ul style="list-style-type: none"> • Semi structured interviews • Focus groups • Observation 	<ul style="list-style-type: none"> • Owner, • Proprietor • Authorised claimant • Authorised user • Authorised entrant. 	<ul style="list-style-type: none"> • Qualitative: interview notes • Fieldwork notes
What difficulties do domestic water users and water institutions encounter regarding provision of the DWSS? (Chapter 7)	<ul style="list-style-type: none"> • Domestic water users • Householder • DWSS • Willingness to pay (WTP) • Ability to pay (ATP) • Trust in the authority 	<ul style="list-style-type: none"> • Household head • Domestic water users 	<ul style="list-style-type: none"> • Semi structured interviews • Focus groups • Informal talks • Field observation • Contrasting sources of information 	<ul style="list-style-type: none"> • Sufficiency of the water received • Water uses • Struggles to obtain water • WTP • ATP • Perceptions about the quality of the service 	<ul style="list-style-type: none"> • Qualitative: interview notes, observation notes, • Informal talks notes, field walks notes.

The data collection was carried out in two main stages. The first involved semi-structured interviews, focus groups and observation, and the second focused on gap identification through secondary sources. The following sections explain the sources of information and techniques taken into account to collect data.

3.4.2 Primary data collection

Semi-structured interviews were carried out with government representatives and ex-representatives from water institutions, customary authorities, legislators, private water vendors, academics and domestic water users. This stage was critical to understanding the drinking water supply problems identified by official and customary institutions, and to understanding the water authorities' priorities and concerns when making decisions about resolving DWSS problems.

The interviews included topics related to the institutions responsible for the DWSS, the actors involved in providing drinking water, managerial activities, water tariffs, collection of payments for the DWSS, the quality of the service and willingness and ability to pay. At the end of the interview stage a period of data analysis identified any gaps in the data, which was important because it helped to strengthen the information required for the second stage, thus refining the methodology.

The second stage investigated and analysed the relationships between the main aspects of community life – family life, household size, employment, community activities – and the use of the drinking water received for household activities. This information was obtained from the secondary sources detailed below.

To have a better understanding of the robustness of the study findings the following table summarises the number of interviews, focus groups, informal conversations, groups discussions, and field observation I had with the case studies with the different actors involved.

Table 3.6 Information about research techniques conducted

Research technique conducted	Participant	Number conducted	Date	Location
Semi-structured interviews	Government representatives Government ex-representatives	6	October-November 2008, June 2009 June 2009	(3) CONAGUA (1) CAEM (1) UNAM (1) AyST
	Private well proprietors	2	April 2009, June 2009	San Francisco San Mateo
	Domestic water users	10	February 2009, April 2009 January-February 2011	(4) San Francisco (5) Santiaguito (1) San Mateo
	Water committee member	1	August 2009	Santiaguito
	Academics	1	May 2009	UNAM
Focus groups	Academics	1	October 2008	UNAM
	Government reps.	1	October 2008	Legislators
	Water committee	3	July 2010	(1) San Francisco (1) Santiaguito (1) San Mateo
	Female water users	2	June 2010	(1) San Francisco (1) Santiaguito
	Male water users	3	June 2010	(1) San Francisco (1) Santiaguito (1) San Mateo
Informal conversations	Domestic water user	15	January-April 2009	(5) San Francisco (5) Santiaguito (5) San Mateo
	Private informal water vendors	3	April 2009 May 2009	(1) Almoloya (1) Toluca (1) San Francisco
	Bombero/pocero	2	April 2009	(1) San Mateo (1) Santiaguito
Field visits, unstructured observation, walks	Santiaguito	5	January 2009	Community and wells site
	San Mateo	5	March 2009	
	San Francisco	5	April 2009	
Attendance of groups discussion	Academics and legislators	7 (6 with academics and 1 with legislators)	October 2008 November 2008	Mexican Association of Hydraulic (AMH)
	Community meetings	2	January 2009	(1) Santiaguito (1) San Mateo

Source: Fieldwork

Apart of these mentioned techniques used, I also attend 5 academic presentations and I participated in a 7 months water research with research members of the Engineer Institute of the National Autonomous University of Mexico (UNAM). After more than two years of academic discussion of ideas, experiences, and research proposals about the main problems faced by the water sector in Mexico,

a group of academics from UNAM, in collaboration with stakeholders, students, researchers, representatives of different governmental levels, water users organisations, and civil society, have collaborated in order to generate a document called ‘Strategic Orientations II’. I participate with them in ‘Strategic Orientations II’ project. In this period there were analysed the main water problems that affect the appropriate development of water-related activities in Mexico, also there was a proposal of likely solutions and a proposal of policy implementation about water issues in Mexico. The following subsection list the actors and institutions taken into account to collect data during the fieldwork period.

List of interviewed people⁵

Semi structured interviews with employees of official government institutions

- CONAGUA Engineer, Toluca. Retired from the National Water Commission. Currently he is working in the Agrarian and Livestock Development Secretariat (SEDAGRO) at state level. He also does some research about spring’s area reduction.
- CONAGUA Engineer, Toluca. Working at the National Water Commission at the regional level (only in the state of Mexico) as sub-manager of water management.
- CAEM Engineer, Toluca. He is currently working at state of Mexico Water Commission in Toluca. He is working in the operation area and ecological perspectives.
- UNAM Engineer, Mexico city. He is retired from the National Water Commission. He is currently working as a researcher in the Engineering Institute of the National Autonomous University of Mexico. He has experience in urban hydraulic. His researches aim to study water infrastructure.
- AyST Public Administrator, Toluca. He works on water finance, public policies, and rights at the Municipal level.

⁵ To protect interviewees’ safety and confidentiality their personal information is not included. I will only include their position and the city they are working in the list of government representatives, water committee members, and domestic water users. The most important characteristic of interviewees is their job position and the institution they represent.

- CONAGUA ex-employee, Toluca. Currently is a water user. He used to work in the Public administration of water in Toluca. He was an inspector and technical of water infrastructure and has been working as reader of water meters. He has been the one responsible of operating the drinking water supply service in Toluca city.

Semi structured interviews with water committee representatives

- Water committee president, Santiaguito.

Semi structured interviews with domestic water users

- Male water user, San Mateo
- Female domestic water user, Santiaguito
- Female domestic water user, Santiaguito
- Male water user, Santiaguito
- Male water user, Santiaguito
- Female domestic water user, Santiaguito
- Housewife, San Francisco
- Housewife, San Francisco
- Female water user, San Francisco
- Housewife, San Francisco

Semi structured interviews with local private well proprietor

- Well proprietor, San Francisco
- Well proprietor, San Mateo

Focus groups with water committee representatives

- Water committee members, Santiaguito (president, secretary, treasurer)
- Water committee members, San Mateo (president, secretary, supplants)
- Water committee members, San Francisco (president, secretary, *bombero*)

Focus groups with academics

- Engineer, UNAM, Mexico city
- Engineer, coordinator of Mexican association for Hydraulic, Mexico city
- Dr., expert in water governance, UNAM, Mexico city
- Dr., expert in IWMS, water resources research centre (CIRA), Toluca.

Focus groups with legislators

- Senator and president of the water resources commission from the senators' camera, Mexico.
- Facilitator of LAN, Mexico.
- Juridical assessor and federal secretariat, Mexico.
- National Legislator and participant of LAN elaboration and up to dates, Mexico.

Participation within group discussions

- About Water Legislation in Mexico. Led by the President of the Senators at the Federal level.
- Integrated Watershed Management. With the lecturers from Inter-American Centre of Water Resources (CIRA).
- Water Governance. With Dr Fernando González Villarreal. AMH.
- Water and sanitation. Led by Dr Jorge Saavedra, Mexico city.
- Alternatives for supplying water resources. Led by Engineer Jesus Campos López.
- Research and capacity development to manage water resources. CIRA, Toluca.
- The media in the water management. Led by Luis Manuel Guerra.

3.4.3 Secondary data collection

Secondary sources were required to fill in the gaps related to information missed between formal legislation and customary community rules. They helped in understanding the water governance problem in a legal plural territory and among administrative levels. Secondary data were obtained from official national and state institutions' published and unpublished documents. Academic studies, both published and unpublished, were also analysed. After this refining stage, updated semi-structured interviews with domestic water users and water vendors and focus groups with customary water committee members, female domestic water users, and legislators were carried out which covered water needs, water sufficiency, service quality, water tariffs, payment for water, and actions carried out by

community members to deal with water shortages and the frequent lack of drinking water in their communities.

Information obtained in the second stage also included data about water quantity. However, the main focus was on collecting qualitative information about timeliness and quality in the DWSS delivery. Data were also collected about economic issues – water tariffs, water charges, payment and collection – and about the relationship between domestic water users and the customary water authorities, for example how people approach the water committee members to talk about debt, lack and shortage of drinking water, and leaking pipes. Information about community members' actions to obtain drinking water to cover their needs was also obtained. Finally, domestic users were asked what strategies they thought might be relevant to improving the DWSS. These data helped in understanding of water governance at the community level.

Unstructured observation carried out at any time was also relevant. It provided information about participants' behaviour and the environment they live in. The aim of using this technique was to comprehend, in detail, the factors that shape the problems of the DWSS and then develop a narrative account of participants' behaviour.

3.4.4 Selection of respondents

The respondents selected included decision-makers and representatives of customary and official water institutions, domestic water users, academics, local water vendors and water resources professionals. The snowballing technique was used to identify key informants for in-depth interviews or focus groups (Bryman 2004). Using information collected from previous interviewees, snowball sampling guides the researcher to find key informants able to provide unique and relevant information about the research topic. Using this technique it was possible to arrange individual interviews with domestic water users, water institution representatives, academics and water well proprietors.

Focus groups were held with legislators, customary water committees, women and private water vendors. The number of people interviewed depended upon the

number of key informants and the availability of water institutions personnel and water users.

In order to obtain a broad understanding of water administration and to comprehend the roles and responsibilities of water institutions it was necessary to interview representatives of the following water institutions: National Water Commission (CONAGUA), state of Mexico Water Commission (CAEM), Water and Sanitation of Toluca (AyST), and customary water committees.

The rationale behind choosing multiple actors was that data from different sources would help to reduce or avoid bias. The richness of information obtained from diverse sources and points of view created a broad understanding about the provision of the DWSS in the communities studied and the main problems of water governance and management. It also helped to make an accurate analysis because of the input from the different actors. Multiple sources of information represent strength in the sample selection because they broaden the depth of the information obtained.

3.5 Data analysis

Data analysis of documents and text was carried out using the content analysis technique to quantify the data in pre-established categories (Bryman 2004), *e.g.* the numbers of wells managed by the water committees of each community, number of households, days of service, water tariff, payment collection and so on.

Codifying and categorising the information in variables related to the governance of the DWSS was carried out to do the analysis of the primary data gathered from the semi-structured interviews and focus groups. The data analysis focused not only on the water authorities' decision making but also on domestic water users' perceptions of governance of the DWSS.

The aim of the analysis was to identify the water committees' level of engagement in governing and providing the DWSS. The analysis also included practices to provide or to obtain drinking water not only from water committees but also from domestic users. The analysis included issues of decision-making, organisation and

operation of the DWSS, communication among water committee members and society, experience of water management, transparency of information provided to water users and the actions of domestic water users faced with the drinking water supply problems. Previous sections of this chapter aimed to address the methods and techniques used for data collection and its analysis. The following section concludes chapter.

3.6 Conclusions

A qualitative multiple-case study was chosen in order to obtain empirical evidence to understand, in detail, water governance in traditionally organised communities that provide the DWSS. The advantage of choosing multiple case studies is that they can help the researcher to understand real-life decisions and behaviours in order to provide solutions related to the DWSS. Using multiple case studies to do this research help to broadly understand the similarities and differences of traditionally organised communities to govern the DWSS. It also helps better understanding of the particularities of individual cases and then understanding general patterns of the customary governance and management of DWSS. These case studies focus on the governance of the DWSS in three communities in Mexico's central highlands.

Four techniques were used to obtain empirical data: interviews, focus groups, observation and documentation. Interviews were carried out to collect information from domestic water users, official water institutions, academics and private water vendors; focus groups were held with female domestic water users in the case study communities, water committee members, and legislators and official water institution representatives; and I also attend community members meetings in which householders discussed with the water committee issues related to the DWSS. These meetings were observed for an understanding of the organisational dynamics in a community and the water committee office to organise the DWSS.

Advantages were found to using qualitative methods to study water governance at the community level. The first of these is that analysis in a community context makes it possible to understand and analyse regional or national dynamics because

there are practices and decisions taking place in upper administrative levels. Therefore, from a particular case could be understood general and larger water governance dynamics. Second, it leads on to analysing and understanding the wider problems faced not only in the DWSS but also in the water sector in Mexico and Latin America. Water problems at community level are frequently a mirror of similar water problems faced some Mexican and Latin American communities because diverse communities share similar characteristics in terms of property rights to use natural resources such as water. Third, it allows data collection from different sources in parallel, allowing triangulation and validation of information to support the arguments of the thesis. However, the researcher should be careful when analysing and interpreting not only primary sources interviewed but also direct documental sources in order to avoid bias or miss information (Pahl-Wostl 2009).

The advantage of doing case study research on water governance is the facility and ability it affords to deal with a variety of sources of information because it let the researcher to explore different sources of information and then analyse data according to the particularities of the case study. I found that a main concern in carrying out case studies at community level relates to the kind of information available. For example, there might be no data generated in specific topics, or not up to dated and incomplete information. In my research I found there is not enough quantitative data available because is not generated. Neither there is systematic and precise information about money collected and money spent. These limitations are further detailed below in section 3.6.1. I collected enough qualitative information about the governance of the DWSS, but not enough quantitative evidence at the community level due to the lack of statistics. Most statistics are generated at the municipal, state and national levels. In interviews and focus groups there may be initial biases in the information collected, caused by the strength of personal opinion. According to Brenner (1981), obtaining response biases or poor answers are due to poor recall of information, poor formulation of the question, or because the data collection is not based on realistic settings (Brenner, 1981). I was aware of these concerns, and paid attention not only to how the questions were phrased but also to the interviewees' responses,

and reduced the likely restrictions and biases to the minimum through triangulation of information.

The advantage of using qualitative over quantitative methodology in this research is the richness of the data collected and the ability to compare, contrast and validate data with information from diverse sources (Lewis 1998). For more advantages of the use of multiple sources of evidence are found in Lewis' (1988) work. In addition, obtaining data from direct sources of information was central to this study because it allowed access to detailed information that would not be available from published or unpublished documents. Nonetheless, one of the main inconveniences or difficulties of dealing with primary data when using qualitative methods and techniques is the amount of time it consumes: for example if the interviewee needs to change the interview date, as happens particularly with government representatives and members of official institutions, the researcher has to adapt to the change and readapt her/his schedule. The other main difficulty that frequently limits a research is the expense of travelling, limited funding and the need to finish by a specified time.

3.6.1 Limitations of data collection

This section describes the limitations of the data collection for this research. One of these was the lack of access to information about the collection of water bill payments. Water committees do not always hold an updated list of householders and debtors or know the total amount they owe, and many community water committees do not have a detailed database of the amount of money they should collect from the householders monthly, nor a record of the amount they actually collect.

It was difficult to follow the budget and expenses – investment, weekly expenses, electricity fees, water concession title payment and money collected not only by water committees but also by AyST. Water committees not always keep the records from the previous committee administrations. Therefore, it is difficult for the researcher to obtain data from previous years. In addition, it was difficult obtaining specific information about total money collected from householders of

the communities because it was found that sometimes the treasurer of the water committee of one community had stolen domestic water users' payments and left the community without previous notice. The water payments are vital as they are used to pay the electricity companies for the energy consumed when providing the DWSS. Electricity is required to turn on the pumping system that diverts water towards the areas from which it is distributed. When a treasurer fails to collect users' payment or steals householders' payments, the committee's water budget starts again from zero limiting the provision of the DWSS. Therefore, the water committee commences again the actions to provide drinking water and reduce as much as possible further water shortages as a consequence of the lack of budget.

Finally, another difficult challenge in this research was collecting quantitative information about the amount of water supplied to and consumed by domestic water users because there is no data generated at community level.

3.6.2 Ethics

Ethical issues were contemplated in mind throughout the research, not only when collecting data but also in the interpretation and processing of the information collected. The sensitivity of information was taken into account by protecting informants' personal details and by appropriately using the information provided by these informants; for example, about strategic data, concession titles, well owners, debtors and quantity of water delivered to any of the community areas. All ethical issues were considered and highlighted on the ethical approval forms submitted to the International Development faculty committee following University of East Anglia regulations.

Ethical factors in three main categories are considered in this research. First, before each interview with key community informants and official representatives, the purpose of the study was explained, the interviewee was asked if s/he was willing to participate, and oral consent was obtained. Second, the data were professionally treated when processed and analysed in order to produce reliable information. Finally, ethics are essential for providing accurate and reliable data without compromising interviewee people. Ethics is also important to make sure

the information presented is authorised by the interviewee. Interviewees' personal information was kept anonymous to protect their privacy and security.

As mentioned before, this chapter aimed to analyse methods and techniques used for data collection. Methods and techniques were linked to the research questions; data collected with qualitative techniques and interviewed actors. The following chapters analyse the data collected to answer each research question characterised in this chapter. Each question will be analysed and discussed in a different chapter.

CHAPTER 4

The rules governing the drinking water supply service

Chapter 4. The Rules Governing the Drinking Water Supply Service

4.1 Introduction

This chapter analyses the formal law and customary rules of formal and informal institutions in Mexico governing water resources and management of the DWSS, paying particular attention to the community level. This chapter also discusses the disjunctures between official government and customary water institutions regarding the DWSS. This chapter uses the term official or formal to mean those institutions of government whereas customary or informal to mean those community institutions that are not governed by an official institution but by a community institution through their own customary rules.

The chapter is divided into six sections. This section introduces the chapter; the second introduces the national, state, municipal and community-level institutions that govern the DWSS in Mexico. The third section focuses on the formal law and customary rules governing water resources, with a particular focus on the DWSS. The fourth section analyses DWSS tariffs in both systems and contrasts those of government institutions with those set by customary institutions. The fifth section analyses the main inconsistencies in the legislation that affect the governance of the DWSS. Finally, the chapter draws some conclusions.

The governance of drinking water in Mexico involves institutions and rules of different origins and legitimisation. There are formal and informal institutions, which generate valid mechanisms of action that are legitimised by both the population and the institutions. In Mexico, formal institutions and laws govern water resources and related services – including the DWSS. There are more formal water institutions governing and enforcing the laws than informal institutions and customary rules. However, customary institutions are also valid in communities that validate this governance system.

At the national and state level, government institutions such as CONAGUA and CAEM are responsible for generating, approving and enforcing the laws and for allocating responsibilities to lower administrative levels. However, these

institutions are not responsible for the provision of public services such as the DWSS. At municipal level there are formal water institutions responsible of the DWSS. However, at community level there are some communities governing and managing the DWSS in their community. Some private institutions also participate in the management and provision of DWSS; especially in large cities in a few states in North Mexico. In the case study communities the rules are created and legitimised by customary rather than government institutions, making them more acceptable to community members.

Two main institutions govern drinking water and the provision of the DWSS in the case study communities. The first is a customary institution shaped by community members who form a water committee. Every community case studied has its own water committee that manage the DWSS. The second institution is the decentralised government institution AyST, which works at local and municipal level to provide the DWSS to many communities in Toluca municipality that are not customarily organised. In San Mateo community, AyST is responsible only for collecting householders' payments for the DWSS. It does not provide San Mateo households DWSS. Water prices are set by Toluca municipal city council. Only in Santiaguito and San Francisco the customary water committee is totally responsible of the DWSS, pricing water and collecting householders' payment for this service.

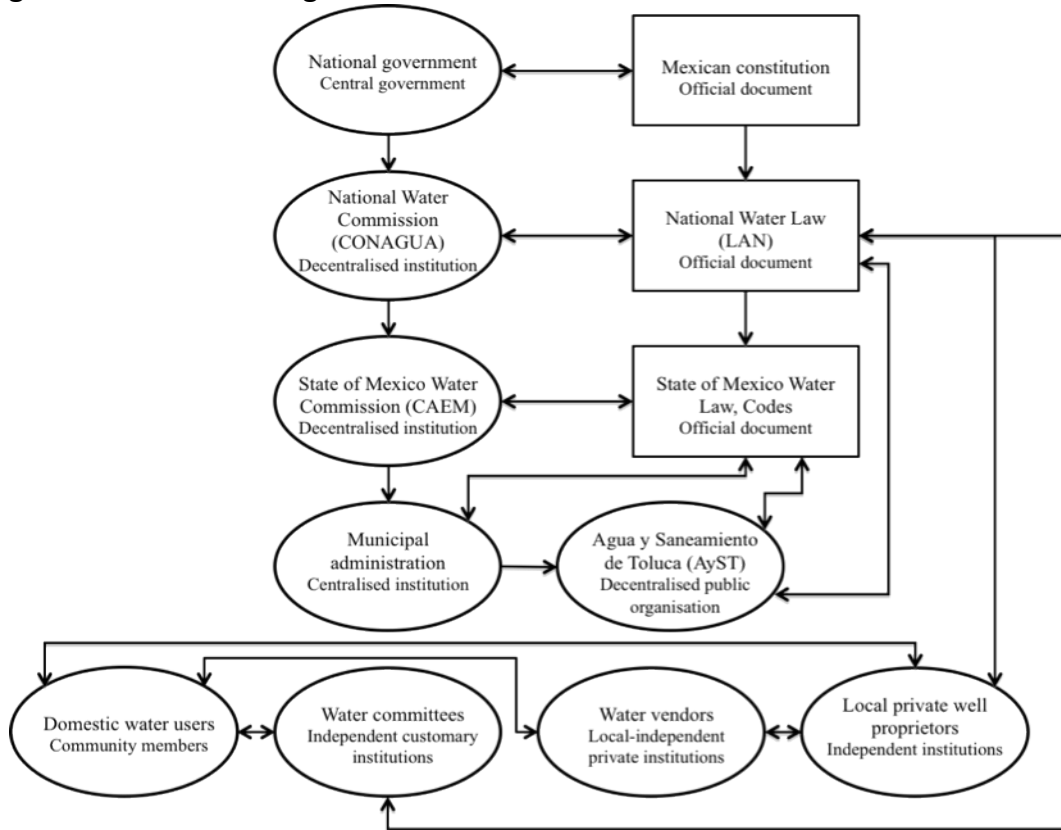
The main findings presented in this chapter are concerned with the disjuncture between the formal law and customary rules about water governance and the management of the DWSS. The interaction and opposite interests between formal and informal governance systems can result in lack of success in aspects of the provision of the DWSS such as the collection of payments for the DWSS. There is also a disjuncture in enforcement of and compliance with the law, which does not always match current needs to manage the distribution of the DWSS. Laws and customary rules work differently, not only between legal plural institutions but also because rules are sensible to the context in which they were created and are enforced.

4.2 Formal and informal institutions' interaction regarding the DWSS

The interaction and involvement of the formal and informal institutions that manage the DWSS is an everyday relationship. Each institution fulfils its own responsibilities based on rules legitimised by other institutions or the population. This pattern of interaction among the differently-legitimised institutions that provide the DWSS occurs not only at community level but also at municipal, state and even national level in different parts of Mexico, with State, customary and sometimes private institutions' laws and rules interacting around the management of the DWSS.

In Mexico there are national and state written laws governing the access to and withdrawal of ground water. At community level there are unwritten rules to govern and manage the use of ground water for a specific purpose. It depends what water is used for the law or rule considered to legitimise its access. For example, there are rules that legitimise the use of water to provide the DWSS, to commercialise it or for industrial purposes. Thus, each water institution at every administrative level considers as valid a specific law or rule according their main purposes. Figure 4.1 displays the organisational structure of the main institutions governing water resources in Mexico. This is a hierarchical structure that encompasses not only the main institutions and its relationships but also the laws and regulations followed by each one.

Figure 4.1 Hierarchical structure and vertical and horizontal relations in the governance and management of water in Mexico



Source: self elaboration

This figure shows the hierarchy of the State institutions and laws that govern water resources in Mexico. It also shows the horizontal level on which the customary institutions interact. The arrows show current relationships between water institutions and actors and also the law that is valid for every institution at each level. Single flow arrows connect in a unidirectional way hierarchical institutions and laws. Thus, in a top-down hierarchy single arrows connect the upper administrative level to lower administrative levels. In terms of legislation, the upper position of the law means the hierarchy in terms of power is higher.

The double side arrow shows the direct mutual relationships between institutions and laws or between two institutions. However, two laws cannot be mutually related. Though, one law might be linked to more than one different institution. In this figure; for example, a double side arrow connect the national water law to three water institutions; *i.e* private well proprietors, water committees, or AyST.

The arrows also show the relations between government and customary institutions and the laws and regulations applied to each one.

The figure pays particular attention to institutions related to the governance and control –management, operation and/or maintenance– of the DWSS. Water resources in Mexico can be managed by formal (official government), informal (customary) or private institutions. The main document and institutions governing water in Mexico is the National Water Law (LAN, Spanish acronym), created by CONAGUA (the National Water Commission). LAN is a formal written document regulating access to, withdrawal and use of both surface and underground water resources in Mexican territory. LAN complies with the Mexican constitutional mandate, whose 27th article states:

“Ownership of the lands and waters within the boundaries of the national territory is vested originally in the Nation, which has had, and has, the right to transmit title thereof to private persons, thereby constituting private property” (Congress 1967).

Coming down the formal hierarchy, in Mexico every politico-administrative state has its own document governing water, which is usually based on the LAN. For example, Figure 4.1 shows that CAEM, the decentralised state of Mexico Water Commission, has a water law and codes governing waters within state of Mexico territory and is responsible for the administration of water resources at state level. The laws governing water at this level are: a) state of Mexico Water Law (LIII Legislatura del Estado de México 1998); b) LIII Legislatura del Estado de México 1997, created by CAEM; c) state of Mexico Administrative Code (LIV Legislatura del Estado de México 2001), d) state of Mexico and Municipalities Financial Code (LIII Legislatura del Estado de México 1998b).

At the municipal level, each municipality follows the state’s and national mandates regarding water resources. Municipal institutions need a concession to access groundwater. Though, not all written rules governing water are recognised by each institution at municipal level. Instead, there are some institutions that legitimate agreements emerged by custom that are expected to be followed either by population, municipal water institutions, or community institutions that manage the DWSS.

Figure 4.1 also shows the formal and informal institutions involved in the governance and management of drinking water at community level – State water institutions and laws, water committees, private well proprietors and water vendors – all of which have specific laws and unwritten rules that are legitimised by members of the community that require their DWSS. It shows the institutional and legal framework governing water resources and the DWSS at national, state, municipal and community levels in Mexico, and the levels at which water resources are administered by specific institutions and the their main responsibilities.

Table 4.1 Regulatory institutions governing water resources

Laws and regulations		Institutions' responsibilities
Level	Document	
National or Federal	Mexican Constitution <ul style="list-style-type: none"> All waters are owned by the State 	CONAGUA (State, centralised) is responsible: <ul style="list-style-type: none"> For public policy (and its management) For water allocation For water regulation (through Official Norms – NOMs – for private actors) For investment in water infrastructure
	National Water Law (LAN) <ul style="list-style-type: none"> Establishes criteria by which to manage and allocate water resources No regulations regarding water supply or sanitation services 	
states	state of Mexico water laws <ul style="list-style-type: none"> Establish criteria for state water management and allocation Establishes criteria for allocating responsibility for the provision of water services. No clear definition of users and operational organisations' services, rights, or obligations. 	state water commissions (state, centralised) E.g. state of Mexico Water Commission (CAEM) <ul style="list-style-type: none"> Responsible for public policy Responsible for investment in water infrastructure Operator organisation actively participates in water management and regulation
		Congress <ul style="list-style-type: none"> Establish water tariffs. However there are no technical criteria to set water price the DWSS according to socio-economic characteristics of the community or area.
Municipal	Water service and sanitation regulations <ul style="list-style-type: none"> Few municipalities have regulations 	Operator organisation AyST (State, decentralised) <ul style="list-style-type: none"> Actively participated in water management and regulation Investment in water maintenance and large repairs Responsible for public policies
		City council (Cabildo) <ul style="list-style-type: none"> Approves or disapproves tariffs. There are no technical criterion by which to do this
Local level: decentralised water organisation	There is no official document but such organisations follow municipal, state and federal laws and regulations	State decentralised institution <ul style="list-style-type: none"> Recognised by State and state of Mexico government but economically and administratively autonomous. Has its own directive council of president, commissary, council representative, eg. Toluca water and sanitation. Responsible for water supply, fees collection and infrastructure maintenance.
Community level: independent water committees	Customary rules only	Customary authority. Organised and managed by community members. Even when there is no state registration the municipal government recognises its <i>de facto</i> existence.
Water users	Customary rules only	Water users manage their own water consumption

Source: self elaboration

The table above shows the formal regulatory framework and institutions governing and managing drinking water resources in Mexico from the national to the community level. The institutions that integrate this framework are the main authorities for the governance of the DWSS for domestic consumption. Each has specific responsibilities. Embracing a regulatory framework for water enhances the protection and conservation of water resources and its appropriate use. The water framework displayed in Table 4.1 contains the written legislative norms that institutions should follow in governing the DWSS. Accordingly, designing and applying policy should take this framework into account. At community level there is no a written regulation; however, Table 4.1 acknowledge there are customary rules used by customary institutions.

As Table 4.1 shows, the national, state and municipal institutions are responsible for drawing up public policy and for their regulation and management. Allocating this responsibility at every level has consequences; for example, responsibility for public policy overlaps across levels, affecting how legislation and responsibilities allocated to lower administrative levels are enforced. An example of overlapping activities was observed at the national, state and municipal levels, with CONAGUA, the state of Mexico and municipal government all assuming responsibility for public policy. However, in terms of the DWSS, CONAGUA directly allocates responsibilities to lower administrative levels.

In practice, there are no explicit mandates about the DWSS in state laws and regulations. Neither are states nor municipalities always responsible for its management because they delegate this responsibility to community institutions. In many communities in central Mexico there are self-sufficient water institutions in which community members, through a water committee, manage groundwater and provide the DWSS to community households themselves. For this reason, even when the LAN does not acknowledge water governance by informal institutions at lower administrative level, Table 4.1 includes informal institutions as part of the water governance and management picture at local and community level. This is a gap in the law and a potential knowledge problem to be analysed in this research.

This section has introduced the main written documents and institutions governing water resources in Mexico. The following section explains how these laws and customary rules are used not only by formal water institutions but also by informal water institutions. The section also explains how the relationships between official and customary institutions connect with the governance of the DWSS.

4.3 The formal law and customary rules regarding water governance and the DWSS

In Mexico, formal written law at national level set the rules about who govern the access and use of water resources, who is entitled to have a formal concession to withdraw water and, which institutions are responsible of water management available to be used for specific purposes. However, there are also informal laws and rules carrying out these activities but at local and community level. Therefore, through legal pluralism theory I analyse formal water law and institutions governing groundwater in Mexico and those informal laws and institutions responsible of water management at community level.

The Mexican Constitution is the main legislative written document that formally governs the country, institutions and individuals. This document allocates responsibilities to national, state and municipal institutions. It also gives institutions agency to make strategic decisions and manage their own administration. Additionally, it enables particular official institutions to establish strategies for the management of natural resources and to implement policies and programmes dealing with the distribution and use of these resources.

The Mexican Constitution mandates public sector employees to provide their services following principles that enable improvement in the provision of any kind of public service (Cámara de Diputados 2010). Article 113 of the Constitution states:

“Laws about the administrative responsibilities of public sector employees will determine their obligations – bearing in mind legality, honesty, loyalty, impartiality and efficiency when they are providing a service – and sanctions when official offences occur” (Cámara de Diputados 2010: 74).

According to this article, the position that a public employee holds should not affect the way in which they develop their responsibilities. By contrast: public servants should follow the rules in coordinating the provision of public services and the appropriate administration of natural and economic resources. Therefore, based on formal mandates, the DWSS should also be provided by official institutions according to the legislation. Therefore, if governance and compliance with the legislation improve the quality of the DWSS may also improve. For formal water institutions, the implementation of formal law might bring effective results.

The Mexican Constitution mandates that formal water institutions should focus on three topics: a) the administration of economic resources for investing in infrastructure and services for achieving specific purposes; b) improving the efficiency of the technological infrastructure through the distribution of water, avoiding water loss and measuring water for accurate charging and the recovery of financial resources through the payment for the DWSS; and c) providing public administration according to the principles of legality, loyalty, honesty, impartiality and efficiency (Cámara de Diputados, 2010). All formal institutions should consider these general statements. However, in terms of water,

Written law mandates are responsibility of specific institutions. CONAGUA, the State's main water institution, seeks to assume water governance and elaborate and enforce a specific water law, the LAN. LAN mandates could be implemented at lower administrative levels through state, municipal, or community water institutions. Though, LAN does not include a specific formal rule only to manage the DWSS.

Currently the only article of the Mexican Constitution that might indirectly include water supply issues is the 115. No other article mentions provision of the DWSS (IIJ-UNAM, 2011). Article 115 considers the states and municipalities as the politico-administrative composition of the Mexican federal government. The basis of the territorial division and politico-administrative organisation in Mexico is the municipality. Based on this article, there are three main principles behind municipalities: 1) they are administered by a council (*Ayuntamiento*) elected by

popular vote and there is no intermediate authority between the municipality and the state; 2) municipalities administer their own finances, composed of taxes, and are self-sufficient in meeting municipal needs; and 3) they have juridical autonomy to face legal purposes (IIJ-UNAM 2011). This gives municipal councils legal freedom to govern the municipality according to local needs. Decisions about the DWSS are made according to their municipal responsibility to improve the DWSS and their infrastructure, institutions and finances. Therefore municipal authorities make their decisions based on local needs and the budget obtained from federal government to implement such decisions.

As mentioned, article 115 does not specifically include the DWSS *per se* but it allocates responsibility for the provision of public services, including the drinking water supply, to municipalities. However, even when municipal public employees work to maintain municipal functioning, municipalities have several responsibilities and there are not always enough public sector employees to carry all of them out.⁶ Thus some municipal governments delegate some responsibility to self-organised communities. One of the main responsibilities frequently given to communities is provision of the DWSS, by agreement between the municipality and the community, or according to customary rules between community members and a water committee.

In a focus group carried out in October 2008 with national legislators and other government representatives, the legislator responsible of updating LAN mentioned that in Mexico there is no a specific legislation about water and sanitation. Legislators have not defined yet the main common variables that need to be regulated to govern the DWSS. Therefore, this is a problem in the provision of drinking water at local level because nobody takes serious responsibility about quality of the service. According this legislator, the lack of legislation for drinking water represents a limitation to the water institutions and the legislators governing and managing the DWSS because there are no standard rules that can be used for the equitable provision of drinking water, sufficiency, and quality service. Every institution at any administrative level follows a specific law according to their

⁶ Articles 108 to 114 of the Mexican Constitution regulate public employees' responsibilities.

responsibilities and targets. Its members make decisions convenient to the institution and framed by a specific set of rules and based on experience gained in the process of provision of the DWSS. However, these decisions are not necessarily the most convenient for domestic water users. A national legislator expert in LAN stated in the mentioned focus group:

“According to my experience there is no [a specific] legislation about the [provision of] drinking water and sanitation [services]. Modification of the 115 article is necessary [to include the provision of drinking water as part of the Sate responsibilities to meet peoples needs]. It is necessary a national policy [in terms of water and self-sufficiency of water institutions] and must be regulated. The law must be modified and must be faced with honesty and courage. We suggest that by law [decentralised] water organisations should have the concession to supply the [drinking] water service” (Legislator expert in LAN, Mexico city, October 2008).

Supplying drinking water has not been easy or successful for Mexican municipalities, firstly because they have a wide range of activities and services that limit their ability to provide a good-quality DWSS; and secondly because the municipal office responsible for water-related services usually focuses on general aspects of water and sanitation, together, than either drinking water supply or sanitation issues. Decision makers think that municipalities cannot totally manage their DWSS because of the lack of regulation in this matter.

Additionally, there is a recurrent problem of non-payment of domestic water users for the DWSS they receive from the water institution and consequently there is a debt from the water institution to the federal government. Due to these problems, municipalities tend not to be economically self-sufficient, and in consequence any investment to improve the DWSS is affected too.

Decision makers think that municipalities cannot totally manage their DWSS because they are not economically self-sufficient, and would not be able to recover the necessary investment for operation and maintenance costs from [domestic] water users if the law is not enforced. If there is not a clear water law that includes the provision of drinking water, the appropriate charges for it according to population socio-economic status, and cannot be properly enforced there might be troubles to become economically self-sufficient. The budget municipalities receive from federal government is not always enough to cover all

municipal expenses; and they still have debts with federal institutions such as the Electricity Company or with CONAGUA:

“The annual budget held by [decentralised] water organisations is usually divided in the following way: 30 percent is used to pay debts, 30 percent is for the payment of workers and 40 percent would be required for water systems maintenance ... maybe the authority tries to cover maintenance expenses, but in the short term” (AyST representative, Toluca, April 2009).

In addition, water users frequently suffer from a poor-quality DWSS, and the vicious cycle of lack of quality in the DWSS and lack of payment for the service, and low level of cost recovery continuously affects the governance and management of the DWSS. By June 2009, in an interview carried in Toluca municipality, a decentralised institution representative affirmed:

“Most municipalities are in deficit in terms of economic recovery from [the drinking] water service supply ... taking into account that there are 125 municipalities in the State of Mexico, there is 60 percent economic insufficiency [in terms of water-related issues]” (AyST representative, Toluca, June 2009).

The annual budget that municipalities receive from federal government through *Ramo 33*, a legislative norm to regulate federal budget expenditure, has to be invested in public services that become priorities. According to local and community water institutions members, the DWSS is not always a priority, even its importance. The budget obtained from *Ramo 33* is invested in solving urgent issues; for example, building schools and health centres, investing in security, expanding the water network, paving roads, buying administrative equipment, etc.. Nevertheless, for the municipal authorities, the DWSS is not usually considered the most important service at the point of decision making or is not the top priority at the moment of distributing budget to improve some public services. A member of AyST in an interview mentioned carried out in June 2009 complained:

“For decision makers, water is not always a priority because they know it is expensive to improve the infrastructure system or expand it. They would always prefer fixing leaks because is cheaper and it makes the idea within a community that they are working by improving the water network, but it is not like that” (AyST representative, Toluca, June 2009).

The DWSS might not be a priority when it comes to the budget distribution. However, it has become a recurrent problem in political discourses that are used to

gain citizens' votes in political campaigns. By 2009, in an interview a representative of AyST explained:

“Water is politicised.⁷ The municipal president thinks about what to do the following year when elections come and candidates seek votes. The drinking water [supply service] is the first service they propose improving, because they know everyone needs water and this is the campaign promise that might attract people's attention. Drinking water has been politicised. Water has been used as a measure for social control” (AyST representative, Toluca, June 2009).

Water is usually the main political campaign promise because candidates know that drinking water at community level represents the main problem that needs solution. However, water problems become only the political strategy used to gain votes but it is not their objective bringing solutions if their political party win the local election. In this sense, water is politicised but the drinking water system functioning is not necessarily improved. More about politisation is found in section 4.5 of this chapter.

To complement the role and responsibilities of municipalities in relation to the mandates of the Mexican Constitution, the legislators mentioned that there is a misallocation of activities between the state and municipal levels, and a frequent overlap of responsibilities. The State still has the political and economic faculties, which municipalities should hold. Where drinking water is concerned, municipalities need the authority to set rules that directly benefit their decisions and population. In a focus group carried out in October 2008 a government representative also commented:

“Article 115 is done in a very convenient way [for federal government because it protects its own interests]. This is a problematic article because it is not possible to have agreements with municipalities unless it is convenient for [federal government]. As they are today, the rules and laws are not working. We need to regulate the operational [water] organisations. We are in a very bad situation” (National legislator, Toluca, October 2008).

According to information provided by Mexican legislators in a focus group (2008), the main problem with the current water governance is due to failure to clarify and enforce the law. These laws might not benefit those who need them most, and by

⁷ Politicising any service is understood as the voluntary or involuntary actions carried out by the supplier against water systems functioning (Usobiaga Suinaga, 2007).

October 2008 the national legislators in a focus group suggested that it is relevant and urgent to write a new water law. They assessed the 2004 LAN as nothing more than putting a patch on the first LAN, which was issued in 1992, and concluded that it is necessary to rewrite and update the LAN with significant changes:

“There are challenges. There is agreement [among the majority of legislators]: the water sector needs a deep reform. The [national water] law does not work, it is necessary to pass another one but [the legislators] do not do that. Instead they start to reform other [laws], but this is not always efficient. Irrigation use and the drinking water [supply service] need to be regulated” (National legislator, Mexico city, October 2008).

Based on the legislators’ opinions, drinking water professionals and experts need an overall strategic vision that takes into account the infrastructure, finance, a solid administrative system, participation mechanisms and governance for the water sector. From their perspective, the best option is to modify the legislation, otherwise the governance of the DWSS might be affected (Silvano 2008).

An UNAM engineer, CONAGUA ex-representative and responsible for the national water programme (PNH) mentioned in an interview in 2009 that he saw the DWSS problems not as due to lack of clarity or enforcement of legislation but to the engineering and technical capacity of the water institutions to mend the leaks. He affirmed that 85 percent of drinking water infrastructure has leaks; the infrastructure is old and poorly maintained. And therefore, there are also problems with drainage, water treatment and governance:

“Once full responsibility was delegated [to official government institutions] to supply the drinking water [service], the government lost its capacity to do it. Unfortunately, people do not have the power to do everything, or to make decisions. The problem is not the law. When it is difficult to do something [to resolve a problem] or enforce [the law], government institutions modify the law. There are no mechanisms for enforcing the law. There are aspects that can be improved, but these are not [important to the government]. The solution is that the State retracts to provide the DWSS” (CONAGUA ex-representative, UNAM, Mexico city, May 2009).

Another problem is the institutions’ ability to comply with the law. In an interview, a retired from CONAGUA representative complained about the law relating to drinking water management and the institution governing it:

“CONAGUA does not have influence regarding the drinking water. It does not have [in practice] real powers to regulate the drinking water. Everything CONAGUA does is done by bending the law” (CONAGUA representative, Engineer, Toluca, October 2008).

According to information provided in an interview in May 2009 by an academic from UNAM and CONAGUA ex-representative, the main DWSS problem is maintenance of the infrastructure. This is directly related to the water institutions’ investment in maintaining, repairing and updating the infrastructure for the provision of drinking water. According to this ex-government representative, 85 percent of drinking water is lost through leaks and investment in infrastructure repair is low. According to academics and legislators’ opinion in a group discussion by October 2008, the reason for the increase of leaks is that

“Currently there is a tendency to reduce investment in the drinking water supply service and for allocating water for different uses. Government pay more attention to water for industrial purposes or irrigation because this is part of the main economic activities” (Academic and Mexican legislators, AMH, Toluca, October 2008).

Drinking water professionals see good governance in water issues as necessary to improving the DWSS. Water governance should consider not only compliance with plural legal laws and rules but also the opinions and requirements of domestic water users. The water sector requires the support of the legitimate water institutions and rules to allow official and customary water institutions to operate the DWSS according to local needs. Customary governance is analysed in section 4.3.4 and Chapter 5 of this thesis. The following section analyses water governance according to the LAN.

4.3.1 Governance according to the National Water Law (LAN)

Formal water governance in Mexico is directly associated with CONAGUA and the way in which this institution establishes the rules and enforces the LAN to govern all waters available in the Mexican territory. CONAGUA uses the LAN as the main document for governing all water uses in Mexico. Although the LAN allocates the water, CONAGUA assigns responsibility to other water institutions at lower governmental levels and manages water resources. However, in the LAN there is no mention of customary institutions organisation to provide the DWSS, and it pays little attention to the DWSS for rural communities.

The LAN allocates the management of drinking water for human consumption to lower administrative levels, such as the municipal, to cover the local DWSS. The municipality is officially the lowest administrative level of public administration (Cámara de Diputados 2008). The LAN recognises, in article 9.XIII, that the DWSS and sanitation in urban and rural areas is the responsibility of the state government working together with the municipality (Cámara de Diputados 2008).

The municipality, take this responsibility to provide the DWSS through the decentralised water operational organisations, such as AyST who provides the DWSS in most of Toluca communities. However, the current LAN also specifies that when the municipality considers it necessary it can contract or give the DWSS as a concession to other state governments or other actors such as private institutions, individuals, or community centres that have been granted a concession title by CONAGUA (*ibid*). The LAN does not pay particular attention to customary institutions. Actually, CONAGUA does not keep records about there are customary water institutions providing DWSS at community level; it mainly focuses on the government institutions that should provide water services included the DWSS at the municipal and state level. The LAN also focuses on the water resources required to develop irrigation, industry and urban systems' performance (Cámara de Diputados 2010).

According to the Mexican national legislators participating in the AMH and presenting in the group discussion in November 2008, in Toluca, the enforcement of LAN does not guarantee appropriate performance by the water institutions. They consider that official water institutions at the national level still require improvement in their performance in decision making, the management of financial resources, institutional organisation, the designation of responsibilities, and political will.

Accordingly, in June 2009, a member of AyST affirmed in an interview that there are ways of improving and achieving specific purposes. However, some problems need to be solved first:

“There are ways of enforcing legislative norms [for example, through the use of] internal regulations, financial codes, even the current LAN or the penal code. But [the problem is] there is no political will. The problem is that government lacks awareness and willingness to do its job” (AyST representative, Toluca, June 2009).

By contrast, national legislations, In November 2008 suggested that improvements to the LAN might also improve formal institutions performance. According to the academic literature, these changes and improvements are expected to be complemented by water institutions and actors through their participation and communication and linked among all vertical and horizontal levels in which water governance, and specifically the DWSS, is involved (Mukherji and Shah 2005).⁸

In a focus group carried out in October 2008, in Mexico City, legislators agreed that a new and updated LAN is necessary to regulate all water uses. Mexico has had the same national water law since 1992 with few changes, and these were not regulated or updated. Therefore these changes were not useful. As a consequence, the LAN is not fully considered by formal or informal water institutions at the point of decision making about what to do and how for implementing decisions and enforcing its compliance.

Legislators, academics and stakeholders participating in the group discussion organised by the AMH, by October 2008, agreed that updating the LAN is a challenge because it requires considering current realities in terms of who is responsible of specific activities, who will be responsible of managing water resources, which waters can be used, by whom, when, and in which amounts. Also, an update should wonder what is the main purpose of updating the LAN and to what extent this will be different to the previous one. LAN has been modified several times; however, it has not had real changes or every time the writing is more difficult to understand, applied and enforced. Legislators participating in this group discussion suggested that a more appropriate option would be to create a new document according to the new realities and including the different Mexican contexts. The following section focuses on the rules governing the DWSS through the LAN.

⁸ Vertical and horizontal levels are administrative levels through which governance takes place. The vertical level includes the international, national, regional and local levels while the horizontal level involves civil society, private institutions and markets (Mukherji and Shah, 2005).

4.3.2 Decentralisation of the DWSS in the 1992 National Water Law and water reform

The LAN came into force on 1st December 1992 and there have been several reforms since then. The main reforms took place in 2004 and 2006 when the legislators updated it. However, these reforms did not help to improve either the governance or the management of water resources in Mexico.

The concept of water reforms in Mexico has been characterized as a ‘shift from centralised policies ... to more decentralised schemes’ (Romero Lankao 2001: 1). Decentralisation is conceptualised as a policy used to guarantee governance improvements (Badenoch 2002). The Mexican government aimed to improve governance in general, including the governance and management of the DWSS. In terms of water management, the decentralisation was regarded as a legitimate way of justifying the modernisation strategy of the 1988-1994 National Development Plan. However, studies around this topic (Lehoucq et al. 2005; Wilder and Romero Lankao 2006) have found that Mexico’s decentralisation processes have not achieved governance improvement.

The water reform was part of a global modernisation perspective under World Bank guidance and funding which suggested the adoption of neo-liberal reforms and the acceptance of decentralised governance models (Wilder and Romero Lankao 2006). The decentralised models considered as important allow more privatisation around drinking water resources, water rights and changes to the water pricing mechanisms (*ibid*). Both the decentralisation and the privatisation were proposed as instruments to improve the efficiency of the irrigation and drinking water supply infrastructure and their services.

The water reform did not take into account local needs or the political, institutional, or organisational structure, and failed to achieve the aims of economic, social and political development that guided the country (*ibid*). The increasing gap between demand for the DWSS and investment in provision of this service led scholars (Lehoucq *et al.* 2005; Wilder and Romero Lankao 2006) to suggest that the Mexican water reform has not succeeded. What is more, national governments sometimes prioritise other economic and political factors over social

development and environmental protection (McIntyre 2007), paying more attention to decisions that generate economic growth rather than creating social improvements. For state and local governments probably the provision of the DWSS does not represent a service that generates profits because in states from central Mexico the DWSS has subsidy. At community level, the operational and managerial cost recovered only help to provide the service but not to make a profit. Therefore, for most of local and community governments from the case studies, the provision of the DWSS has not succeed and the decision to privatise or to totally give this responsibility to community institutions is taking place. This occurs with community institutions in Santiaguito, San Francisco, and San Mateo, they are organised by custom and do not follow formal law; however, they assume not only the provision of drinking water but also the challenge of collecting water users payments.

With the water reforms the LAN established water rights, allocate water uses for the different economic activities and domestic consumption, and management for all water uses and services. It also aims to manage the exploitation, distribution, control, use and preservation of water quality and quantity, in order to achieve integral sustainable development for agricultural purposes and population consumption (Cámara de Diputados 2008). Additionally, the LAN allows the federal government to grant concessions for the administration of urban and peri-urban DWSS to lower governmental levels such as states, municipalities, and non-state concessionaires such as the private sector and the industry. Granting these concessions reduces the federal government's responsibility for direct water management, although water resources for all uses legally remains under federal government jurisdiction (Cámara de Diputados 2008).

As mentioned before, the 1992 LAN has undergone several reforms, the largest being in 2004 and 2006. However, the water experts qualified these reforms as merely patching up the 1992 law, because the modifications to the law were not successful in practice. Specifically, the governance and management of the DWSS continued as usual with no practical improvement. In October 2008, National Legislators in a focus group affirmed:

“In 2004 the LAN was almost completely reformed; however the regulation is [still] the one from 1992. So, you might ask why the 2004 LAN is not used? If there is a reform in process, it is not worth regulating [the law] because in a short time it will be modified [again] ... In 2006, [the LAN] had almost 80 parts modified. However, tomorrow [16th October 2008] there will be a discussion within the legislative camera [legislators] ... The 2004 LAN was a disaster regarding water-related matters. It was a grave backward step in juridical matters for the water sector in Mexico ... The LAN lacks clarity; each time it is more complex. Therefore, it is more difficult to understand it and carry out it in practice, not only for CONAGUA but also for other actors” (National Legislators in a focus group, Mexico city, October 2008).

It is difficult to understand and implement a written law in Mexico; especially LAN, because it is complex; firstly, there is difficulty to understand the writing because of the vague concepts used; LAN is not an easy to follow law because the text is confusing. Secondly, because it has been modified several times and those modifications cannot always be implemented in practice. Third, LAN does not regulate how a good DWSS should be provided. And fourth, it does not group appropriate water tariffs suggested to be charged by water institutions according to population socio-economic characteristics, neither it regulate issues about payment recovery from householder water users and the reinvestment for improvements to the water infrastructure. Therefore, actors attempting to interpret and follow it may make omissions that nobody will take responsibility for. A law that is difficult to understand causes decision makers to avoid enforcing and following it, and makes users bend it for their specific purposes. This is recurrently occurring with the LAN.

Modifications to the LAN have suffered ambiguity because legislators responsible of its creation and modifications use vague concepts and technical language and writing that few law experts can understand. It is important that a national law could be understandable for everyone, experts and non-experts in law and water issues. Additionally, modifications to the law are expected being implemented. However, LAN cannot always be practically applied due to the articles might confuse the reader or there might be omissions of information that might be required in practice.

The problem of the reforms to the LAN and the lack of regulation affect water governance because the legislative norms cannot be enforced, and thus the

objective of providing a good-quality service also fails. The DWSS needs to be regulated according to local socio-economic characteristics and water availability. The LAN should consider social and cultural needs of population, governance structure and management practices in order to involve the participation of different water institutions and water users in the governance and management of the DWSS.

Currently it is recognised by water institutions and community members that there are customary institutions that assume responsibility for provision of DWSSs. These institutions establish their own rules and ways of enforcing them, which are legitimised by the population, who are then willing to follow those rules. Furthermore, DWSS authorities require continuous economic support to provide a good DWSS to domestic water users.

Currently the existence of the LAN does not guarantee a good DWSS that is provided with sufficiency, enough pressure, and timeliness. Community water committees face various difficulties, a common one being related to the full recovery of payment from householder water users. There are also practical limitations that frequently constraint to carry out successful water payment collection at community level. These limitations are related to the fact that many local municipal authorities and water committee members do not have the necessary professional expertise or training to act as tax collectors. They are community members, many of whom work in a different economic activity and support their community by providing the DWSS. Municipal water authorities and water committee members may not be trained to manage the water infrastructure, make decisions about maintaining it in optimal condition, or keep the team updated on water-related issues.

The LAN, as the main document governing water resources and the institutions governing the DWSS, should take into account the drinking water management of formal and informal water institutions, the socio-economic status of the population, and community needs in terms of water consumption. LAN should also motivate, through incentives, water institutions at municipal and community

level to provide the DWSS with enough pressure and quantity and when domestic users need it.

4.3.3 Municipal governance of drinking water

Like federal and state government, in accordance with the LAN, municipal councils, seeking to reduce administrative and financial pressures, delegate some responsibility to decentralised organisations, private institutions and independent customary institutions.

In the case study communities the only decentralised organisation is AyST, which assumes responsibility for the DWSS for most of communities located in Toluca municipality territory. Almoloya de Juárez municipality does not have a decentralised water organisation. However, the municipal water institution provides the DWSS to most of their communities. Though, in both municipalities there are also customary water institutions responsible of the DWSS in their community. Compliance of the formal law in every municipality and community depends on who establishes the rules to govern and manage the DWSS and if those rules take into account domestic water users needs and water institution organisation.

When a municipality delegates the DWSS to a community institution it not only means that the operation is moved from the municipal level to community level; other specific responsibilities such as water payment collection, infrastructure maintenance and updating the user database may also be transferred to communities. This means that the community institution responsible for the DWSS assumes full control of water management, operation and maintenance as it occurs with Santiaguito and San Francisco. According to information obtained from fieldwork, in many state of Mexico communities water committees take part in the administration and distribution of the DWSS. When a water committee governs and manage the DWSS, neither the municipal water office nor the decentralised organisation interferes with the making and enforcement of rules and decisions unless the community allows its participation. In an interview, carried

out in Toluca, an AyST representative mentioned that on average in each municipality of the State of Mexico:

“There are at least seven or eight independent water committees. These water committees are not [formally] legalised. This means that CONAGUA does not have a register of them. In the state only 30 percent of independent water committees are regulated and approximately 8 percent do not have an urbanisation permit [that entitle them to use drinking water from a specific well] and freely administer the drinking water [to provide a free DWSS in their community]” (AyST representative, Toluca, June 2009).

In the state of Mexico, thus, there are water committees in every municipality that assume full control of the DWSS, which because they are not recognised by CONAGUA as formal institutions, are classified by formal water institutions as unregulated bodies. However, the water committees have their own rules and are fully recognised in the communities that they serve, which see them as valid authorities governing and managing the DWSS.

In previous sections I have analysed the formal laws and institutions that set the rules governing water. The following section goes to the next level to analyse how informal institutions govern the DWSS.

4.3.4 Customary governance at community level: water committees

At the community level, the national or state legislation is not necessarily considered an instrument for decision making related to ground water management. Neither does it affect the election of water committee members. However, community water institutions require a formal concession from CONAGUA to withdraw and manage groundwater. The period of governance of each water committee depends of the agreements between community and water committee members rather than the municipality period or the law.

Customary rules govern the DWSS that manage San Mateo, San Francisco and Santiaguito communities. Customary rules are taken into account to govern and manage underground and surface water. However, the permission to access this water is provided with an official written concession granted by CONAGUA, which is giving water institutions specific property rights to extract and use underground water for human consumption. The rules governing water use are

agreed by community members and are as valid as State law. Nonetheless, there are different priorities involved on the governance of natural resources at community level. For example, the community carries out decision making by social consensus, so community meetings and social agreements are legitimate at the point of setting the rules and decision making. Mutual trust between the water committee and the community is important. Further analysis of community water management and the responsibilities of water committees are addressed in Chapter 5. The following section discusses an important topic implicit in formal and informal institutions' provision of the DWSS: the rules, and how water institutions decide on DWSS water tariffs.

4.4 Water tariffs for the drinking water supply service

According to the LAN, the municipalities are responsible for supplying and collecting payment for the DWSS (Cámara de Diputados 2008). However, in practice they are not always able to supply all users with the DWSS neither to collect payment from all users. A similar situation also occurs with self-organised communities that have a water committee responsible for provision of the service. This section discusses the water tariff accepted by Toluca municipal council. This applies only within Toluca's urban and peri-urban area, where San Mateo is located. San Francisco and Santiaguito communities have different tariffs agreed between community members and the water committee.

According to the information I collected during my fieldwork, official water authorities from national and state institutions find three main reasons for municipal authorities' inability to provide the DWSS and collect payment for it. Firstly, municipalities still have a busy agenda with many other responsibilities that make it difficult for them to focus on the payment collection for the DWSS, and are not always able to provide an efficient service to urban and rural areas, and so they delegate this responsibility to the community. Secondly, the water user database is frequently out of date, affecting full payment collection. Thirdly, the people involved in collecting and administering domestic water users' payments are not always experts at doing so. These factors affect the water finances and infrastructure.

Customary institutions also have difficulties collecting domestic users' payments, caused by out-of-date user checklists, lack of expertise of the people responsible for collecting payment and sometimes mismanagement of economic resources by the treasurer of the water committee. Customary institutions have their own set of rules for governing the prices set for the DWSS. The water committee assumes full responsibility for pricing the DWSS and collecting user payments. The following section analyses the drinking water tariffs approved for households by both official and customary legal systems.

4.4.1 Water users obligations to keep their right to receive the DWSS

According to the LAN, all water users must pay CONAGUA for the right to use water resources. In general, water tariffs are divided into five main groups: domestic consumption with a water meter; commercial consumption with a water meter; industrial consumption with a water meter; domestic use without a water meter; and commercial and industrial use without a water meter.

The tariff applied depends on the amount of water required by each user for specific activities: domestic, commercial, industrial, agricultural, etc. For example, a well proprietor pays CONAGUA for the right to extract water while a domestic water user only has to pay the official or customary water institution for the DWSS they receive at household level.

This case study focuses only on the tariffs paid by householders for water for domestic consumption. The tariff paid by domestic users usually depends either on the quantity of water consumed and the area of residence or it is fixed price agreed between the community and the water committee. It depends of how every community is organised. For example, in San Mateo, a household in a high-income residential area technically pays a higher rate for the DWSS than householders of a medium-income residential area or than householders living in a low-income house. Water tariffs for domestic users in a government-run water governance system are priced differently. Prices are normally agreed in the municipal city council according to the population's socio-economic characteristics, geographical location and availability of water resources.

For example, in Toluca municipality water pricing currently depends on the municipal, city council and AyST, which have approved the water tariff for the period 2007-2012. This tariff is valid in most of the municipal communities, including San Mateo community, where the official decentralised institution, AyST, collects the payment for the DWSS. Santiaguito and San Francisco water committees assume not only the provision of their own DWSS but also the pricing and collection of payments.

San Mateo community householders' payments for the DWSS to AyST are made every two months. The payments include the DWSS and sewage service but do not include wastewater treatment. The charge calculated for sewage is 20 percent of the total payment determined for water services included the DWSS (Gobierno del Estado de México, 2006). The tariff that water committees charge to San Francisco and Santiaguito community members only includes the DWSS. Tables 4.2 and 4.3 show the water tariffs for the DWSS for domestic use approved by Toluca municipal council. These tariffs are applied to the communities located in Toluca municipal territory. Table 4.2 shows the tariffs for houses with a water meter and Table 4.3 shows those approved for houses without a water meter in Toluca municipality. The prices are in Mexican pesos. As a reference, 13 Mexican pesos are equivalent to 1 USA dollar.

Table 4.2 Water tariff approved for domestic use in houses with water meter in Toluca municipality

Consumption rates limits (M ³)		Tariffs for domestic consumption	
		Low-income house	
Lower	Upper	Minimum tariff (Mexican pesos)	Tariff for m ³ extra
0	15	\$ 89.62	\$ 0.00
16	30	\$ 89.62	\$ 6.49
31	45	\$ 187.03	\$ 7.01
46	60	\$ 292.24	\$ 7.54
61	75	\$ 405.24	\$ 8.05
76	100	\$ 526.03	\$ 9.09
101	125	\$ 753.33	\$ 9.24
126	150	\$ 984.31	\$ 16.07
151	300	\$ 1386.05	\$ 17.57
301	500	\$ 4021.43	\$ 18.70
501	700	\$7761.84	\$ 19.63
700	1200	\$ 11687.88	\$ 19.93
1200	2000	\$ 21652.94	\$ 19.93

Source: Gobierno del Estado de México (2006).

The prices approved by the city council are decided for low-income houses; these are houses located not in high-income residential areas but in peri-urban areas with limited services. According to my fieldwork, urban households in San Mateo that are close to the city centre have water meters, which determine the total amount they need to pay for the DWSS.

Table 4.3 displays the water tariffs for houses without a water meter in Toluca municipalities. In San Mateo there are also houses without a water meter, mainly in rural and peri-urban areas. Based on data collected during my fieldwork period, the average a householder pays for the DWSS is \$300 pesos (around £15) every two months for the drinking water they consume and the expenses for the operation, maintenance and repairs of the DWSS.

Table 4.3 Water tariff approved for domestic use. Houses without water meter in Toluca municipality

Water tariff for domestic use (without water meter)		
Tap diameter (millimetres)	Description	Cost per two months period
13	Operation, maintenance and net reposition	\$ 76.16
13	Low-income rural household	\$ 202.99
13	Low-income urban household	\$ 225.28
13	Low-income media household	\$ 254.79
13	Low-income high household	\$ 344.91
13	Low residential household	\$ 479.94
13	Medium residential household	\$ 668.94
13	Medium-high residential household	\$ 1229.38
13	High residential household	\$ 2044.10
19	Special residential household	\$ 4279.67

Source: Gobierno del Estado de México (2006).

Water prices are approved according to the socio-economic status of the residential area that received the DWSS, what it is used for, and what is the social status of each household. An urban household, by law, should be charged more than a rural household for the water service they receive. This rule is only applied for urban areas where the official water institution provides water services. Table 4.3 shows the water tariffs for different types of houses. The higher tariffs are charged for medium- and high-income residential households. The higher prices probably reflect the quality of the water service provided, which includes daily drinking water provision, sewage disposal, infrastructure and maintenance. The

tariff charged takes into account whether provision of the DWSS is 24-hour, and its operation, maintenance, repairs and repositioning when necessary.

Table 4.3 shows that a low-income rural, low-income residential, or medium-income rural household receive a cheaper water supply service than urban, medium- and high-income households. The tariff that a householder pays also depends on the characteristics and quality of the DWSS provided in the area they are living. Usually, the municipal city council (*Cabildo*) approves the water tariffs for communities and villages that are part of the municipal territory. However, prices for DWSSs governed and managed by customary communities follow a different pattern.

Customary water committees manage the drinking water and charge for the DWSS in rural and peri-urban areas. The DWSS is priced differently from official institution DWSS. The lower cost of the DWSS in rural and peri-urban houses is based on the characteristics of the service, which tends to be provided only on two or three days a week. The price of water in communities organised by customary water committees reflects the limited pressure, continuity and timing of the service provided. Either, official or customary the pricing and management of the DWSS the water tariffs should be sensitive to any social, political, economic and environmental requirements of the geographical space, such as it was agreed by Tortajada (2010) and Biswas and Tortajada (2010b). The tariffs for the DWSS agreed between the water committees and community members in the three case study communities are included and characterised in Table 7.2 of chapter 7.

4.5 Inconsistencies in the legislation: main failures in water governance

According to Bourguett Ortiz *et al.* (2007) Representatives from official water institutions, affirm that there are four main reasons for water management problems: 1) lack of a good legislation; 2) lack of compliance with the legislative norms, 3) variety of actors and water uses and d) unpaid water bills. This information was corroborated in a group discussion with academics participating with the AMH, in November 2008, and semi-structured interviews with government representatives from CONAGUA, CAEM and AyST in October-

November 2008 and June 2009. Some of these difficulties are caused by the low enforcement of LAN because it does not specifically address the main consumption practices of underground water, identified in the field. Management problems are frequently related to financial difficulties operating the DWSS, collecting payment from all water users, managing and distributing drinking water resources, maintaining the system, recovering operational costs and reinvesting in infrastructure.

Customary water management practices do not necessarily take into account formal laws and regulations governing drinking water because customary communities have their own set of rules; for example, there should be a water committee governing and managing ground water, water committee should be integrated only by community members who have to be elected in community meetings, and that provision drinking water is a community service rather than a job. Their traditional way of organising themselves involves this set of rules, inherited over generations, which enables customary governance and management of water. Traditional or customary governance practices in the three case study communities have been learnt from experience and from elders. Learning from experience enhances social improvements of most community members, who decide their own set of rules and how to organise themselves. These communities follow their own rules, agreed within community members, rather than obeyed from the official water law. They also have their own tariff structure and arrangements for collection of payments.

Municipal water institutions receive a specific budget each year from the federal government to invest in and maintain the water infrastructure. However, informal institutions do not receive a budget because they are not included in the list of official water institutions. Customary communities rarely benefit from municipal financial resources unless the municipality assesses the need to improve the drinking water infrastructure, extend the system or dig a new well as urgent and highly necessary.

One more failure in governing the DWSS is in the formal hydraulic planning and daily water management of formal and informal institutions. National hydraulic

planning is not developed according to water management practices. The main problem is that the national hydraulic programme (PNH) pays more attention to activities that generate a profit for the water sector, such as the use of water for agriculture and industry, than to providing water for human consumption. This disjuncture, according to information provided in focus groups with academics, legislators and government representatives in Mexico, is caused by the different interests of formal water institutions enhancing water for economic activities, the legislation and the current management of drinking water. Legislation is mainly created to defend specific projects that might generally benefit the economy or private companies' investments. The problem occurs when projects accepted at state and municipal level are not compatible with society's common interests. According to academics' perceptions obtained from a focus group, carried out in UNAM in October 2008 the problem is closely related to decision making:

“The law says one thing – how the system should be built, when [and] where; however, the decision makers in turn are those professionals that make the final decisions. They decide according to their experience and perceptions rather than taking into account community [members] participation and common consensus” (Academics, UNAM, October 2008).

The current disjuncture between the two water governance systems is exacerbated by poor communication between the formal and informal governance systems and among administrative levels. My fieldwork identified that there is more communication about water-related issues between the national and municipal levels and between the national and community level than with the state level. A member of AyST, mentioned in an interview carried out in June 2009:

“There is no communication, mainly, between the states and the municipalities. There is a disconnection between CAEM [state of Mexico Water Commission] and the municipalities. It is supposed that CAEM officially plays the role of intermediary between CONAGUA and the municipalities ... however, this relationship usually occurs directly between federal government and the municipalities. Federal government only allocates responsibilities to [formal] institutions while municipalities carry out the activities in practice. Federal government creates the laws and municipalities execute them. Thus, CAEM, which is a state institution, remains relatively inactive” (AyST representative, Toluca, June 2009).

This disjuncture in the communication of information is a frequent cause of problems related to the governance and management of the DWSS: it is both a

problem at the point of creating and enforcing the rules, and affects provision of the DWSS in practice.

Political changes at state or municipal level are also significant at the point of making and implementing decisions and policies. The information management among official water institutions at state or municipal level can have serious implications when political parties are involved. For example, during election periods in the state of Mexico it is common to hear political parties promises to solve DWSS problems if the population vote for them. Candidates' main promises are to expand the water infrastructure, charge less for the DWSS and supply drinking water directly to households. However, after the election there is usually no improvement in either the infrastructure or the DWSS. A public administrator, representative from AyST, affirmed in June 2009 in a semi-structured interview:

“It is necessary to leave aside political barriers. It is necessary to leave aside ideas such as: if this governor comes from a different political party, public information [for example about costs, expenses, investment] shall be restricted” (Public administrator, Toluca, June 2009).

Governors and scholars have identified problems with the ways in which legislators and water institutions work (Béjar Algazi 2009). They raise three main issues: difficulty in understanding the legislation and failure to update it; lack of action taken by legislators and government representatives once they win an election; and the changes experienced every three or six years when a political governance period ends which affect water administration and the management of the DWSS.

With regard to the first of these issues, Mexican legislators and scholars (Lehoucq et al. 2005; Wilder and Romero Lankao 2006) think that LAN has had problems with clarity, fulfilment of the implementation of the law to govern and manage water resources and enforcement of the law due to continuous reforms. They are aware that LAN is not updated, despite the reforms. Legislators and CONAGUA representatives, in a focus group mentioned that they see each reform to LAN as document they had to bring up to date without bringing depth changes. It is only an up to date version of the previous LAN. Each LAN version has had few yearly

changes to the access to water resources and has the approval of water-related regulations. The changes depend on the main issues legislators need to discuss and quickly approve. Thus, it is difficult for legislators to discuss the truly important issues in depth because one year is not enough time to promote and to do a new LAN. They only have time to do some small changes and present them as an up to date LAN version. They consider it is important to reform and improve the legislation; otherwise water governance might be affected. In a focus group carried out in October 2008 with government representatives at national level, a public sector employee suggested:

“The option is to ask the legislators for a new water law. If we put another patch on the LAN today we may be making another mistake like the one in 2004. Instead, a clear, simple law, with few articles, with a short regulation, understandable to everyone, experts and non-experts, is needed. Non-experts have to become experts in understanding [the LAN] or the country would be going on without direction” (Facilitator of LAN, Mexico City, October 2008).

This point is important because it reflects the importance of making severe changes to the LAN. The reforms in 2004 and 2006 were neither deep nor useful because they failed to improve the water sector in general and the DWSS in particular. These reforms were general; addressing the involvement of private sector, decentralisation and suggesting increased public participation in the governance of water. Nevertheless, in practice these changes cannot always be implemented because of the particularities of every community. This is the case in customary communities, which are not formally recognised although they govern and manage the DWSS at community level. The LAN reforms have constrained not only State institutions but also customary institutions’ improvement of the water infrastructure because of economical constrains, which consequently affect the delivery of the DWSS. Lack of payment for the DWSS and incomplete payment by householders generates delay in covering operational expenses also affecting the DWSS. CONAGUA representative, retired engineer, in a semi-structured interview developed in October 2008 agreed that a change in the LAN is necessary:

“We can have the best legislation in the country and the most reliable. However, they are not followed because there is no political will. There is not an appropriate water management by operational organisations. Neither there are the technical capacity or sufficient economic and human resources to operate the water infrastructure. Countries that have attained high levels of improvement have done so because the population has asked for it. If the government continues promising but not doing it, if people do not insist, [Mexico is] not going to get there ... It is also a matter of a culture of political will. Politicians need to work: laws and regulations that can be followed need to be made” (Engineer CONAGUA representative, Toluca, October 2008).

A member of the Mexican senate commented in a focus group, in October 2008, on this point:

“The law should continuously be reformed. If there are technological improvements, the law should also be improved to enable it to adapt to the new changes” (Senator president of the water resources commission, Mexico, October 2008).

The legislation needs much improvement. Legislators need to change current governance practices and look for common social advantages adapted to the continuous social requirements rather than to personal or political interests related to fulfilling electoral campaign promises after an electoral campaign finishes. I identified strong concerns by population about how politicians govern. According to fieldwork, community members and professionals see the political parties using the electoral system for personal gain and to have a chair in the parliament that economically favour themselves. Béjar Algazi (2009) thinks that in parliament, deputies and senators find the opportunity to make personal decisions even when these decisions cannot be implemented.

Once political candidates have won an election they become totally uninterested in the common good and campaign promises are forgotten. Winning politicians focus on political compromises with other politicians or investors rather than on the good of the majority of the Mexicans s/he represents (Béjar Algazi, 2009). At the end of each government period, actors in civil society, academics, local entrepreneurs and even decision makers quickly assess the government period. The recurrent outcome shows low political will by parliament representatives to fulfil the political campaign promises and governance agreements with the citizens to create the water sector reforms that Mexico requires. A decentralised water institution employee, in an interview carried out in June 2009, stated:

“There are ways [of updating and enforcing legislative norms, internal regulations, financial codes, even the current LAN, or the penal code]. But there is no political will. The problem is that the government lacks the awareness and [political] will to do its job and to solve immediate [water] problems” (AyST representative, Toluca, June 2009).

One of the main impacts of this political will failure to fulfil managerial agreements with community population affects the quality of the DWSS. This failure to improve the DWSS, affects householders’ willingness to pay for it and their trust in the water authority.

Finally, the third problem is the short period of governance, which is three years at municipal level and six at state or federal level. The three-year period of governance limits management of the DWSS and investment in long-term projects to improve the water infrastructure. According to an official water institution representative, affirm in an interview that the three-year period affects the continuity of water projects:

“I think government transitions are what damage water organisations most. Transitions have damaged the governance and management of water because everybody changes around after elections and nobody working with water, at the official level, continues with water projects. Water is politicised. Everybody goes; everybody is doing whatever they want ... and the new governors just have three years of government” (AyST representative, Toluca, June 2009).

In a three-year administrative period, short-term water projects are the first to get attention from the water authority. Short-term projects include small repairs such as fixing leaks. An UNAM engineer, retired from CONAGUA affirmed:

“Of the entire water distribution system, approximately 85 percent is likely to have leaks. When leaks appear, water institutions just weld the pipes. If necessary, they change a small piece or they cover it with a piece of inner tube ...” (Retired from CONAGUA, UNAM, Mexico city, June 2009).

However, some parts of the system require total replacement or major repairs. This is the point at which the problem becomes cyclic, because total replacement is a long-term project that frequently cannot be addressed due to economic constraints or lack of time to carry them out at the municipal level. A member of AyST, in an interview carried out in June 2009, complained:

“Repairs are, in the long term, more expensive than installing a totally new system. However, there is no long-term project to do this ... and repairs are never finished because there is no financial management. So much money has been spent on the water infrastructure because it is very old; it is greatly damaged. However, governments do not like to invest huge amounts. Thus invested money is used to mend leaks or to change just a piece of the system; but they do not invest more money in improving the entire system. Every government period is the same: obviously we all know the reason. We know the problems that municipalities face due to governmental transitions ...” (AyST representative, Toluca, June 2009).

The problems highlighted above increase when the political party in power also changes after the election. Political party change brings serious consequences for the formal public administration of water. In municipalities, political changes mainly have negative impacts because in only three years of governance the government has to learn, plan, and operate decisions. Compared with the state and the country, municipalities have the shortest governance period. This presents a daily challenge in terms of drinking water administration and operation, not only for the water authorities but also for the water users, who suffer as consequence water insufficiency problems. For example, it is difficult to implement rapid improvements in terms of water governance in a three-year governance period because:

“The first year [the water authority] is occupied with learning what to do. It is also used to build political relationships. The second year is used to work; you work for just one year, because the last year is used to close the governing period. After that, elections start again. [Therefore] you have to stop collecting money from users and threatening users in debt with a reduction in the service [DWSS] if they do not pay. You also have to stop many administrative and practical activities because re-election time is approaching. And you close and finish on-going activities in the middle of the year. Thus in this short period you realise that there is no continuity for long-term projects ... you have to stop because you just have three years. You do your work in just two or three years, and there is no chance of keeping working” (AyST representative, interview, Toluca, June 2009).

Taking their short period of governance into account, water authorities work only according to what they know they are likely to carry out during the second year. They do not worry about what they could do; they just do whatever they can according to the economic resources and period of governance available to them. At community level something similar happens. Customary institutions undergo even more frequent changes in water governance by water institutions: on average every water committee changes each year. The new water committee members

have to learn how to govern and manage the DWSS from the shared experience of the previous water committee members and complement it with their own experience and daily management practice.

4.6 Conclusions

This chapter has analysed the legal plural laws, formal legislation and informal rules and the instruments governing the DWSS in Mexico. Specifically, the analysis takes into account the set of legal rules and laws that govern water resources and discusses the institutions that use these laws and rules at municipal and community level to govern and manage the DWSS. The chapter also analyses the tariffs approved by water institutions for the provision of the DWSS.

State law governing water resources in Mexico appoints CONAGUA as the main institution to set out the LAN. This national water law should also be adopted at the local levels that govern water resources. There are many issues related to the DWSS that the state of Mexico current water law, financial code and regulations do not yet consider. Specifically, legislation is needed to support water services, especially the DWSS supplied by customary water institutions. It is important that communities using customary and traditional practices of water management and governance – as is the case in San Francisco, Santiaguito and San Mateo – continue providing this DWSS to maintain the water rights to use underground water from the community to supply drinking water to community households. Legislation is needed to support these community water committees with a budget to enable them to improve their DWSS, tariff system and payment collection. Improvements to approved tariffs and collection of payments might increase investment in infrastructure, maintenance and repairs. In the case of San Mateo it is important that the law allows the water committee to share and exchange information with AyST as well as receiving some budget from this institution to improve its management practices.

Improvements to the DWSS are needed both as a priority national strategy and as a local reality. Formal and informal laws, rules and regulations and how the water institutions of both systems operate and enforce them require updating. The

relevance of both systems must be recognised by the legal-plural water institutions in order to improve the DWSS not only at municipal but also at community level. In the case of the official institutions governing this service, a strong and updated water law is required that explicitly regulates the DWSS according to the population's needs. This legislation should take into account not only the performance of the institutions providing the DWSS but also the quality of the service provided. At community level there is no written law; however, the customary rules are as valid as the law, and this must be taken into account by customary institutions when managing the DWSS and domestic water users receiving the service.

A new and updated national and state law governing water resources and the provision of services, explicitly including the DWSS is needed. It should be clear, precise and understandable by everyone and should also take into account the differences and particularities of every administrative level, including community level. Finally, its use and enforcement should be sensitive to the context in which it is used.

CHAPTER 5

Main actors participating in the provision of the drinking water supply service

Chapter 5. Main Actors Participating in the Provision of the Drinking Water Supply Service

5.1 Introduction

Multiple actors participate in the governance, management and operation of the provision of drinking water at community level. My fieldwork identified actors related to the DWSS in Santiaguito, San Mateo and San Francisco communities with origins in one of three different roots: official, i.e. CONAGUA and AyST; customary, i.e. water committees and community members; and private, i.e. well proprietors and water vendors. This chapter analyses these main actors and investigates how they influence governance of the drinking water supply service in Mexico.

The chapter is divided into four main sections. The first introduces the chapter. The next, based on formal institutions, analyses who are the official actors participating in the governance and management of water at national and municipal level and how they relate with legal plural water institutions at lower administrative levels. The third section analyses, through community management, legitimate customary actors involved in the provision of DWSS to the three case study communities, how they make decisions and how they legitimate customary water authorities. The fourth section addresses local private actors who provide drinking water to households not only in the case study communities but also in neighbouring communities and the way they are legitimised.

5.2 Official actors involved in the governance and management of the drinking water supply service

Based on article 4 of the LAN, water management in Mexico should be guided by CONAGUA (Cámara de Diputados 2008), which is responsible for allocating concessions to water institutions at national, state, municipal and community level. CONAGUA is responsible for creating and enforcing official laws that govern water at different levels. It is not involved in the practical operation and delivery of the DWSS as it allocates responsibility for this to local levels. In the state of

Mexico, CAEM represents CONAGUA and legislates and administers the different water uses, including the DWSS.

National and state formal actors are not the only water institutions regulating and managing drinking water. There are other State-based and social actors participating in the management of the DWSS, for example formal local governments at municipal and district level, customary local authorities and user associations (Ribot 2004; Torres Espinosa 2004).

Official institutions, especially both municipal and decentralised water institutions, such as AyST, tend to maintain close relations and direct contact with CONAGUA. This direct relationship is particularly required when a water concession at local level is required. CAEM as state water institution do not maintain a direct relationship with CONAGUA because CAEM only focuses on the approval of water legislation and the rules adopted from CONAGUA and then allocate practical responsibilities to lower administrative levels. The level of interaction among administrative levels, especially at national and state level, generates a disjuncture because, as mentioned by a member of AyST in an interview carried out in June 2009:

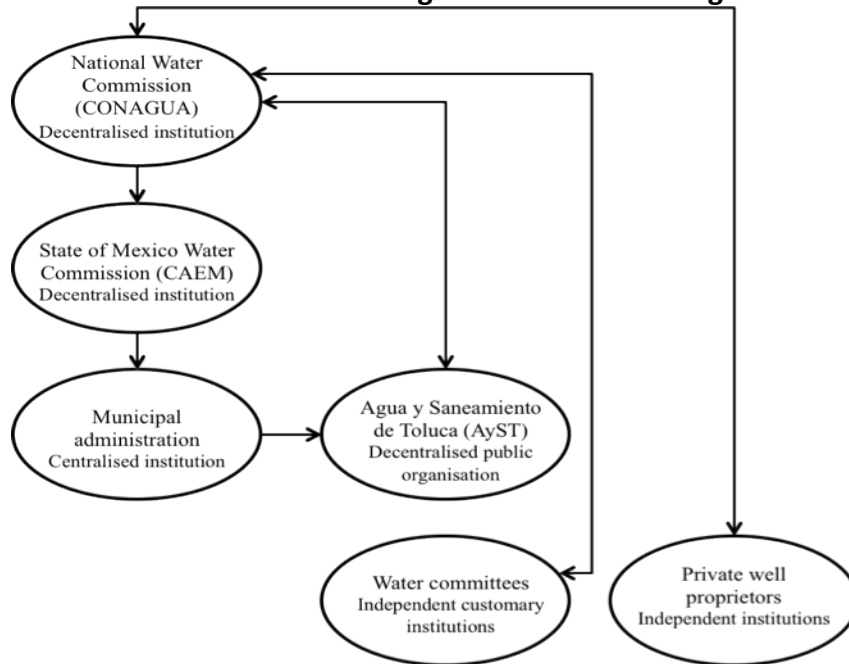
“There is no communication, generally, between the state of Mexico and the municipality. There is a disconnection between the State of Mexico Water Commission (CAEM) and the municipalities. CAEM is officially supposed to play the role of intermediary between the National Water Commission and the municipalities ... however; these relationships usually occur directly between the federal government [represented by CONAGUA] and the municipalities. The federal government provides responsibilities to official institutions while municipalities carry out the activities in practice. The federal government creates laws and the municipalities execute them. And CAEM remains relatively inactive” (AyST Public Administrator, Toluca, June 2009)

This direct communication and coordination among the administrative levels is represented in Figure 5.1, below, in which the arrows show that there is direct communication between the federal government represented by CONAGUA and the municipality, CONAGUA and CAEM, CONAGUA and local private institutions, and between CONAGUA and customary institutions. However, there is no close relationship between local water institutions such as AyST and the water committees, or between CAEM and the water committees. According to the

fieldwork carried out, there is no communication at all between CAEM and AyST because CAEM is a state institution that does not have responsibilities of provision and AyST is a decentralised institution with practical responsibilities to provide drinking water. They both have different purposes and objectives.

Other actors interacting within the management of the DWSS are water vendors and domestic water users. They have unofficial relationships; though, they get involved in the management of drinking water. Water vendors, have direct relation with local private well proprietors and community householders. Domestic water users, have direct relationships with water committees, water vendors when necessary (when they do not receive drinking water as they expect), and some communities with AyST, when they have to pay for the DWSS received. The relationships between these institutions that govern and manage the drinking water are set out below.

Figure 5.1 Hierarchical relations in the governance of drinking water



Source: Author

This figure shows the main actors involved in water governance and their relationships. It shows CONAGUA as the main water institution with more direct relationships with other legal-plural water institutions and actors than other water institutions at lower levels. CONAGUA maintains hierarchical relations with

water institutions at state, municipal and community levels. The implications of these relations influence the quantity of water and the source each institution is allowed to access. For example, CONAGUA legitimises property rights of the state of Mexico over specific wells. Also, CONAGUA legitimises through title concessions the quantity of water and the wells AyST and municipalities are allowed to exploit to provide the DWSS within their communities. Moreover, CONAGUA maintain relationship with water committees of some communities when a water title concession is required. This title detail the characteristics of the well, the amount of water granted per year to only provide the DWSS and the water quality necessary to provide for human consumption. Section 2.7 elaborated about those difficulties in terms of quality and quantity of the DWSS faced in community water governance due to institutions relationships and their performance. Finally, CONAGUA also maintain direct relationships with private institutions to grant water concessions to withdraw groundwater for industrial or commercial purposes, or for providing DWSS. Sections 5.2.1 and 5.3 reflect on these issues later on. Each water institution adopts the CONAGUA mandates required for water governance and management at the level they represent. CAEM adopts and adapt CONAGUA's mandates to the requirements of water management at state level and mandates municipalities to comply with the national water legislation.

Figure 5.1 also shows the particular direct relationships that water institutions and actors – AyST, water committees, and private water actors – maintain with CONAGUA, and vice versa. These actors maintain a continuous relation with CONAGUA with regard to two main issues: first, updating permission to withdraw water, and second payment to CONAGUA for the water rights that enable their continued permission to withdraw underground water and manage the DWSS. The part of the legislation that attracts more attention at municipal level is related to payment for water and payments that guarantee permission to withdraw and use national waters.⁹ These payments, on paper and practically, guarantee

⁹ Water found within the national territory, also called national waters, ie water from natural lakes, permanent or intermittent rivers and canals (from the headwater to the end in the sea), the sea, lakes, lagoons, estuaries, torrential water, springs, fonts and water extracted from quarries.

recognition of water rights of those actors responsible of providing drinking water. However, it does not practically guarantee water rights of domestic water users.

According to the Mexican Constitution, municipal government is the lowest level to which the official administration is divided. Because of the position of municipality as part of the official hierarchical structure, the municipality is officially allowed to administer itself and to regulate the DWSS according to National Constitution requirements (Cámara de Diputados 2010).

Municipalities make decisions about DWSS issues based on formal rules approved at the upper hierarchical levels. A municipality has multiple responsibilities, which include administering and providing the DWSS to the total municipal population. However, providing this service is a difficult task and the municipal authority is not always able to do it; therefore the federal and municipal governments have approved the delegation of the DWSS to local institutions such as municipal decentralised organisations, or gives entire responsibility to customary institutions represented by community water committees.¹⁰

Decentralised institutions are officially recognised by law and interact on a top-down, hierarchical constitutional basis. Decisions made under decentralised schemes have to follow general national requirements; at the same time, decision-making about the operation and payment collection of the water infrastructure is independent of decisions made at national and state level. Decentralised organisations have gained some autonomy to make and operate decisions. This is the case of AyST, which has managerial responsibility for water resources, and specifically for the DWSS.

¹⁰ The decentralisation of water managements aims to move it from higher (federal institutions) to lower governmental levels (state or municipal institutions). Additionally, the privatisation of resource management focuses on the delegation of responsibilities from the public to the private sector, including more market participation to promote economic growth. Finally, with public participation the need was stressed for more social actors' involvement in state activities, such as water protection, to achieve appropriate use of water and help to encourage a culture of caring for and protecting natural resources (Wilder and Romero, 2006).

5.2.1 The role of the AyST institution in the management of the DWSS

AyST is the official water institution and local authority. It is a decentralised institution with several responsibilities related to the management of drinking water. For example, it is responsible for providing the DWSS to different communities in Toluca municipality. It is also responsible for collecting water user payments and for maintaining the water infrastructure.

CONAGUA expects AyST to seek to recover its investment in the water infrastructure and services according to the mandates of LAN that emphasise that water is an economic good and that its use must be priced and charged for. As an official institution, AyST recognises the necessity for official water rights to enforce water users' duties and obligations when it comes to the DWSS. It plays an important role in San Mateo community, where it collects householder water user payments. It does not collect payment in Santiaguito and San Francisco communities because they are in a different municipality and are wholly organised by a customary water governance system. In San Mateo, AyST is responsible for charging for the DWSS according to the tariffs already set and approved by the municipal council, and for collecting user payments. However, a water committee runs the DWSS in San Mateo.

The connection observed in the field between official and customary systems of governance in San Mateo is the coordination between these systems to avoid overlapping of responsibilities. For example, in San Mateo the water committee provides the DWSS to households while AyST collects user payments on a monthly, bi-monthly or annual basis. However, there are failures related when the DWSS depends partially on a customary and partially on an official institution. The failure is generated due to the disconnection between payment collection and reinvestment in the DWSS. Based on fieldwork information the water committee in San Mateo provides the DWSS but cannot charge for it or re-invest in the infrastructure. But AyST does it. Maintenance and small repairs depend on the water committee, who also solicit community support. By contrast, in Santiaguito and San Francisco the water committee have full responsibility for providing the DWSS and collecting users payment. Table 5.1 summarises the major similarities

and differences among the case studies in relation to the main authorities that manage the DWSS.

Table 5.1 Similarities and differences among the case studies

Community Characteristic	San Mateo	San Francisco	Santiaguito
Operation of DWSS infrastructure	Water committee	Water committee	Water committee
Pricing water	Official city council	Water committee	Water committee
Payment collection from domestic water users	AyST	Water committee	Water committee
Reinvestment in water infrastructure	x	x	x
Maintenance	✓ Water committee	✓ Water committee	✓ Water committee
Small repairs	✓ Water committee	✓ Water committee	✓ Water committee
Large repairs	Water committee with federal budget	Water committee & community members	Water committee & community members

Source: Author

As the table shows, San Mateo is the only community with mixed official and customary water governance; both official and customary institutions are involved in the management of drinking water. AyST is involved in the collection of domestic water user payments, but it does not reinvest the money it collects in the water infrastructure for the community. The water committee provide the DWSS and therefore assumes responsibility for maintenance of the infrastructure and carries out small repairs when necessary.

This section has addressed the official actors involved in the provision of the DWSS. The following section analyses customary actors participating in the governance and management of the DWSS at community level.

5.3 Customary actors involved in the governance and management of the drinking water supply service

Community management plays an important role in the provision of the DWSS at community level. Some communities that are organised according to custom in Mexico adopt management of the provision of the DWSS to community households. The community members organise themselves, according to community needs, to provide this service. This section analyses how the San

Mateo, San Francisco and Santiaguito communities manage their DWSS and how each water committee governs this service according to its own specific rules.

As mentioned in section 5.2, customary actors – water committees and community members – are also an important part of water governance and management at community level. Water committees and community members are directly involved in the governance of the DWSS because they set the rules that govern the administration of water resources. The water committee is the main customary water authority that carries out agreements made by community members. Community institutions allocate and distribute drinking water among community households. The community management approach suggests that local government, including customary institutions, knows the common interests of community members as well as their needs, which must be covered, and so, might be better suited than a centralised structure.

The strengths of a customary system governing and managing the DWSS is that as community members they know community needs and they might directly work with water users to solve likely problems. One more advantage is that water extracted and supplied in a community does not have to travel long distances because water well is located in the community. Also, any leak or minor infrastructure damage can be fixed faster than in a large community governed by the municipality. However, there are also weaknesses, for example, a customary system might not always have the economic resources to cover all expenses, especially large repairs. A likely disadvantage is that water committee members have to learn alone, by experience; though, in the beginning of the governance period they do not entirely know the drinking water supply system.

By contrast, formal water institutions also present strengths and weaknesses in the management of the DWSS. Strength is that formal institutions might receive or collect more economic resources to cover water supply operation and maintenance because they are able to receive money from *ramo* 33 and collect more users payments. Public employees working in water institutions are trained to understand the functioning of the DWSS and operate it. However, a disadvantage

is that communities receiving a formal DWSS do not have the property rights of the well used to withdraw drinking water.

Community management and property rights of communities over water resources is a key issue; first because of the rights and second because of the cultural identity of communities to manage their water resources. Therefore, even though the difficulties faced by customary communities to manage the DWSS it is an advantage keeping the possibility of managing their water resources and owning property rights to control them. Therefore, in the case study communities, the customary system to govern the DWSS is the best option for community members to manage this service because it allows the involvement of a plurality of actors when there are failures in the quality of the service. In terms of quality of the service a customary system is not always the best option because it has frequent failures. However, it is also important water committee representatives receive training to manage this service and improve the quality of it. In terms of governance and decision making, customary water governance system is the best option because it let water committee and community members legitimate common decisions according to their needs. Also, the implementation of decisions might be faster than at municipal level.

There have been successful cases of community management where community members are organised to govern a specific resource (see Doe and Khan 2004). Community management allows the use of customary structures of governance in, for example, electing and legitimating water authorities and setting and enforcing the rules. Community management of drinking water is a customary organisational system through which the DWSS is provided to community households. This section discusses the customary management of drinking water and the rules that govern the DWSS in San Mateo, Santiaguito and San Francisco communities. The section is divided into two main subsections: socioeconomic structure and community size, and water committees.

5.3.1 Community management of the drinking water supply service

Small communities demonstrate greater availability than large ones for participating in community management projects (Doe and Khan 2004). Specifically, self-organised communities decide whether they would like to be involved in particular projects. They usually select those that suit community needs. The case study communities maintain a customary system for the operation of the DWSS. Decisions are made by community members according to what they think is best for the majority, and the water committee. In the cases studied it is common not only to reach consensus but also to inform individuals about decisions, agreements and plans that might help them in the continuation of the community management of the DWSS. A water committee representative from Santiaguito community spoke about this in a focus group:

“How we work is simple: every time a new water committee starts [managing the DWSS, the previous water committee] calls for a community meeting. In that meeting the rules and agreements for that year are settled. The new water committee is introduced, and community members know how it will work that year. The population can suggest things and they also ask questions about their plan” (Santiaguito water committee member, Santiaguito, July 2010).

For a community-managed DWSS to succeed, as illustrated in the analytical framework, it is necessary to understand the socioeconomic characteristics of the population. The case studies are all different even though customary water institutions manage them all. The outcomes of their governance and management are also different in every community, as I discuss in this chapter. According to Doe and Khan (2004) the success of communities organised by custom to manage the DWSS is not based on the community size, that suggest small communities are more successful than large ones, but on the specific social and economic characteristics of their inhabitants, the particular legal plural community management and the local agreements that most benefit the majority of water users. These characteristics are explained in section 5.3.2 and summarised in table 5.2 and 5.3. Scholars’ recognition of these differences is necessary in order to approach and understand community management taking into account the particular context of each one. If water authorities also approach communities and understand their needs and the way in which they are organised they may succeed

in the governance and management of the DWSS. The following section describes and analyses the socio-economic characteristics of the peri-urban case study communities.

5.3.2 Municipal socioeconomic profile and its relationship to the studied communities

The municipal socioeconomic profiles shown in Table 5.2 were obtained from data generated by the National Institute of Statistics and Geography (INEGI) in order to explain how municipal statistics, through the years, also illustrate what happen at the community level.¹¹ This municipal behaviour approaches to community level dynamics.

Table 5.2 Socio-economic profiles for Toluca and Almoloya de Juárez municipalities

Year	1990		1995		2000		2005	
Municipality	Almoloya de Juarez	Toluca	Almoloya de Juarez	Toluca	Almoloya de Juarez	Toluca	Almoloya de Juarez	Toluca
Variable								
Total population	84,140	488,293	96,651	560,564	110,489	654,898	126,163	747,512
Population in all homes	81,471	478,568	Inconsistent data	Inconsistent data	104,024	633,927	120,459	707,848
Total literate population	56,221	380,902	67,173	451,356	76,149	513,765	92,624	589,002
Male household heads	72,114	411,345	Inconsistent data	Inconsistent data	87,648	529,818	105,432	586,750
Female household heads	9,357	67,223	Inconsistent data	Inconsistent data	16,376	104,109	15,027	121,098
Illiterate household head	18,977	58,598	Inconsistent data	Inconsistent data	19,054	51,015	14,449	41,756
Population with incomplete primary education	38,017	119,814	Inconsistent data	Inconsistent data	36,659	108,870	34,900	85,747
Population with complete primary	14,803	98,732	Inconsistent data	Inconsistent data	25,467	125,139	32,246	133,164
Population with technical or commercial studies	406	6,657	Inconsistent data	Inconsistent data	76	2,612	38	1,241

¹¹ There were limitations to obtaining information by locality from the 2005 and 2010 censuses because not all indicators were available by locality. Thus, in order to approach community dynamics it was necessary to approach and to analyse the municipal data.

Population with incomplete secondary education	1,085	19,459	Inconsistent data	Inconsistent data	2,029	23,185	2,841	19,944
Population with complete secondary education	3,435	47,674	Inconsistent data	Inconsistent data	12,099	118,414	21,645	159,371
Population with complete high school education	1,499	53,382	Inconsistent data	Inconsistent data	4,410	89,252	7,525	119,351
Population with higher education (e.g. university degree)	1,139	66,009	Inconsistent data	Inconsistent data	3,059	106,703	4,368	132,433

Source: INEGI (2011a)

The municipal statistics show the population growth in Almoloya de Juárez and Toluca over the years. A growing population requires continually-growing DWSS provision to cover its domestic needs. At community level, population growth also demands more services and expansion of the DWSS network.

Table 5.2 also shows the educational variables in both municipalities. This information is important because it helps to understand the populations' socio-economic status and consequently ability to afford and demand a good-quality DWSS. The education variables show the community members' levels of qualification. Some of community members are water committee members and are the water authorities that govern and manage the DWSS at community level.

By 2005, 72.65%, a significant proportion of Almoloya de Juárez's population did not complete basic state education – primary, secondary and high school. By 2005, 73.4%, the majority of the municipal population was literate, even though a large proportion had not reached the average of basic education level set by the country or even finished their basic education. In 2000, 31 percent of the population was illiterate, decreasing to 26.5 percent in 2005. In 2000 and 2005 there was still a large number of inhabitants with incomplete primary (27.66%) and secondary

education (2.25%).¹² The average education of the inhabitants of this municipality ranges from incomplete primary to complete secondary education. According to field observation and informal talks, a large proportion of males are employed in agricultural jobs or are employees as technician in the industrial sector. Also, a significant proportion of the population focused on learning the technical activities required for the job they develop – in daily practice –. Females, respectively, work mainly as housewives and cleaners. In this municipality only a small percentage of the population has finished high school, and some even have higher education (INEGI 2011a).^{13, 14}

The population's level of education affects the management of the DWSS. In two of the case study communities the education level affects more the provision of this service. In the studied communities, members that had not reached the average of basic education level integrate the three water committees. None of water committee members is illiterate; however, none of them has a higher education level. They all range from incomplete primary school to complete secondary school. This means, they all might be employees in a job as technicians or they might be peasants. This activities, consequently affect the time spent for the management of the DWSS, the quality of the service they provide because of their understanding about water issues and management issues, and quite often it also affects the honesty of treasurers to appropriate use householders payments for the DWSS for personal purposes. Additionally, water committee members' education influences how they organise the operation of the DWSS and prioritise decisions. Water committee members are not water experts and thus have to learn how to operate the water infrastructure, price water, collect payments and so on, for which they are responsible. Something important to mention is that water

¹² In Mexico, the 6 compulsory years of primary education are usually completed by children from the ages of 6 to 12. Secondary school is usually completed within 3 compulsory years, from ages 12 to 15.

¹³ In Mexico, high school education follows secondary school education and can be completed in three years. Students usually do high school education, also called preparatory school, from 15 to 18 years old. Once they finish high school they have the option to study at university or to study for a non-university career, which is a short-term career where they learn by trades. During this non-university education system, students are trained to gain technician skills and start working.

¹⁴ Higher education continues after preparatory school in institutions such as universities or teacher training colleges. The age at which most students start at university is 18. This education prepares them for work or to continue to a postgraduate degree.

committee members are not elected because of their understanding of lack of understanding about the operation of the DWSS. Community members do not understand water committee position as a job but as a community service.

Moreover, the low level of community members' education, included water committee members, influence the job they can find. Water committee members' level of education closely relates the main work they carry out and the income they receive for it. Their main job is not the management of the DWSS; this is usually a secondary activity that they do to serve their community. Water committee members in San Mateo, Santiaguito and San Francisco communities have a main labour job as technicians rather than professionals; they have a main salaried job to support the family. Additionally they are also committed to provide their service as members of the community water committee institution. Because of these reasons, they might fail in appropriately manage the DWSS and price it, also to update water users checklist because of the time spent providing this community service. Additionally, they do not know how to lead the equitable distribution of drinking water within different areas in their community. Finally they are economically limited to implement novelty strategies and technology to improve this service.

Education level not only affects how water committee members organises provision of the DWSS; it also affects how community members make decisions about the provision the payment for it. Decisions from community members are made according to basic needs expenses they have and the money they have to cover them. Community members spend their salary to cover basic needs first and then the payment of some services. According to fieldwork information obtained from interviews, focus groups, and informal conversations to housewives, female and male domestic water users in San Francisco, Santiaguito and San Mateo along February and April 2009 and June 2010 it was identified the main expenses people prefer covering. The first expenditure denotes higher importance: 1) food, 2) bottle water, 3) electricity, 4) children school and 5) the DWSS. The main reasons to pay the DWSS at the end is because they mentioned that before paying for it they frequently do need to pay for water tankers and bottle water and that

paying for the DWSS is not always a guarantee to receive the service. However, when they receive it they use water to cover basic needs such as: washing dishes, showering, toilet cleaning, clothes cleaning, house cleaning, plants irrigation, car cleaning (if applicable), garden. The first two are a priority for domestic water users.

Most of the population in the case study communities cannot always save money to cover events such as the frequent water shortages and cuts in the DWSS. While community members are willing to pay for water, they are not always able to do so because of financial constraints. Their willingness to pay and ability to pay are analysed in Chapter 7. According to female voices from Santiaguito and San Francisco collected from a focus group in June 2010:

“We [domestic householders in rural communities and peri-urban areas] are constantly worried about how to obtain money to pay for a water service [the DWSS]. Sometimes our husband’s salary is spent on basic needs such as food, transport and the kids’ school. However, the salary is not always enough to pay for all services...so we have to decide what to pay first” (Female water user, San Francisco, June 2009).

According to research and to the statistical data obtained from INEGI (2011a), low incomes in rural and peri-urban areas are frequently associated with low levels of education (Nyarko et al. 2007). This was identified in Santiaguito and San Francisco, in the fieldwork period I did, where some householders do not always have money to pay for the DWSS. As mentioned above, householders do not always have enough money to pay because they might have a variable salary and they also have basic-needs expenses that prefer paying before the DWSS.

In Toluca the level of education is increasing. Between 2000 and 2005 just over 20 percent of the population were illiterate. Most of the population have at least finished secondary school. The majority of the population ranges from having completed primary school to having a higher education degree, although there are still a relatively small number of inhabitants in Toluca who have not finished their basic education. People’s level of education influences their salary.

5.3.2.1 Drinking water supply service conditions

Housing services at the municipal level are expanding due to population growth. However, they are not expanding as fast as the population and new housing development. In 2005 it was not possible to supply all houses with all services, especially services such as drinking water and sewage (INEGI 2011a), for three main reasons. Firstly, urban expansion is not homogeneous, and expanding the drinking water supply networks and infrastructure for a few houses calls for considerable investment by the government. Secondly, municipalities have many investment requirements and providing the DWSS is not always considered a priority. Thirdly, water authorities usually prefer to use money for public works that are observable by most of the population. According to this point a municipal government representative confirmed in an interview in June 2009:

“For the [municipal] government it will always be better to invest money in infrastructure where there is a larger population than where there are few houses ... [because] it is more expensive to bring the [drinking] water [supply] service to a few people even when [the government] can charge more for the service... This is the pitfall ... and usually the authority will try to solve problems that people are aware of. And works [in larger settlements] are more visible. For example, [the government] might provide a sewage connection but not water treatment; it might install a water network in the main street, but it does not provide household connections” (Municipal government representative, Toluca, June 2009).

Providing water infrastructure involves actors differently legitimised that need to be coordinated other actors participating either in the governance, management or drinking water provision. CONAGUA acknowledges that the drinking water infrastructure’s coverage does not mean that drinking water is available to everyone. It recognises that not all households have the infrastructure to receive the DWSS in their properties, and nor they are supplied with drinkable water. Some people only receive piped water that is not considered drinkable. In Mexico it is common for the population to consume drinking water from different sources such as bottled water, boiled water, filtered water, or water bought from water tankers (Guardiola *et al.*, 2010). This consumption is independent of the DWSS provided to households. This situation was developed because first, there was a historical belief that piped water does not have the quality to be drinkable; and second, because people in peri urban and rural areas can not rely in the timeliness

to receive the DWSS in the days they are expecting to receive it due to managerial problems.

In Almoloya de Juárez and Toluca municipalities, DWSS coverage is increasing across all households. By 2005, in Almoloya 69.88% of inhabitants receive the DWSS within their property, either indoors or outdoors. While in Toluca 86.16% receive it. Toluca has 175,024 households and Almoloya 26,229 (INEGI 2005); by 2005, more than half of householders, a majority, were receiving the DWSS through their own tap installed on their property. In Toluca, 73 percent of the population had an indoor and 13 percent an outdoor DWSS available on their property. However, 7 percent of the population were still obtaining drinking water from other sources, only 0.25 percent access water from a public tap. By contrast, by 2005 41 percent of the Almoloya de Juárez population had a DWSS on their property but out of doors; 28 percent had drinking water supplied inside their house; 24 percent obtained it from various different sources and less than 1 percent still got their drinking water from a public tap. In order to better compare these percentages see the following summarised table:

Table 5.3 Municipal increase of the piped water infrastructure coverage

Municipality	Almoloya de Juárez 2005	Toluca 2005
Variable		
Total households	26,229	175,024
% With indoor water coverage	28	73
% Outdoor water coverage	41	13
% Obtaining water from other sources	24	7
% Householders obtaining water from a public tap	0.9	0.25
Total population % receiving indoor and outdoors DWSS	69.88	86.16

Source: INEGI (2005)

These conditions are similar to the results observed in 1990 and 2000 in both municipalities. Over time, the DWSS has been made available to more houses, either indoors or outdoors and within their property boundary. The DWSS coverage is improving. An increasing number of people are benefiting from this in Toluca and Almoloya de Juárez. By 2005, the availability of outdoor water in Toluca was decreasing as the indoor water supply increased because more houses

had indoor drinking water infrastructure. In Almoloya, slightly more households received an outdoor DWSS. This might be due to population growth and the self-installment of taps outside the houses of those who could not afford internal pipework. Based in the statistics, in 1990, 2000 and 2005, populations from Toluca and Almoloya de Juárez municipalities obtained drinking water from different sources included a public tap. However, through the time, there were improvements in the DWSS piped water network coverage letting householders receiving indoors DWSS. Table 5.4 shows the total municipal population receiving DWSS coverage under specific conditions.

Table 5.4 Municipal populations advantaging from municipal DWSS

Year Municipality Variable	1990		1995		2000		2005	
	Almoloya de Juarez	Toluca	Almoloya de Juarez	Toluca	Almoloya de Juarez	Toluca	Almoloya de Juarez	Toluca
Total population	84,140	488,293	96,651	560,564	110,489	654,898	126,163	747,512
Population with indoor drinking water availability	13,510	284,034	11,471	Inconsistent data	17,998	385,781	35,469	546,020
Population with outdoor drinking water availability on their property	27,672	116,238	Inconsistent data	Inconsistent data	44,962	158,199	52,701	98,086
Population obtaining drinking water coming from a public tap	4,032	11,382	Inconsistent data	Inconsistent data	4,436	24,810	1,232	1,885
Population obtaining drinking water from different sources	35,234	64,243	Inconsistent data	Inconsistent data	34,727	60,030	30,271	55,731
Not specified	1,023	2,671	Inconsistent data	Inconsistent data	1,901	5,107	786	6,126

Source: INEGI (2011a)

The municipal water statistics are reproduced at community level. According to information obtained by locality in 1995 (INEGI 1996) some households did not have a main connection to receive the DWSS. In San Mateo, 42 percent of households did not have piped DWSS and used a public tap to collect water for

domestic consumption, compared to only 4.5 percent of households in Santiaguito and 6 percent in San Francisco (see Table 5.5). In the following decade, San Mateo community experienced an increase in DWSS infrastructure coverage. In Santiaguito and San Francisco the drinking water supply network has also expanded, even where there has also been a population increase. Nevertheless, there are still households without a DWSS, which have to obtain drinking water from different sources to cover their basic needs. The municipal statistics in Table 5.4 show that in 2000, 31 percent of the population of Almoloya de Juárez was buying its drinking water from different sources, decreasing to 24 percent by 2005, compared to only 9 percent of the population of Toluca in 2000 and 7.4 percent in 2005.

Table 5.5 Households with piped water coverage in the case study communities (1995)

Municipality	Toluca		Almoloya de Juárez	
Community	San Mateo	Santiaguito	San Francisco	
Variable				
Total number of houses	409	741	1,671	
Number of houses with piped water	236	708	1,566	
%	57.7	95.5	93.7	

Source: (INEGI 1996)

By 1995, as Table 5.5 shows, most of the houses in the case study communities has had water infrastructure installed, either indoor or outdoors, to enable them to receive the DWSS, although this did not mean that all households immediately received the DWSS. Because of this reason, CONAGUA mentioned that the installation of water infrastructure is not a guarantee households receive the DWSS. These results could be compared to municipal statistics summarised in tables 5.3 and 5.4. At community level the statistics seem to show higher water infrastructure coverage than at municipal level, this is because by 1995 there were less houses and then higher expansion of the piped water infrastructure network. Comparing Table 5.5 with the municipal statistics in Table 5.4 it is find there has been an expansion in DWSS coverage at the municipal level. Municipal information, then, is useful for understanding DWSS coverage at community level. There are some variations by community. For example, in 1995 slightly over half

of the total houses in San Mateo had piped water compared to all case studies but a small proportion of houses in the other communities did not have the piped water infrastructure.

This analysis helps to provide an overview of the evolution of the DWSS networks in the three communities, which have had a water committees organising and managing the distribution of the DWSS since 1995. Each community has had a different experience of improving its drinking water network and organising its provision to community households. Therefore, according to municipal statistics and fieldwork information it is concluded that community size do not necessarily guarantee community success to manage the DWSS. Success depends of socio-economic characteristics, local agreements and the compliance of these. As a result, San Mateo drinking water supply problems are not related to community size but to social characteristics of water committee members. Additionally, San Francisco and Santiaguito drinking water supply problems are also related to socio-economic characteristics of both water committee members and community inhabitants as well as the education level of them. The following section focuses on water governance at the community level, and on how water committees organised the management and provision of DWSS to households in their communities.

5.3.3 Community management of the DWSS through a water committee

Members of the case study communities are organised to represent the water authority through a water committee that assumes control over underground water resources. In each community a water committee has full responsibility for and authority over the DWSS provided to community households. All householders who have installed a tap in order to receive the DWSS on their property are registered in the water committee's administrative book, which also holds a register of monthly payments from each household. Registration of a householder on this list is evidence that s/he has paid the first payment required to start receiving the DWSS and legitimises their right to receive the service on their property.

Provision of the DWSS in San Mateo, San Francisco and Santiaguito entirely depends on each customary water committee. Community members do not have a relationship with the national water commission, and they set their own rules for water governance and management. This means that CONAGUA and the water committees are not necessarily connected in terms of the practical allocation and distribution of the DWSS. In San Francisco and Santiaguito both the official and the customary institution are related in terms of the formal agreement that legitimates property rights over underground water (see Chapter 6 for further analysis of property rights).

In San Mateo, however, there is a direct managerial relationship between the water committee and AyST, with the water committee providing the DWSS while AyST charges for the service and collect householders payment. This is not the case in San Francisco and Santiaguito, whose water committees assume total responsibility for provision of the DWSS and for collecting payments.

My fieldwork revealed that the three case study communities entirely manage their own wells in order to provide their DWSS. Their main problem is the water committee members' limited experience in providing this service and collecting user payments. They generally have to learn in practice how the drinking water infrastructure works, how much to pay CONAGUA for the concession and when, and how they can incentive householders to pay for the service.

When the three communities decided to manage and provide their own DWSS for the first time there was an initial investment by the official institutions and community members. After that, community members were expected to contribute periodically, either financially or by providing labour, to installing, maintaining and repairing the drinking water infrastructure.

From the 1960s, public reservoirs, taps and pipes were installed in communities in the state of Mexico to provide households with water (CONAGUA 2009). From that time onwards, community members were required to organise the provision of the DWSS and develop a customary governance system for its administration. When the water infrastructure was first installed, labour to install and connect the

pipes was provided by members of the community, who also have to cover maintenance and repair costs through periodical payments for this service. A group of community members elected by consensus, in each community, took on responsibility for the administration, control and management of the DWSS and for collecting payment from users, and became the main water authority, the water committee, representing the community regarding water related issues.

Since 1960, the water committees in the three case study communities are responsible for the decision-making, operation and most of the maintenance of their drinking water infrastructure. The following section analyses the main structure of the water committees, and how they are organised.

5.3.3.1 Water committees' management of the drinking water supply service

In Mexico there are still customary and self-organised communities that control and organise water resources available within their territory. Community population organise the management and provision of their own DWSS using local water resources, through water committees. The water committee is an institution that represents the community and administers, controls and provides the DWSS to community households. Doe and Khan (2004) suggest that this control should involve their management, operation, and maintenance. I found during my fieldwork that San Francisco, San Mateo and Santiaguito communities assume the management, operation and maintenance of their water resources in order to provide their DWSS.

As analysed in the literature review and then built in the analytical framework there are legal plural institutions governing water resources; and informal institutions in some Mexican communities are still legitimised as the main water institution with attributions to make decisions and operate them. Informal institutions governance and management of water resources have been also identified in Latin America – in the Andean region (Beccar *et al.*, 2002; Boelens, 2008). In central Mexico, community-managed institutions that govern and manage the DWSS are self-organised through water committees. According to Bah (1992), self-organisation community is the key to promoting water supply

development because community members know their own needs. It enables them to make advantageous decisions for their community. Community self-organisation is key in water governance and management because it enables fast communication within the community and the water committee, and therefore the interaction between community members is direct. If a self-organised community has the participation, support and trust of most of its members it is likely to succeed in the development of its DWSS. Nevertheless, these communities might also face managerial and economic troubles by organising the DWSS. These problems might improve if community members and water committee members are willing to do so by generating and complying with agreements. A male domestic water user from San Francisco, confirmed in a focus group:

“We know what [our community] has to do to improve [the DWSS]. For example, the water committee very often calls for meetings, but people do not go any more; people are not interested any more. Maybe they think: ‘Well, if there is no water let’s see how many days there are water cuts and how many more days the [DWSS] is delayed. If someone calls for another meeting, some people go, but not that many as should go. The problem is that people do not complain, they do not say anything. We have apathy; we have become indifferent. With this behaviour we cannot succeed” (Domestic water user, San Francisco, June 2010).

As observed, community water supply management alone does not guarantee community success in the provision of drinking water. The community needs to trust the water institution and *vice versa*. The generation of rules and agreements by both institutions – water institution and community members – and the compliance of these ones possibly generate a positive environment of responsibility, trust, and quality of the service improvements. Additionally, working rules for collecting users payments for the water consumed and to maintain financial health are required. Each water committee not only needs community members’ approval to control the DWSS for a specific period, but also they need householders’ payment in order to maintain the water infrastructure and technical and practical training. I found during my fieldwork that even though community members legitimate water committees to manage the DWSS there are also financial problems constraining the quality of this service and then the sufficiency of drinking water received per week.

Scholars highlight there are weaknesses in community management when water committee members do not have the necessary training or technical assistance to manage their DWSS appropriately (Leahy and Anderson 2008; Madrigal *et al.* 2011). They suggest that water committee members need technical assistance to cope with likely problems (Matta and Alavalapati 2006; Whittington *et al.* 2009). According to my case study interviews, community members also think that technical assistance for water committee members is important to enable improvement in how they deal with drinking water supply problems. In a focus group, a domestic water user from San Francisco set out the changes she would make to the DWSS if she were member of the water committee:

[From the water user's perspective] "it is complicated, because from the outside everything looks a mess. But it might be difficult to carry out [the DWSS] ... If I were part of the water committee, I would first learn about the water network. I think all the water committee members have missed several issues. It is also necessary to be aware of the administrative procedures and precisely explaining how much householders are paying and what they are paying for. Usually water committee members talk and talk [about financial issues] but [we domestic water users] never know the true story. People say that the problem [of the DWSS] is that the pumping [infrastructure does not work well]. I would start by identifying the problem, and whether there is a solution. People say the well has good capacity to provide water to the entire town. So if everybody in the town could have [the DWSS] at least twice a week, or for only a day, with enough pressure, people would not hesitate to pay for the service and maybe we would not have so many problems" (Female water user, San Francisco, June 2010).

Analysing domestic water users and scholars' perspective (Leahy and Anderson 2008; Madrigal *et al.* 2011) it is essential to understand not only technical aspects of managing water infrastructure but also to know water network; because, it might help water committee to better know the pumping capacity to distribute and allocate water in a specific timing before stopping the pumping system. It is also important to understand about managerial issues of drinking water at community level. These ones might be learnt through oral communication from previous water committee and improved by experience. Both, learning and practicing are important rather than only trusting in learning by trial and error. Additionally, pricing and collecting water payments from users is a key variable to operate the service, cover operation and maintenance expenses, and improve it.

Customary water committees need to be consolidated in order to perform their duties according to their community's needs because water committee members become the main institution that community members contact when there is a drinking water supply problem in the community. For an understanding of customary management the following section analyses the water committees' structure and responsibilities.

5.3.3.2 The structure and responsibilities of water committees

As mentioned before, a water committee is the community water institution elected by community members to provide the DWSS and supervise its delivery to households. The water committees in all three case studies are elected democratically in community meetings. The election takes place outside the water committee office, in the street, or in the main square, where the community elects its representatives, takes decisions about water related issues, raises concerns and problems and agrees the DWSS management strategy during the water committee's period in office. In a focus group, the water committee president from Santiaguito responsible of ruling and promoting common decisions commented on his experience as member of the water committee:

“This is a community service. We are happy to cooperate because there are years when someone else does this job. I know this committee service is only for one year. During this year we will try to do our best, even when we can't be here all day long. However, as a team we have talked about this and have decided to come in every afternoon. You can see this office open every day to provide the service. During this time we hear about water problems, we try to resolve complaints, we collect water payments and we also try to contact debtors to get them to pay their debts in order to collect more money – even when it is not always possible” (President of the water committee, Santiaguito, July 2010).

Even though it is a community service, the water committee has its own governance structure, its own actors and rules to guide its decision-making. Water committees require a minimum number of members to operate and make this governance system work. According to information I obtained during my fieldwork in Santiaguito, San Mateo and San Francisco, a water committee from similar case studies commonly comprises a minimum of six members and a maximum of ten community members, including the following:

- a) President
- b) Secretary
- c) Treasurer
- d) Vice president
- e) Vice secretary
- f) Vice treasurer
- g) Person responsible for pumping water from the pump house (*bombero*)
- h) Person responsible for cleaning reservoirs
- i) One or more temporary technicians, who is paid only for a day or few days, to maintain the pump and water pipes.

The three main members head of the water committee are: president, secretary, and treasurer. For each one it should be an extra in case one of them vacate. Another indispensable member is the *bombero* or *pocero* because he operates the pumping water system and practically manages the distribution and delivery of drinking water. Other members are important; however, are easily contacted when necessary.

In most of customarily managed Mexican communities, the members listed above usually shape a water committee that provides the DWSS. Of these, four main members work on a daily basis: the president, the secretary, the treasurer and the person responsible for the water pumping. These are the main water authorities to whom householders turn when a new connection is required, when they want to pay for their DWSS, or to report failures in the water infrastructure.

The president and secretary are responsible for planning, decision-making and directing how the DWSS is governed. In the three case study communities, the president of the water committee is the main authority and community representative when procedures related to drinking water management need to be followed. The secretary may act on behalf of the president if the latter is not able to attend a meeting or to be at two events at the same time. Both the president and the secretary are responsible for updating the water user list and providing it to the treasurer.

The treasurer is responsible for organising the budget, planning strategies to collect user payments and administering the financial structure. The treasurer plays an important and responsible role in the water committee's work because he is responsible for collecting water user payments and dealing with DWSS finances according to a tariff discussed and agreed by the water committee and community members. In San Francisco, Santiaguito and San Mateo communities the members of the water committee have always being men.

The person responsible for operating the infrastructure system that pumps water from the well is called the water pumping man (*bombero* or *pozero*). Usually, the *bombero* has a day job and also works for a few hours in the afternoon or early morning every day operating the DWSS water pumps. The other water committee members cooperate through social labour – *faenas* or public service – in the community to provide this service thought they are not paid for this. The only one that receives some payment and frequently also some contribution is the bomber, who sometimes, receives from community members a monetary contribution in return. Everyone of water committee members perceive that providing this service to community households is a way of giving something back to the community.

In Santiaguito, the water committee pays the *bombero* \$1000 MXN pesos, equivalent to £50 GBP per week, although this is not the case in San Mateo and San Francisco where water committees do not provide any payment. If the *bombero* earn something is because population sometimes gives them tips when they specially ask to send the DWSS towards their community area. The cooperation among members of any community shows its sense of ownership to the community they inhabit. According to Nyarko *et al.* (2007), such a sense of ownership develops when people find in their living area or community the natural resources and social environment that let them learn from the community and grow in it, such as occurs in the case study communities.

Cooperation is the key to the strength of community management. Community members are regularly responding to cooperation when community improvements are required. Community members' cooperation tends to be conditioned or limited to the trust of community members to the authority. This was observed in San

Francisco where domestic water users are continuously hesitating in cooperating, either economically or with labour, with the water committee when money is required to fix infrastructure or to do large repairs because they do not know where their money is going to end up. For legitimacy this is a very key issue because after a water committee member is dishonest, community members do not recognise him anymore as water authority because they do not trust him, and community call for a meeting to vote another one. In an interview, a female water user from San Francisco raises her concern because of a fraud committed by a water committee member and the resulting lack of trust of community members in their water committee:

“People from the community lack of trust [in water committee members] and they become debtors [because people feel the water authority lie them]. For example, when we realise the [water] valve located outdoors was not working anymore we ask a member of the water committee that fixes infrastructure and makes repairs to do it. All neighbours cooperate to buy a new piece. Female neighbours collected the money. But after we gave him the money he leaved away and took with him the money we gave him to buy the required valve. He said he would buy the required material and missed pieces. However, he did not do it. Now he did not fix the valve and he took the money...and again we have extra expenses...that is why I do not like to cooperate” (Domestic water user, San Francisco, February 2009).

To gain the community’s trust, the water committee needs to improve its leadership ability and problem solving capacity continuously. It also needs to perform with honesty; especially when it comes to the management of financial resources.

In all three communities studied, the number of committee members varies for different reasons, one of which relates to the population’s willingness to participate in managing the DWSS. Willingness to participate as a committee member depends on individuals’ activities. By 2010, in San Mateo and San Francisco, for example, the average number of members in the water committee was eight, while in Santiaguito the water committee had only six members: president, secretary, treasurer and a vice president, secretary and treasurer for each one. If a community member is voted as water committee member they still have the possibility to accept or deny the offer. Another reason that influence the number of water committee members is their behaviour and honesty in this

community service. If population is not happy with their performance they might ask him not be water committee member anymore or to change the full team.

The three case studies also vary in the number of technicians responsible for pipe and pump maintenance and reservoir cleaning. These members of staff are usually temporary, and each community selects them according to the requirements of water infrastructure they need to maintain or repair and also the time in which a technician is required. In Santiaguito the president, secretary and treasurer also maintain the water infrastructure and clean the water well; in San Mateo the water committee pays someone to do this job; and in San Francisco there is a designated technician who, while the water committee does not pay him, receives voluntary tips from the community after providing his services.

During the fieldwork I found that the water committees in San Francisco and Santiaguito are responsible for doing managerial, operation and maintenance activities, for planning, organising and collecting user payments, and for identifying the source of water problems, finding likely solutions and encouraging community consensus to solve them. In San Mateo, managerial activities are shared with AyST. The water committee is responsible for DWSS operation and maintenance while AyST assumes responsibility for pricing water and collecting user payments.

During my fieldwork period I also found that the case study water committees worked as follows: firstly, the previous and current water committee members meet when there is a change of committee to talk about how the DWSS has been managed and discuss the main DWSS issues. The outgoing water committee suggest procedures for managing the DWSS to the new committee. They also give the new committee the domestic water user list with information on payments made; receipts for payments to CONAGUA and the Electricity Company; and, where relevant, information about the amount outstanding to be paid to these institutions. The new water committee also receives the title concession that enables it to withdraw and use underground water for domestic use and allows it to manage and distribute water and charge community households for the DWSS. Finally, the new water committee members discuss the tariff for the DWSS and

the costs, to date, of new connections to the network, debts and updated estimates for maintenance and repairs costs. In a focus group carried out in July 2010 according to a Santiaguito water committee member:

“We do everything. We are responsible for providing water [DWSS], maintaining the infrastructure, cleaning the pipes, cleaning the well, fixing the pump, doing field walks, checking that [the DWSS] is pumped with enough pressure, collecting user payments, encouraging debtors to pay ... and besides all that, sometimes we have to deal with angry people” (Secretary of water committee, Santiaguito, July 2010).

As mentioned, the water committees in the three case study communities are mainly responsible for managerial activities. However, each community also requires the collaboration of other community members for the operation and maintenance of the drinking water infrastructure, and this is delegated to a *bombero* who understands how the infrastructure works and is responsible for operating of the pumping system and distributing the drinking water to different geographical areas of the community.

San Francisco, Santiaguito and San Mateo communities require the services of the *bombero* to open and close the valves and taps and to divert drinking water to different areas. When a new household needs to be connected to the DWSS for the first time, the water committee is responsible for installing and charging for the tap system. For an average water committees charge \$3,500 MXN (£175 GBP). Charges for the DWSS are addressed in Chapter 6. Responsibility for maintenance is allocated to different community actors: a) the water committee as the main water authority, b) a *bombero* and c) domestic water users. The water committee is responsible for minor repairs such as mending broken pipes and fixing minor leaks, and for cleaning the wells and storage water reservoirs when the community have one.

The *bomberos* are also responsible for cleaning and chlorinating the water to make it potable in all three communities. Community members, especially men because of their gender role within the community¹⁵, assume responsibility for keeping their household large water tanks in an appropriate condition to receive

¹⁵ As part of their gender role women are responsible of appropriately use the water.

the DWSS and maintain good water quality. In an interview carried out in August 2009, the president of Santiaguito water committee explained:

“We continuously encourage [water] users to wash water tanks [installed on the roof]. We [water committee members] clean the big water reservoirs [used to store some drinking water and chlorinate it], but if [householders] do not clean their tanks, the water might be dirty from the start ... when we do pipe maintenance or cleaning we let them know that perhaps for the first 30 minutes [of the DWSS the following day] the water might have bits in it [and is not be drinkable]. But after that [the DWSS] become normal” (Water committee member, Santiaguito, August 2009).

Cleaning domestic water reservoirs was a suggestion also shared by the secretary of San Mateo water committee in a focus group in carried out in July 2010. A housewife, domestic water user from San Francisco talks in an interview about the high quality of the water in her community:

“There might be other problems, such as lack of water [from the DWSS], but the [water] quality is always good. We even drink tap water straight from the tap [which is not a common practice in Mexican cities]. Only when there are repairs we are told the water might contain bits of clay and might be dirty, but after some minutes water quality becomes normal” (Housewife water user, San Francisco, April 2009).

In terms of repairs, community members are required to help with larger repairs such as to common water pipes. This kind of maintenance and repair support is carried out as *faenas*, common work by community members for a specific purpose at a specific time and for a specific period. The community is organised in this way to repair the drinking water supply infrastructure, clean the main water sources such as the well and storage containers and expand the drinking water supply infrastructure and sewage system when necessary.

Community members mentioned in the interviews they are keen in participating in *faenas*. However, community members' participation depends on their willingness to work for free to provide a community service. It may also depend on the population's accepting them in *faenas* or on the water committee acceptance with responsibility for the community's DWSS.

Customary institutions and actors in a water governance system are central to decision-making and resolving drinking water supply problems. Customary actors have their own ways of organising the service they provide in order to obtain

successful outcomes. However, the provision of the DWSS brings customary actors daily challenges because they need to learn first about their main responsibilities, rights and duty that enable them to govern and manage the DWSS and then how the water infrastructure works.

San Francisco and Santiaguito communities have assumed total responsibility for customary governance of the DWSS with each community water committee. In these communities, community members have decided to maintain this customary governance structure over the formal one. They assume total control over groundwater, operate the water infrastructure, and fully manage the DWSS. In the process, there are failures to provide with timeliness and sufficiency the drinking water because they need economic resources. They also fail to collect users payments because the water users checklist is not up to date and not all users are willing or able to pay. Through willingness and ability to pay is possible understanding the main constrains of population to pay and likely solutions to this problem under an informal community managed water system. Water committees are also trying to learn how to solve the problems according to their means and to the extent that community members allow them to make and implement decisions. San Mateo has also a customary governance system, but the decisions made in this community, particularly those related to the use of economic resources, are only partial because the water committee has no agency to use the domestic water user payments, which are directly collected and managed by AyST.

According to the customary institutions analysed in this chapter, it is possible to conclude that the more independently the customary institution governs its own DWSS, the more decisions it can implement without following long administrative procedures to obtain permission to operate its decisions. This is because community members legitimate decisions made; thus, water committees have direct deals and agreements with their community and consequently faster answers to implement some decisions. The main problems for these water committees are financial. Decisions are frequently based on the water committee's budget, which in turn influences decisions about expense priorities, infrastructure maintenance and the planning of large and small repairs. By contrast, a main

strength is community participation with ideas and *faenas*. Customary water institutions are not always able to be financially self-sufficient and to cover all expenses at the time of need because there are financial difficulties that affect the performance of water committees. According to information provided in July 2010, in a focus groups with water committee members from Santiaguito and San Francisco, there are householders unable to pay for the DWSS due to their low and variable salary, which therefore produces the DWSS is frequently delayed. There are no generated statistics to know precise percentage of people unable to pay neither how much of their salary they might spend on water. Generate this data might require future quantitative research in these communities. When water committees are unable to collect the amount to pay for maintenance or repairs they usually have to ask the community for extra money and to collect the amount required before starting large repairs, for instance, or extending the network. The collection of DWSS payments and the struggles of water committees and community members are analysed in Chapter 7.

5.3.3.3 The influence of water committees in water governance

The governance of drinking water involves the organisation of the community to elect a group of individuals, community members, enabled to make decision for providing the DWSS. These individuals integrated as water committee members are the main customary institution providing the DWSS at community level. The water committee's main water control responsibilities – managerial, operational and maintenance – are agreed with community members. Water committees have to ensure that the DWSS is provided to community households and to organise it according to the needs of the community. Customary water committees also make their own rules to govern the DWSS, which are related to the rights and duties of customary actors that receive the DWSS provision.

An important part of the DWSS' governance is a solid and trustworthy water committee and a financial structure that supports the decisions taken. Financial resources are a central variable of DWSS functioning. The water committees in San Francisco and Santiaguito are also responsible for collecting user payments. As they are customary organisations, they provide the DWSS without the need for

CONAGUA's approval and do not have to report on decisions made by the water committee and community members to municipal, state, or national water institutions.

This section has analysed two important types of customary actors participating in the governance and management of the DWSS at community level: water committees and community members. Additionally, there is a third type of actor, these are local private actors who participate at the community level to sell and transport drinking water, through water tanks, to individual households that have not received the community DWSS. The following section focuses on these actors.

5.4 Local private actors participating in selling drinking water

As illustrated in Chhotray and stoker (2009) concept, in governance there is a plurality of actors interacting; in the studied communities water governance there are also local private actors selling and transporting drinking water to households that urgently require drinking water. The two main types of private actors are well proprietors and water vendors. The difference between the two is that well proprietors have a special permit from CONAGUA to withdraw groundwater from their wells and sell it to householders or water vendors, while water vendors – by custom – have the approval of community members, well proprietors and water committees to sell water to community members and transport it in a water tanker. Both local private actors sell drinking water at the local and community level.

Local well proprietors in Mexico usually run a private family business. Their main aim is to profit by providing and selling drinking water in areas with no DWSS, or where the DWSS is intermittent and there is frequent water insufficiency to cover basic needs. Well proprietors sell water to water vendors, who transport drinking water in water tankers, or *pipas*, for sale to inhabitants facing water insufficiency in their household in the case study communities. Water vendors do not necessarily own the water tanker they use, which has an average storage capacity of 10,000 litres, although some carry 15,000 or even

20,000 litres. Photographs 5.1 and 5.2 show water vendors and their *pipas* queuing to buy water from a well proprietor and withdraw it from the water well.

Photograph 5.1 Santa Leonor private well



Photograph 5.2 Tanker trucks queuing to buy water



Photographs: Author

Once the tank is filled, the driver delivers the water to the household that require this private service and is willing to pay for it. The drinking water transported by water tankers is discharged from the tankers into household cisterns, open concrete reservoirs, roof water containers, or, if a household lacks storage infrastructure, 20-litre barrels.

The private well owners and water vendors' advantage and success rely on their rapid response to householders demand. They make water available in a matter of hours or, at most, in a day. Their objective is to provide drinking water as soon as they can fill the water tanker and transport the water to the client requesting their service. The number of tankers-full delivered depends on the number of orders they receive in a day and the distance they have to drive to deliver the water. Once the water is deposited in the cistern or reservoir, payment is collected. The success of this local water market is based on the speed of the response to domestic users' demand.

There are also disadvantages in the operation of these local private actors. The first is the price that householders have to pay for water from a private vendor. While householders have to pay their local water committee for the DWSS monthly, they also recurrently have to buy more expensive water from private water vendors. This extra expenditure is generated by the unreliability of the

DWSS. Households that frequently lack of drinking water have to adapt to contingencies and they develop an adaptive capacity to face water insufficiency problems and bring solutions to these. In the studied communities, population buy drinking water from the local market: as bottled water, or from water tankers, or they borrow drinking water from a neighbour. Despite the economic disadvantage to domestic water users, who buy drinking water from local private market, domestic water users affirmed that private water vendors allow them to access drinking water when customary or official administrative procedures fail to deliver the piped DWSS. Buying drinking water from water vendors is expensive. A 10,000 litres water tanker varies from the \$350 MXN to \$450 MXN. The price is set according to the living area and the season. 10,000 litres might last in a household in average one month. A second disadvantage is related to the cost-recovery difficulty faced by AyST and community water committees to complete for the operational and maintenance expenses. A representative of AyST, public administrator, gave his opinion in an interview carried out in June 2009:

“I think that *piperos* [water tanker drivers] should be legalised [to make them pay taxes]. This is a problem, because they do not pay taxes and they keep all the money they earn. This is a problem because in the end not all householders pay for the DWSS. Householders pay approximately \$400 MXN [£20 GBP] for a *pipa* that lasts a month. If they cannot then also afford to pay [\$50 MXP per month for the DWSS] to the water institution, in two-months they end up paying more for continue buying *pipas* than if they paid for the DWSS. As you can see, there are financial losses [from the operation of informal water vendors’ sale of drinking water] and for many [other] reasons” (AyST representative, Toluca, June 2009).

Formal water institution representatives affirmed that water users delay making their monthly payments to AyST when they have bought water from private vendors. AyST complained about the number of non-authorized water vendors who sell drinking water to domestic users, who then fail to pay for the DWSS, while the water vendors fail to pay taxes, causing financial losses not only for AyST, but also for the federal government as represented by CONAGUA. The water committees are also directly impacted by non-payment of domestic water users for the DWSS; when there are problems with insufficient DWSS householders tend to buy drinking water from private vendors and may not be willing or able to pay again for an intermittent DWSS.

Finally, for local communities, the option to buy water from the tankers is a relief, despite the price; otherwise they would be totally dependent on the days when each water committee provides the DWSS. While AyST considers local water vendors harmful to its financial stability, for the customary water committees the presence of local water vendors is not a problem because they do not have to deal with them directly; the only inconvenience is householders' delay in paying for the DWSS. In general, the water committees of the three communities analysed perceived that buying drinking water was more of an economic problem for householders than for the water committees themselves. The customary water committee members from Santiaguito affirmed that it is more expensive for householders to buy drinking water from a private water service than to pay promptly for the community DWSS. This is a cyclical relationship. If one of the actors involved fails to keep its commitment, this causes financial and water insufficiency problems that affect not only the water management but also the governance of the DWSS in customarily organised communities.

This chapter has analysed the actors involved in the governance and management of the DWSS. The three main actors are official, customary and private actors, all of which are essential parts of the administration of the DWSS. The official and customary institutions are involved in governance and management activities while private actors play an important part in the provision of drinking water in the three communities studied. The following chapter analyses decision-making regarding the governance of the DWSS. This is closely related to the property rights systems that enable every actor to make decisions according to their position in the governance, management, or use of groundwater.

CHAPTER 6

Decision-Making according to the property rights of actors to access drinking water

CHAPTER 6. Decision-Making According to the Property Rights of Actors to Access Drinking Water

6.1 Introduction

The disjuncture in terms of the water rights held by the actors involved in the DWSS and its use is the main focus of this sixth chapter. As mentioned previously, governance concerns the rules that guide collective decision-making where a plurality of actors interacts. This chapter analyses decision making according to the rights of actors involved in the governance and management of groundwater to provide the DWSS. In this study, the decision making is related to the property rights system, which involves every actor that holds property rights over water resources. There are five different property rights taken into account in this research: rights to access, withdraw, manage, exclude, and alienate actors for the use of groundwater (Schlager and Ostrom 1992; Ostrom 2001). And there are six main positions held by the actors concerned as identified from the literature, in table 2.1 from section 2.4.3.1 about the Property Rights System, and the fieldwork: owner, proprietor, authorised claimant, authorised user, authorised entrant, and unauthorised user of groundwater and drinking water. The interaction between the types of rights held by every actor is defined as the property rights system. This chapter investigates what a property rights system is and why it is important in decision-making.

Politico-legal institutions involved in the governance and management of the DWSS and domestic water users hold property rights over water resources, and specifically the groundwater used to provide the DWSS. Actors involved in official, customary or private systems provide their services in different ways. The differences are mainly due to their different and often contesting interests and perceptions of the priorities in their performance. These differences create disjunctures between official and customary legal systems mainly regarding who holds property rights over water and how the actors legitimate these rights.

This sixth chapter focuses on the water rights held by official, customary and private actors in the three case study communities selected. In particular, it

considers the disjuncture between the water rights held by official and customary institutions providing the DWSS. Official institutions are generally more dedicated to seeking official permission, updating payments for concessions and collecting user payments to legitimate water rights; while customary institutions have different priorities. They legitimate property rights of actors and assume the distribution and provision of drinking water to community households as well as covering operational and maintenance expenses through payments collected from householders.

The actors involved in the DWSS and the use of groundwater follow specific rules and agreements according to the property rights they hold and the positions they represent in the official, customary or private legal system. The rules every property rights holder follows, in turn, generate a disjuncture between the official and customary water institutions and their DWSS activities. The source of the disjuncture derives from the organisational, practical and administrative differences between the institutions due to the specific property rights that each hold to allow them using water. This chapter provides empirical evidence of the water rights of the official, customary and private water institutions and actors and how these influence the DWSS at community level.

This chapter has five main sections. The first section has introduced the chapter and the second defines water rights. The third section analyses the specific water rights granted by CONAGUA to the formal and informal institutions that provide the DWSS, as well as the property rights over water that are recognised by customary actors. Formal water rights are provided via a grant or concession title after the applicant has fulfilled a series of official requirements. Informal water rights are recognised by customary institutions. This section discusses how the San Mateo, Santiaguito and San Francisco communities have obtained property rights over water through their water committees in order to provide their DWSS. It also considers the property rights of individuals and local private actors that use drinking water. The fourth section discusses issues related to the legitimate recognition of property rights to access groundwater and how formal and informal institutions legitimate property rights over the DWSS. The fifth section focuses on

payment for the DWSS and groundwater permissions. Through their payments, individuals and institutions legitimate their property rights over water resources. Finally, this section draws some conclusions. The chapter uses the narratives of official government representatives, customary water authorities, private actors and domestic water users to explain the mechanisms they have used to gain water rights to use groundwater resources and to access or provide the DWSS.

6.2 Defining and understanding water rights in the DWSS

Defining water rights is important to understanding the rules that legitimate the use of water. As illustrated in chapter 2, section 2.4.3.2, Water rights is the authorised right or permission to take water from a particular source, to use water and/or the water infrastructure (Beccar *et al.* 2002: 11). In the case study communities, there are formal and informal water rights, formal water rights are obtained through official written permission that allows a water right holder to withdraw, distribute or consume groundwater. This permission is granted by CONAGUA to formal, informal, or private institutions that fulfil the requirements and justify their reasons for wishing to use groundwater. By contrast, informal water rights are legitimised by custom or convention. Customary water users legitimate their rights by paying a formal or informal water institution for their right to water.

My fieldwork identified there are three main actors that require and hold formal water rights to withdraw groundwater for distribution to community members: the water committees of the three communities studied; AyST; and well proprietors. Also, there are actors (institutions and domestic water users) holding property rights over water. Property rights, as discussed in section 2.4.3.1, are access claims recognised as legitimate property by a politico-legal institution or a legitimate social actor (Sikor and Lund 2009: 1). Property is also recognised if socially legitimate institutions sanction it. Property rights of actors are usually informally recognised and legitimised, this means they do not hold a written document to certify this but recognition is also valid. In the three case study communities domestic water users and water vendors usually hold legitimate

property rights over water. Nevertheless there are also formal actors interacting within the PRS proposed by Schlager and Ostrom (1992) and Ostrom (2001).

Scholars working from a critical tradition have extensively examined official rights. They argue that water rights are influenced by a range of social and customary norms and relationships and not just by formal law (Bruns 2005; Roth *et al.* 2005, Boelens 2008; Zwarteveen *et al.* 2005; Derman and Hellum 2007). Mexican water law recognises users' rights to withdraw and use water. Possession of these water rights is legally acquired through official regulatory mechanisms. Water rights are also acquired by custom, labour or convention (Chandhoke 2003). In the communities studied, both official and customary institutions recognise possession of property rights to use water. Official and customary institutions grant water rights to water committees and private well proprietors because they require it for the extraction and provision of water for DWSS purposes. The Difference between both legal systems is that official institutions recognise property rights of actors through a law or written document for the distribution of DWSS to multiple households. Customary law, on the other hand, recognises by custom the water rights of domestic water users and informal water vendors, who pay a fee for drinking water.

Water rights, property rights and governance play a crucial role in controlling the access to and use of specific natural resources such as water (Schlager and Ostrom 1992; Von Benda-Beckmann 1995; Ostrom 2001). Based on the human rights theory, the right to water is the right to use the resource, and is not the same as holding a water right. This theory states that all human beings have the rights to access water to cover basic human needs. A water right, confers power to an actor, through a permission granted by a water institution, for using specific amounts of water from a specific source to obtain economic benefit (Solanes and Jouravlev 2006). Water right tenure is guaranteed not only through official written law but also by customary law (Von Benda-Beckmann *et al.* 1998; Roth *et al.* 2005; Derman and Hellum 2007; Boelens 2008).

The right to use water and water rights also used to be gained through historical use. Years of traditional knowledge have recognised that communities such as San

Francisco are organised to use water from a specific source within the community for a specific activity. For example, in San Francisco groundwater has been used for domestic consumption. This decision was implemented due to traditional knowledge and the awareness that groundwater has the quality for human consumption. Scholars have studied community members organisation and traditional knowledge in Latin American countries and identified that surface water and groundwater used to be equally allocated to different regions and users, not only for irrigation but for human consumption (Beccar *et al.*, 2002). San Francisco still maintains their water rights to manage their groundwater to provide DWSS to community households, but despite the national change from the traditional water supply method to a piped DWSS, householders continuously experience failure in the DWSS and lack of drinking water. The problems of insufficiency in the DWSS derive more from economical and managerial conditions than from lack of recognition of water rights or the water resource. This chapter only focuses on the water rights of actors involved in the DWSS; the following chapter discusses financial problems affecting the DWSS.

This pattern of water allocation for the DWSS was identified in the three case studies. San Mateo and Santiaguito only use groundwater and their water committees decide how to distribute the DWSS to community households. The provision of the DWSS is a complex set of physical, normative, and organisational elements to control the provision of drinking water (Beccar *et al.* 2002). Physical elements involve the water source, the places to which water is provided, the infrastructure to carry and distribute water; normative elements involve rules, rights and obligations; and organisational elements such as human organisation to govern, operate, maintain and sustain water resources (Beccar *et al.* 2002). Therefore, actors' rights over water, and specifically the DWSS, have been defined as 'authorised demands to use part of a flow of water, including certain privileges, restrictions, obligations, and sanctions accompanying this authorisation' (Beccar *et al.* 2002: 3). The authorised use of groundwater for providing the DWSS in Santiaguito, San Mateo and San Francisco involves restrictions to water use, payment obligations and economic sanctions. They all are related to the legal authorisation they obtained to enable their water rights.

As previously mentioned a water right is the ‘permission that provides its holder (either individual or institution) with authorization to take water from a particular source’ (Beccar *et al.* 2002: 3). The key concept to understand rights is authorisation. Case study communities hold a formal permission that authorise them using water from specific wells. Rights can be recognised when there is an individual or collective authority that certifies the use of water with legitimacy and is recognised by users and non-users (Von Benda-Beckmann *et al.* 1998; Beccar *et al.* 2002). Water rights are usually legitimised through payment for the concession or through social recognition.

San Mateo, Santiaguito and San Francisco’s water rights are recognised by CONAGUA, CAEM and AyST. Community members also recognise that their water committees hold the water rights necessary for their provision of the DWSS. At the same time, the water committees become the authorities and main institutions that authorise water users to benefit from the water they provide. Water committees recognise and legitimise domestic water users’ water rights through their payment for the DWSS. Formal institutions and domestic water users also recognise the water rights of local private actors involved in the distribution of drinking water at community level through the correspondent payment.

This thesis highlights official and customary water rights. Official water rights are statutory water rights authorised by State law and recognised by official institutions such as CONAGUA and AyST. Customary water rights are rights recognised and accepted by custom or convention. They usually enable users’ water extraction and consumption practices, and are accepted by individuals, community groups and water committees without formal legislative restrictions but with necessary community acceptance.

This section has introduced and explained the conceptualisation of water rights and official and customary water rights held by the State and non-state institutions in the case study communities. The water rights granted by both official and customary legal systems are valid, and are recognised and accepted by the actors

involved in each system. The following section focuses on water rights obtained by the actors involved in the DWSS in the case study communities.

6.3 Official and customary water rights and property rights in the drinking water supply service

In the case study communities, water rights involve specific particularities according to the position of each water right holder as owner, proprietor, authorised claimant, authorised user, or authorised entrant¹⁶ to groundwater resources and the DWSS. Domestic water users as well as official and customary water institutions have particular property rights. I have adapted Schlager and Ostrom (1992) and Ostrom's (2001) property rights system to the three case study communities.

Table 6.1 shows information collected in the field. It summarises property rights over water held by actors involved in the DWSS who benefit either from groundwater or from the DWSS. The table shows each actor's property rights according to how they benefit from water.

¹⁶ Owners: possess the right of alienation, the right to transfer a good in any way the owner wishes that does not harm the uses of the owners, in addition to the bundle of rights held by a proprietor. Proprietor: hold the same rights as claimants and the right to determine who may access and harvest from a resource. Proprietors develop rules to exclude non-contributors. Claimants: Possess the operational rights of access and withdrawal plus the right of managing a resource and the authority to create limits on withdrawal rights. Authorized user: Those who have both access and withdrawal use rights. Authorized water entrants are the payers of the entrance to use water resources (Schlager and Ostrom, 1992).

Table 6.1 Water rights associated with holders' position: the property rights system

Holder position \ Property Rights (PRS)	Owner: Nation State through CONAGUA	Proprietor: state, municipality, community, local private well proprietor	Authorized water claimant: OI: Decentralised organisation (AyST), CI: water committees	Authorized user: <i>pipero/ bombero</i> (water pumping man)	Authorized entrant to groundwater or the DWSS: householder, domestic water users	Unauthorized user: domestic water users who do not pay for the right to access and withdraw groundwater: middle men, water vendors
Access	OI/CI	OI/CI	OI/CI	CI	OI/CI	OI/CI
Withdrawal	OI/CI	OI/CI	CI	CI		OI/CI
Management	OI/CI	OI/CI	OI/CI			
Exclusion	OI/CI	OI/CI				CI
Alienation	OI/CI	CI	CI			

OI: Property rights to water held by official institutions and recognised by Mexican law and official water institutions.

CI: Water rights recognised by customary institutions.

Source: Adapted from Schlager and Ostrom (1992) and Ostrom (2001)

The table above shows five categories of property rights: access, withdrawal, management, exclusion and alienation (Schlager and Ostrom 1992; Ostrom 2001).¹⁷ Some actors may have the right to access and others, to withdraw water, but they may not have the right to manage the water resources (Boelens 2008). Other actors have the right to control water, exclude and alienate people from the use of this resource. It is also possible for a user to hold more than one property right at the same time (Schlager and Ostrom 1992; Ostrom 2001). These property rights when combined with a right holder position allow holders accessing water. And each position gives the specific user a specific set of property rights to use drinking water or to be involved in providing the DWSS.

6.3.1 Property rights of owners and proprietors

As Table 6.1 shows, the nation State, through CONAGUA, is the owner of all water rights in Mexico. CONAGUA has the property rights to access, withdraw and manage water, as well as to exclude and alienate others from its use. In an official water governance system, where formal law regulates rights and duties, every administrative level has specific formal water rights. The lower the

¹⁷ Access: the right to enter a defined physical area or resource. Withdrawal: the right to obtain the resource or products of a resource system (divert water). Management: the right to regulate internal use patterns and transform the resource by making improvement (of the DWSS). Exclusion: the right to determine who will have an access right, and how that right may be transferred to others. Alienation: the right to sell, inheritance, or lease management and exclusion rights (Schlager and Ostrom, 1992).

hierarchical level, the less property rights over water of water institutions are recognised by official institutions and their related laws. For example, the state, municipalities, community water institutions and local well proprietors are not the owners of the groundwater but simply hold property rights over water in their position as proprietors. The state of Mexico, municipalities, communities and local private well proprietors have the right to access, withdraw and manage drinking water, as well as to exclude some users from its use. In the case studies well proprietors may be local private or municipal. By custom, San Francisco and Santiaguito communities, through their water committee, additionally hold the right to alienate water to vendors or specific individuals or institutions in their own or neighbouring communities. By 2010, in a focus group, the president of the water committee from Santiaguito mentioned:

“[In 2011] we, [the water committee members] are discussing whether we will provide some water [the DWSS] to the new university built between Almoloya city centre and Santiaguito. There is a strong possibility that we will install a tap for them. However, we are discussing how much we need to charge them because of course they are not community members and they will need more water. So we need to be very careful not to lose [money and property rights]. However, we also need community members’ approval. If they agree, we will provide [the university] with the DWSS; otherwise we will not” (Water committee president, Santiaguito, July 2010).

6.3.2 Property rights of authorised claimants

Water rights of authorised water claimants’ are different to those of proprietors. There are formal and informal authorised water claimant institutions. For example AyST, the decentralised water organisation, is the official institution and authorised claimant that works in San Mateo. Customary institutions are also authorised water claimants. According to Ostrom (2001), as the authorised claimant, AyST has the right to access, withdraw and manage water. However, in San Mateo AyST only has access and financial management rights, and cannot withdraw water because San Mateo water committee holds this responsibility. AyST is neither able to exclude nor to alienate community members from the DWSS.

AyST, as authorised water claimant, has the right to withdraw water in formally-managed neighbour communities where AyST provides the DWSS. AyST,

therefore is not only an authorised claimant but also a proprietor, due to the property rights that are legitimated for them by communities and the municipality. The communities that recognise AyST's right to withdraw water are mostly those in Toluca municipality where AyST has full responsibility for providing the DWSS. The withdrawal of water by AyST or the community water committee depends on the DWSS agreement between the communities and AyST.

Water committees in customarily-governed communities hold property rights as authorised water claimants. In San Mateo, Santiaguito and San Francisco, the water committees have the property right to access, withdraw and manage water; however, only in San Mateo AyST is responsible for charging for the DWSS. In these communities water committees can also alienate water from other users.

In Santiaguito the water committee, in agreement with community members, has alienated rights to water of particular users such as a local university, small businesses and neighbouring urban developments. In San Mateo the water committee is not allowed to do this, as its partnership with Toluca municipality limits such decisions.

6.3.3 Property rights of authorised users and authorised entrants

There are authorised users in the three communities studied, including the *bomberos* who are the man responsible for switching on the pump to pumping water to different areas of each community. The *bomberos* in the three case studies have the right to access and withdraw water but are not allowed to manage groundwater, as this is done by the president, secretary and treasurer of the water committee. The *bombero*, as an authorised user, in each community is recognised by the customary but not the official institution.

According to the official and customary water governance systems, authorised entrants to water such as householders and domestic water users in San Mateo, Santiaguito and San Francisco only have the right to access water. The right of authorised entrant is conferred to householders and domestic water users by both official and customary institutions when they pay for the entrance to use drinking water.

6.3.4 Unauthorised users

Finally, during my fieldwork I found that both official and customary institutions identify unauthorised users who do not pay for the right to access the drinking water they consume or to withdraw water for sale, although they have access to water. This category includes householders and water vendors who do not pay for the right to access or withdraw water to the water institution concerned. For example, water vendors do not pay taxes or water right to CONAGUA or AyST. While domestic water users do not pay to the water committee or AyST their monthly or annual bill for the DWSS they receive.

An interesting finding is that some users may be classified as unauthorised by the official water institution but as authorised by the customary institutions, based not on payment but on custom and convention. In addition, some water vendors may be unauthorised by the official water institution but may be authorised by the local private institution that holds property rights as the authorised proprietor. Water vendors pay the well proprietor directly for the right to withdraw water from the well. Once water vendors pay for the rights to access groundwater they are legitimised by well proprietors, water committees and community members to sell and transport drinking water to neighbour communities. Under these circumstances, community members recognise and accept water vendors' role in the sells and provision of drinking water.

AyST categorises unauthorised users as illegal users, while water committees categorise them as debtors. The unauthorised users tend to be water vendors and householders that have not paid for the DWSS they receive or have not up to date their payments. Water vendors are unauthorised because they pay AyST or CONAGUA neither taxes nor for property rights. Their main economic activity is reselling groundwater. They are middlemen between the well proprietors and domestic water users. Currently there is no formal mechanism to legitimate them, and so they cannot become authorised users. While householders who are behind in their payments for the DWSS they receive are also classified as unauthorised users, it is difficult for the water committees or AyST to apply a mechanism to enforce them to pay, which would be the only way to validate them as authorised

users. A public administrator, member of a municipal water institution, complained in an interview about how the operations of unauthorised water vendors affect formal water institutions and the consequent economic losses:

“The problem is ... there are many water tankers and wells without registration or permission; there are proprietors of wells that sell water and [there is] water resale [through water vendors]. It is complicated in terms of norms. These black market sales affect the performance of operational organisations [municipally decentralised water organisations] ... The small customary water committees, small sales and resales are illegal because they cause millionaire [huge] losses for AyST. In San Mateo Atenco [community], for example, selling water from tankers is prohibited. However, AyST often sells water from water tankers due to economic constraints within the institution. It usually sells [water] on irregular settlements or where the water organisation knows that water will not be delivered” (Municipal public administrator, Toluca, June 2009).

Water vendors do not pay the official owner of the water, CONAGUA, because they do not have a water concession; they skip the official law and the permissions granted by CONAGUA and find ways to access and withdraw water from regional aquifers. Unauthorised users such as water vendors might not manage the water but they can exclude others from using it. For example, water vendors may select who they prefer to selling drinking water to from domestic water users, builders, local businesses and municipal offices. Their decision is often based on the number of deliveries they can make in a day or the distance they have to drive to deliver their water. If the distance is great, the driver can decide to exclude a water user from his private drinking water service. Any other water tanker driver can provide this service.

Authorised formal claimant only has rights to access and management but not withdrawal. By contrast, water committees have not only the right to access and manage but also to withdraw and alienate. The official DWSS does not have an authorised user in the three communities studied because this responsibility was entirely delegated to the customary water committee. Moreover, unauthorised users in an official system are able to access and withdraw water. However, in a customary management system unauthorised users can also exclude others from the service. The following table summarises the property rights held by each actor in the DWSS.

Table 6.2 Property rights of the actors in the DWSS

Property rights Actors	Access	Withdrawal	Management	Exclusion	Alienation
CONAGUA	✓	✓	✓	✓	✓
Communities	✓	✓	✓	✓	✓
Santiaguito water committee	✓	✓	✓	✗	✓
San Francisco water committee	✓	✓	✓	✗	✓
San Mateo water committee	✓	✓	✓ (operation, maintenance)	✗	✓
Water pumping man	✓	✓	✗	✗	✗
AyST (in San Mateo)	✓	✗	✓ (economic resources: payment collection, budget, investment, expenses)	✗	✗
Domestic water users	✓	✗	✗	✗	✗
Householders with a waterwheel on their property	✓	✓	✗	✓	✗
Water vendors	✓	✓ (on payment of a fee)	✗	✓	✗
Well proprietors	✓	✓	✓	✓	✗
Householder debtors	✓	✗	✗	✗	✗

Source: fieldwork.

The main differences are that in an official system the proprietor has no alienation rights, while in a customary system the proprietor is allowed to alienate if necessary. This means, that in an official system, proprietors are not allowed to sell, inherit, or lease water management rights because these are owners' rights. By contrast, customary institutions are allowed to sell, inherit, or lease water or its management to other actors because they legitimate others can also do it. Customary institutions recognise they are able to alienate specific water rights or property rights over water they have the authorisation to take. However, they are totally free to select or accept to whom they would like to alienate if necessary. Having the rights to alienate does not mean they have to do it. They are

legitimised to do it in case they require making a decision about it. Below I explain how the positions of the actors involved in the DWSS influence collective decision-making according to the property rights system.

6.3.5 Property rights and decision making in the management of the DWSS

The specific property rights of holders enable them to make decisions about their access to groundwater. As there are multiple legitimate actors in the water governance systems in the study area, it is necessary to identify the wide array of property rights, norms and duties that guide their decisions about accessing groundwater resources.

Scholars support the idea that if communities are involved in decision making, the community members will make collective decisions according to organisational, practical and administrative procedures that benefit the majority of inhabitants. They will take into account the characteristics of both official and customary practices and select the one they think is most suitable for them, as a community knows its own needs best (Doe and Khan 2004; Harvey and Reed 2006). For this reason, communities should be the ones to make the decisions about their DWSS allocation, distribution and delivery of water and who should take on the related responsibilities.

The challenge for the case study communities and formal institutions is not making decisions, but implementing them once made and legitimising water rights in a society with diverse traditions, legal pluralism, socio-economic characteristics and interests. The main challenges for both water governance systems in implementing their decisions and legitimising the property rights of actors to access groundwater are related to two main actions: a) recognition of property rights through a formal document; b) recognition of property rights through the collection of payments from water user. The following section analyses how the official and customary water institutions legitimise property rights over water.

6.4 Legitimising property rights to access groundwater

Water institutions involved in the provision of the DWSS in the study area have two main ways of legitimising property rights: 1) through a formal title concession/ or agreement, and 2) through periodical payment for the water rights to the water institution responsible. The following section addresses how actors legitimise water rights. It addresses first formal water rights legitimised through a title concession and then informal property rights held by customary institutions and actors.

6.4.1 Legitimising formal water rights

In Mexico there is a broad trend towards conditional water rights through formal official procedures. Formal water institutions such as CONAGUA only legitimate individuals' and institutions' water rights via formal procedures such as granting title concessions, allocating titles, giving official permission and charging for the provision of the DWSS through formal water institutions. At any administrative level, such bodies only recognise actors' water rights when an official water institution legitimises them. An official water authority from CAEM working as operator of water infrastructure, at state of Mexico level, mentioned in an interview carried out in November 2008:

“Federal government, through CONAGUA, has directly granted concessions to allow people to hold water rights. CONAGUA allows four ways of managing water: by municipalities, by decentralised organisations, by the private sector, and through concessions. CONAGUA always provides the concession. If I were a civil association, I could connect [people from] a settlement and ask for a concession” (CAEM Engineer, Toluca, November 2008).

Legitimising formal water rights includes obtaining a permit and complying with the specific requirements demanded by the LAN, such as causing no harm to third parties, protecting the environment, using water efficiently and payment for operational costs and for water rights (Solanes and González-Villarreal 1999). These conditions are written into the LAN and aim to promote society's beneficial and appropriate use of water. If the conditions are not fulfilled and the water rights granted do not result in continuous social-improvements use of water, or water

has not been used for a certain period, the water right might be rescinded (Solanes and Jouravlev 2006).

In Mexico a variety of legitimate institutions hold formal water rights, including the case study communities and local private institutions. The main formal institutions holding formal water rights are CONAGUA, CAEM and AyST. Private institutions such as private industries located next to San Mateo community and private well proprietors in San Mateo, San Francisco and Santiaguito also hold formal water rights. Customary community institutions such as the water committees may also hold formal water rights granted and recognised by the State law. However, customary institutions might recognise by custom domestic users property rights.

Holders of formal water rights for different uses included for drinking water use are regulated by CONAGUA. Water rights holders are aware of the specific water rights that they must apply for if they want to use underground or surface water for particular purposes. There are special concessions if water is required for the provision of the DWSS, for community households, irrigation, food production, industrial purposes, or to run a business selling water. The property right to use groundwater held by AyST, the case study customary communities and private water sellers is usually granted for provision of the DWSS.

The different actors in the community case studies that use drinking water legitimate by custom the specific water rights that each requires to take water from a specific source. The process for accessing water, and how the property rights are legitimated, are different in each community. This also is also the case for individuals, local water markets and industries, which have to follow different procedures in order to be allowed to use groundwater. The following subsection explains how formal water rights granted to the communities chosen as case studies legitimate their rights to access, withdraw and manage drinking water. After analysing formal water rights, I discuss customary institutions' property rights over water and how these institutions legitimate their actors' access to groundwater.

6.4.1.1 Formal water rights in Santiaguito

In 1989, CONAGUA first recognised the Santiaguito community's right to access, withdraw and manage groundwater. According to the community water committee records, before 1989 it had a common tap and there was no charge for accessing drinking water from this source. Since 1989 the community, through a water committee, has been responsible for water extraction, control – management, operation and maintenance – alienation, and DWSS distribution, and pays for the right to access and withdraw groundwater.

Even though its formal right to groundwater water was formally recognised in Santiaguito in 1989, the legal document recognising the community's water rights was not granted until 1992, when the State government developed the first national water law. Once the community was granted a water concession it assumed responsibility for paying CONAGUA for it annually. The payment depends on the period of the concession. CONAGUA stipulates that water concessions titles to withdraw or use national waters cannot be granted for less than 5 or more than 30 years (OCAVM 2011).

CONAGUA expects the Santiaguito community to pay on time for the concession that guarantees its community water rights to access and withdraw groundwater as well as to pay to extend the title concession. The payment is made by the water committee, which collects it from the community. The expense generated by paying the formal water concession tends to cause financial problems between the water committee and community householders. Financial problems consequently cause troubles in the operation of the DWSS due to the committee's inability to collect enough money from users to pay for the concession title.

6.4.1.2 Formal water rights in San Mateo

San Mateo installed infrastructure to access and withdraw water in the 1960s. Toluca's Adolfo López Mateos airport and certain industries agreed to provide the community and other neighbouring communities with wells and pipes as compensation for their industrial growth and land use in the 1960s (Contreras

Domínguez *et al.* 1989; Alzúa Pérez 2004). The compensation also took into account the industries' environmental and social impact.

Toluca airport and the industrial corridor assumed the full cost of San Mateo community's new well and the infrastructure to pump water. The community did not have to apply directly to CONAGUA for formal rights to access and withdraw groundwater for the DWSS, as the airport and industries involved dealt with this too. From that date onwards, San Mateo's inhabitants had to assume the operation and maintenance costs. In an in depth interview, a male householder, domestic water user from San Mateo commented:

“As far as I understand, we [the San Mateo community] did not have to ask permission from CONAGUA to withdraw water. We did not have to pay for the water rights, but we were asked if we wanted a well. We just had to organise ourselves to install the pipes through *faenas* and then organise provision of the DWSS. We just received the well and the infrastructure, ready to be operated. The governor, engineers and many politicians came to the inauguration. We even appeared in the [local] newspapers. So now we know this water is ours and nobody tells us what we can or can't do. The only issue is that we have to pay the municipality for the DWSS. But we do not have to pay anyone else for any kind of permission. I don't know if the airport or the industries have to. [The government] knows this water is ours” (Male domestic water user, San Mateo, February 2009).

According to Mexico's urban planning legislation, industries are responsible for providing their neighbouring communities with drinking water. This was why San Mateo community was provided with a well. Most industries are granted by CONAGUA a formal concession to withdraw a specific amount of water called, called *agua en bloque*,¹⁸ for industrial purposes only. In order for the industries to provide a well in San Mateo, which could supply the DWSS, they had to apply for specific water rights, and now the state of Mexico and Toluca municipality recognise San Mateo community's right to access and withdraw groundwater to provide the DWSS.

¹⁸ *Agua en Bloque* is the total volume of water allowed to be withdrawn from a well during a specific period. The amount is granted by CONAGUA via a concession title. If CONAGUA grants a concession, the actor (municipality, community, industry) that benefits must pay for the total authorised volume of *agua en bloque* withdrawn from the well for which they have obtained the concession. Domestic users pay for the water they receive, and the water authority pays for the *agua en bloque* granted in the concession title. Users pay the municipal or customary authority and the municipality pays CONAGUA. The amount of money collected by the municipality or water committee should be equal to the amount they pay CONAGUA.

While San Mateo community members have to pay AyST, rather than the water committee, for the right to receive their DWSS, they do not have to pay for the right to withdraw water from the ground, which is paid for by the industries. The water committee is responsible for water management and provision of the DWSS. And AyST pays the Electricity Company for the expenses generated due to the water pumping operation with the money it collects from householders. In an interview carried out in San Mateo, in April 2009, a male water user talked about this process:

“This community owns the wells for providing drinking water because the airport and the industries donated them. [San Mateo community] did not pay a single *peso* to open the wells. They gave them to us as a gift. We only have to pay the municipality for the [drinking] water service. I do not know if the airport or the industries have to pay anything more. I don't think so, because they've already paid to open the wells”
(Male domestic water user, San Mateo, April 2009).

San Mateo and Santiaguito have formal water rights, recognised by CONAGUA, which enable both water committees to access and withdraw groundwater from a specific well. Local private well proprietors also hold formal water rights, provided by CONAGUA, to access, withdraw and manage groundwater for business purposes. A central part of the decision-making in water governance relates to who is eligible to obtain a title concession to use groundwater. National government governs all property rights to water through CONAGUA and control the number of concessions granted, the uses of groundwater and the location of the main extraction sources.

6.4.1.3 Formal rights to water of local private well proprietors

Private well proprietors usually apply for formal water rights to sell drinking water. To fulfil all the legal requirements involved in withdrawing water for commercial purposes they must comply with LAN's mandates. They pay CONAGUA for water resources granted to develop a water business in a local market.

Obtaining a water concession was a relatively simple procedure for these well proprietors when there were no restrictions on water withdrawal. However, CONAGUA is currently rejecting applications for new concessions to withdraw

water due to intensive withdrawal by the industrial sector and Mexico City's government in the past.¹⁹ Opening new wells and allowing new contracts for water extraction are currently banned; although the renewal of permission granted to well proprietors and concession title-holders, before the ban on concessions came into force, is still valid.

CONAGUA also renew or accept water withdrawal concession shared between two actors. For example, when a water rights holder sells part of his/her titles granted by CONAGUA it is likely that CONAGUA will accept approving the new-shared concession. This process works as follows: when an applicant has an agreement with a water right holder who is able to transfer any spare volume of water, CONAGUA allows the sharing or reselling through the transfer of property rights of spare volume from an already-granted concession. Currently, well proprietors who apply to extract groundwater must first contact private well proprietors who hold water concessions, or the municipality, to negotiate the possibility of buying a portion of allocated volume of water. Once the well proprietor and the interested actor agree on the volume of water to be sold, they go through an official procedure with CONAGUA who will accept or deny the new grant or concession to use the spare volume of water and to open the new well following specific characteristics.

CONAGUA can only validate the transference of rights from a local private water market user to another on condition that the water is used for human consumption, which includes the DWSS, rather than for industry or irrigation. When actors need water for activities different to human consumption they do need to follow a different procedure. Once the transference of water rights has been accepted and the concession title granted, the new right holder may open a well following the required engineering methods that fulfil CONAGUA's conditions in order to meet the quality withdrawal standards. A private well proprietor from San Francisco explained in an in depth interview about the concession that CONAGUA granted him:

¹⁹ From the 1950s onwards, Mexico City government withdrew and transported groundwater from Toluca's aquifers to Mexico City and its metropolitan area, to provide the DWSS to inhabitants of this area.

“The concession we hold was granted by CONAGUA. We have an annual permit and we have to renew it every year. CONAGUA gives specific rights to access [and withdraw water] and you have to pay for those rights. For example, they authorise you [to withdraw] 20,000 litres. However, if you need more, you have to wait a year to ask to increase the extraction. You have also to change the pump and the pipes, as well as paying for the extraction rights, to have all the water you ask for. CONAGUA has total control of the permits within a little circle, thus you can’t [omit a procedure]. [For example, apart from the application, documents and payments], CONAGUA requires you to take a sample of the soil layers every metre once you start opening the well. So you have bags with the soil samples. You have to keep them all because CONAGUA might ask you at any time what material you have at 100 metres’ depth ... it is delicate; but you have to fulfil every requirement in order to get [formal water rights]” (Private proprietor of a well, San Francisco, April 2009).

Once private well proprietors obtain formal property rights to access and withdraw water, they must legitimate these through the periodical payment for them (payment for water rights is discussed in section 6.5). This section has analysed the formal water rights held by San Mateo and Santiaguito communities and by local private well proprietors. The water rights held by San Mateo and Santiaguito water committees enable them to provide the DWSS to community households. However, the way in which these water committees manage the DWSS and legitimate householders’ property right to access drinking water is recognised under the communities’ own customary rules. The following section analyses how customary institutions and actors legitimate their property rights over drinking water.

6.4.2 Legitimizing property rights over the drinking water supply service

Apart from formal water rights held by the water committees to access and withdraw water to provide the DWSS, there are also customary property rights that enable customary actors to govern and manage their DWSS. A similar process occurs with both community members and local private water vendors. Community members’ specific property rights to access the DWSS, and water vendors’ right to access groundwater are recognised and legitimised by custom. In San Francisco, San Mateo and Santiaguito, specific property rights are valid because customary water committees and domestic water users legitimate the actors’ use of drinking water. Below I analyse the property rights held by customary institutions and actors to access, withdraw or manage drinking water, or to exclude others from its use.

6.4.2.1 Customary property rights held in the case study communities

Besides the formal water rights that define them as proprietors, the three communities studied also hold customary water rights, which are recognised by the members of each community and legitimised through customary mechanisms. The recognition of customary property rights allow them access to, withdrawal and management of water, the exclusion of others from the DWSS or the alienation of drinking water when necessary to different actors in the same or a neighbouring community. The three communities hold property rights to the wells that provide their drinking water.

The water committees are recognised because each committee member is elected by community members' common decision to entrust the DWSS and community decisions making related to the DWSS to them. The new water committee representatives form the community's legitimate water authority for approximately one year. San Mateo, San Francisco and Santiaguito water committees also hold customary property rights legitimised by community members, which let them govern and manage their DWSS customarily, each in its own way.

This is the case study San Francisco community water rights have also been gained through historical use while Santiaguito's customary water rights have been also gained due to labour mechanisms. According to Boelens and Zwarteveen (2005) and Boelens (2008), some actors have earned water rights through labour or the historic of water. Santiaguito, for example, initially held the rights to access and withdraw water through a title concession granted by CONAGUA. Santiaguito has additionally gained customary property rights because community members have also put labour on the installation and management of the DWSS. San Francisco has a historical right to access, withdraw and use underground and surface water. Since colonial times, this community – and other communities in Mexico – has committed its labour to organizing the water infrastructure for irrigation and the provision of the DWSS.

San Francisco has always had customary water rights because the community developed in a water-rich area and used to be water self-sufficient, with most households having traditional wells or water wheels that covered all their needs. Since 1970, urbanisation and development approaches to governing water have promoted piped water rather than traditional water extraction methods and the rights to govern water and manage the DWSS have been modified in San Francisco. For example, before 1970 the community's householders were the owners of water found on their property and the decision to use groundwater entirely depended on them; they also decided who they would share water with and for what purposes. They did not have to ask formal or customary institutions for permission to use water.

After 1970, property rights in San Francisco were nationalised and the State through CONAGUA formally took over all water rights and made itself responsible for allocating and recognising communities' specific property rights. As discussed in chapter four, CONAGUA currently is the only owner of water found in the Mexican territory. Therefore, any concession approved by CONAGUA entitles water users as rights proprietors. As a consequence, the San Francisco community became the proprietor of specific wells and community members elected a customary water committee annually to govern and manage the DWSS. Even though the water committees of the communities studied hold property rights, official institutions do not accept the customary institutions management of the DWSS. Official institutions prefer the municipality manage it. In an interview, a CONAGUA ex-employee that used to be working as inspector and technician of water infrastructure in Toluca municipality mentioned:

“In each municipality there are at least seven or eight independent water committees. Those committees are not legal. CONAGUA has not registered them, maybe because it is a tradition, maybe because [if community members perceive that their traditional water rights are affected they might become violent to defend them], but I think CONAGUA does not have them because it [does not carry out its functions properly]. In the State of Mexico only 30% of independent water committees are regulated and 8% have no urban regulation, so they freely administer water [without paying for water rights neither charging community members for the DWSS]” (Municipal government representative, inspector and water technician, Toluca, June 2009).

Community members of the three communities defend their right to access water resources on their territory and to organise provision of the DWSS. Although San Francisco and Santiaguito have the right to access and withdraw groundwater, they still have drinking water supply problems. The main problem is not related to water availability or the property rights held by the water committee and householders, but to how the DWSS is managed. A few San Francisco community members have taken advantage of this problem and have set up local private businesses selling drinking water. They are private well proprietors who hold water rights to access, withdraw and sell drinking water. The way in which they legitimise others access to water is also legitimised through their payment, as summarised in Table 6.1.

The main difference among the water committees of the three case studies, in terms of water rights, is the responsibility taken to manage the finances collected from the provision of the DWSS. In San Mateo, the water committee leaves the responsibility for managing these finances to AyST. Apart from this, all three water committees studied have customary recognition of their rights to access and withdraw water and to manage the DWSS, and if required, to alienate others external to the community the drinking water.

Community members in the three communities also hold property rights to access the DWSS that are legitimised through payment mechanisms. In order to explain the legitimate access of actors such as domestic water users and vendors to drinking water, it is necessary to discuss payment for the DWSS that the former receive for the latter's access to groundwater. The following section analyses payments as a way of legitimating the right to access drinking water or withdraw it to provide the DWSS.

6.5 Legitimising property rights through payment for the DWSS

In the case study communities, the rights to access the DWSS or to withdraw groundwater are mainly legitimised through payment to the water institution governing and managing the DWSS or to the main actor responsible for the decision to allow other actor to access or withdraw drinking water. This section

analyses the payment provided either to a formal or an informal water institution or to an individual actor as a way of legitimising actors' access to water (groundwater or the DWSS).

Formal institutions generally legitimise water rights by granting an official concession, which enables official, customary or private water institutions to access and withdraw groundwater. Water institutions or individuals must fulfil the conditions stipulated and make the appropriate payment to CONAGUA in order to obtain an official document legitimating their rights. However, paying an official institution is not the only way of legitimising water rights. Customary institutions are also responsible for collecting water user payments that legitimate the access of actors to the DWSS. In the communities studied, payment for water is the main legitimate mechanism that recognises actors' rights to access water and water institutions property rights to access, withdraw and/or manage the DWSS when applicable.

AyST legitimates San Mateo householders' access to the DWSS they receive on their property in return for payment. Not all householders keep their payments updated, however, and though they have access to the DWSS they are not legitimate users if they are in debt to AyST. In an interview, an AyST representative complained about users who do not pay for the DWSS:

“In Toluca, people have to pay for water services. If they do not pay, they receive letters of notice. If they continue not paying, we can only restrict the service to the house, but we can't cut it. So all these [missed payments] are money lost [to AyST]. Small sales and re-sales also represent economic losses for the official water institution [AyST]” (AyST representative, Toluca, June 2009).

Similarly, Santiaguito and San Francisco's water committees legitimate domestic water users access to the DWSS through users' monthly payments to them. Community members pay AyST or the water committee respectively. Both customary and official water institutions legitimate the property rights of domestic water users through payment for the DWSS.

For customary water committees, legitimising the property rights of householders to access the DWSS depends more on users' cash payment to the committee than

on their holding an official document guaranteeing access to the DWSS; and water vendors also have to pay the well proprietor, in cash, for the right to access and withdraw groundwater from their well.

The local private water market – mainly represented by well proprietors and water vendors – must follow mechanisms of access to and extraction of groundwater in order to carry out their business. For local private well proprietors, the legitimate way to gain the right to access and withdraw groundwater is through paying CONAGUA for an official concession. Once this is obtained, the owner must make payments to CONAGUA every three months to maintain the right to withdraw water from the well. The payments begin after the well is completed and is ready to be operated. The penalty for not complying with these obligations is a temporary sanction prohibiting the withdrawal of water and a fine, which must be paid before s/he is allowed to continue extracting water. The sanction ends when the payment is complete or the penalty period ends. If the proprietor of a well does not pay the fine by the end of the penalty period, CONAGUA has the right to cancel the concession or repossess the well. In an in depth interview, a private well proprietor, holder of a water withdrawal permit confirmed:

“Based on these rights we have to pay for water every three months. Actually, CONAGUA has a water meter, and based on this meter they charge for the water extracted. You pay for the water you get. However, from this business [of selling water from the well] you have earnings, and with these earnings you pay for electricity and everything you need. The payment [for water rights] works similar to the electricity one. You pay for what you consume [every three months]. There is a tariff and they charge you for the permit you hold. The water you take is the water you pay for. For example, if they allow you to [withdraw] 20,000 litres you have to pay for those litres. You can’t withdraw more water than CONAGUA allows you to take, nor can you withdraw less, because once the year’s contract finishes CONAGUA assesses it and says: ‘You know, we gave you [permission to withdraw] X cubic metres and we are missing some money’. Then you must check the water you are consuming [from the well, through the water meter]. There is no way you can avoid paying for water rights otherwise CONAGUA can cancel the permit” (Private well proprietor, San Francisco, April 2009).

In order to make a profit from their investment with CONAGUA, well proprietors sell drinking water to domestic water users, builders or local water vendors. The latter resell the water to domestic water users from water tankers. Even when a well proprietor’s business is selling drinking water, this does not mean that s/he

distributes the water. A well proprietor from San Mateo explained in an interview how he operated his water business:

“We do not have a single tanker; we sell water to water vendors. They come to the well to fill their tankers and they go and deliver it. The drivers earn approximately \$260 MXN (£13 GBP). So if the price of 10,000 litres of water [transported by a tanker] is \$460 MXN, \$200 MXN remains for the well proprietor. We charge \$20 MXN (£1 GBP) per square meter of water” (Private well proprietor, San Mateo, June 2009).

Reselling water is the water vendors’ main activity. Besides legitimising property rights to access and withdraw water they must also pay the well proprietor for the water they take. However, even when they legitimate their access to water by this direct ‘pay as you go’ payment to well proprietors, formal water institutions do not accept these customary property rights, although they cannot stop them accessing and withdrawing groundwater. An AyST representative, public administrator, complained in an interview about water vendors’ operations:

“Water tanker drivers [*piperos*] should be regulated. It is a problem because they do not pay taxes. They actually charge a lot. They charge \$400 MXN (approximately £20 GBP) for a [10,000 litre] tanker and it lasts for one month. If you [householder] do not pay the provider [of the DWSS] for a couple of months, in the end you spend more on *pipas* [tankers of water]” (AyST representative, Toluca, June 2009).

The *piperos* water vendors act as middlemen between the water users and the well proprietors. Water vendors are authorised by customary actors but unauthorised in the eyes of formal water institutions. They legitimise their access to and withdrawal of water by paying the well proprietors. In customary systems, the sale of drinking water from water tankers is commonly practiced at the local and community level, especially when there is no sufficient water from the DWSS or water is scarce.²⁰ Such water sales generate advantages for the domestic water user, who can buy drinking water when required, and profit for the water tanker operators. Other actors who directly benefit from selling water are local shops selling bottled water and the local water purification industry.

²⁰ ‘Inadequate supply of water to meet the varied demands of humans and their environment... Water scarcity is not only a relative factor of the quantity/quality aspects of supply and the quantity/quality consequences of demand, it is also an aspect of social relations and transformation in the loci (community) of control over water resources’ (Johnston, 2003: 81). Johnston, B. R. (2003). ‘The Political Ecology of Water: an Introduction’ *Capitalism, Nature, Socialism* 14(3): 73 - 90.

Some unauthorised users have property rights in action to access and withdraw water from the aquifers. This mean they manage to access water and sometimes withdraw water even when either a formal or a customary institution does not legitimise them. Authorised rights holders perceive unauthorised users of drinking water as problem because they do not legitimate their access through payment for it. By April 2009, according to a private well proprietor's opinion in an interview:

“There are a lot of people that are not paying for water rights. This is not convenient for the government because these people are only squeezing it without contributing anything. There are a lot of vendors [and unauthorised well proprietors] who do not have permission to use water. However, they do it. Once someone came to me to sell part of their [water] rights or cubic metres. They asked for millions [of pesos], but I do not know how they do that. It is supposed to be impossible. So all this represents losses for the government” (Private well proprietor, San Francisco, April 2009).

In my fieldwork I found individuals classified as unauthorised users, especially in San Francisco. Unauthorised users are interested in obtaining a water concession through their social or political relationships. The narratives of some well proprietors that I spoke to during my fieldwork indicate that individual water users, land owners interested in opening a local water business and would-be water vendors owners occasionally approach members of CONAGUA to ask for hidden help to obtain a grant, permission or rights to withdraw water. This sometimes enables them to develop their business network at the community level. Such users may obtain and legitimate water rights through formal procedures but not legitimate their access to water with the required payment. Or they may pay for the right to water but not fulfil the conditions attached. In an informal chat, a potential unauthorised user, informal water vendor, from a neighbour community to San Francisco mentioned:

“I always wanted to open a well to extract water and sell drinking water to the neighbours, but it is very expensive. You need to obtain a concession first, and then open the well. However, if you invest in the payment for that concession there's no guarantee that you'll get it. But, you know, there are always ways to do it. I think I will ask some friends for their help. Apparently you can't [he took a moment to think about]...but you can [suggesting there are always ways to obtain a formal document that allows you to withdraw water]” (Private informal water vendor, San Francisco, May 2009).

While engaged in my fieldwork I found that knowledge of the law influences how some individuals, such as potential well proprietors, seek to obtain the formal right to extract groundwater, even during periods when water extraction is banned. In an interview, according to the opinion of a CONAGUA-regional level representative, obtaining a new formal water concession can be difficult and granting concessions might depend on the recharging and environmental conditions of the aquifers:

“There are many periods when water extraction is banned. These are defined by region. It usually depends on how intensive the water withdrawal has been in your area. It also depends on how many aquifers have been exploited and damaged. For example, in the Toluca river basin zone there is a closed season. Water withdrawal is prohibited in so many places because of this intensive withdrawal” (CONAGUA engineer, government representative, Toluca, June 2009).

Notwithstanding these restrictions, some unauthorised actors understand the procedures they need to follow to obtain formal water rights and legitimate their water use and the duties and obligations connected to access to, withdrawal and use of water. Social relations among community members are not the only ways of influencing this. Knowledge of the law, social and political relations and unauthorised use can also play a part in their access to water. I also found that indirect privileges legitimate the water rights of certain drinking water users. For example, if the potential water user has a direct political relationship with the person responsible of authorising water rights s/he might be informally condoned of the procedures and even payment and might also get permission to access water. Also, some people tend to intimidate water authorities to obtain whatever they want. Finally, power relations also play an important role because many politicians ‘pay favours’ by using power relations and granting some water concessions or legitimising property rights to access water. Privileges might be also gained through social relations among community members.

I found that unauthorised users in San Francisco and Santiaguito extract and use groundwater without holding either official water rights or customary property rights. They make use of their rights in action, which are not legitimate but they find the way to access water; rights in action allow unauthorised users to benefit from groundwater resources.

After years of experience in the drinking water business have given authorised and unauthorised well proprietors and water vendors a deep understanding of the relationships and procedures required to get permission to withdraw water. Local private water businesses with deep knowledge of the legislation also have a good understanding of the institutions and authorities responsible for granting specific water rights and the type of permission they require to legitimise their access to groundwater. For example, they know the requirements they do need to fulfil if they would like to obtain a water concession for commercial purposes selling drinking water. These requirements are different if they need to irrigate crops or to use groundwater for industrial activities.

In a customary drinking water supply system managed by a water committee, knowledge of the law is not the only way of legitimising the extraction and use of drinking water. In communities organised by custom, the water committee and the population are aware of the State legislation regarding water resources; however, for them, State law is not the main instrument involved in governing, managing, legitimising and recognising the water rights and property rights of actors involved with groundwater withdrawal, use, or the DWSS. Instead, water committees according to custom and convention govern and manage the DWSS and the valid mechanisms for making and implementing decisions are agreements made together with the community.

This chapter has discussed the decisions by the formal and customary water institutions that govern and manage the DWSS according to the property rights they hold. It is important that both legal systems recognise the diverse array of each actor's right to access drinking water according to her/his position. Understanding the property rights system helps in understanding the rights of each actor to water and how these enable them to access water. The following chapter discusses the struggles that customary institutions face in governing the DWSS and domestic water users in receiving it.

CHAPTER 7

Community water institutions' struggles to improve the governance and management of the drinking water supply service

Chapter 7. Community Water Institutions' Struggles to Improve the Governance and Management of the Drinking Water Supply Service

7.1 Introduction

Both the water committees and domestic water users in the three case study communities face recurrent problems that affect the governance and management of the DWSS. The main difficulties are related to financial recovery of operational costs, which affects the quality of the DWSS, community members' trust in the water committee, willingness to pay for the service, and consequently water committee decisions about the governance and management improvement of the quality of the DWSS.

I identified three main problems during my fieldwork: firstly, water institutions' difficulties in recovering payment for the DWSS from community householders; secondly, householders' difficulties paying for the DWSS; and thirdly, a decrease in domestic water users' trust in their water committee, which affects the quality of the DWSS. This chapter discusses the problems of domestic water users and water institutions related to provision of the DWSS.

The chapter is divided into four main sections. The first has introduced the chapter; the second analyses the problems faced by local and community water institutions, particularly water committees and AyST, in providing the DWSS and recovering payment for it; the third section analyses the two main difficulties that householders face paying for the DWSS – willingness and ability to pay; and, the fourth section discusses community members' trust in their water committees.

7.2 Difficulties faced by the water committee and AyST in providing and recovering payment for the DWSS

Providing the DWSS requires the coordination of managerial, operational and maintenance skills to guarantee that the service is delivered with appropriate quality, quantity and timeliness. Coordinating the operation of the DWSS in customarily-organised communities requires the joint effort of the water committee and domestic water users. The case study communities' water committees face three main problems related to the DWSS, which relate to its management, operation and maintenance. All three have a common source related to water institutions' cost-recovery by collecting payment for the DWSS from householders.

7.2.1 Issues that cause difficulties in the operation of the DWSS

There is a recurrent problem with the operation of the DWSS water pump. Most of the men responsible for the pump, the *bomberos*, also have another, paid, job outside the community, and their work supplying drinking water to the community is not economically remunerated because it is considered a service to the community. The president of Santiaguito water committee mentioned in a focus group:

“We [water committee members] also have another job, we have a family and we are doing this activity as a way to give something back to the community. That is why we are not always here. This is not a full time job. We get no salary [as water committee members]. So we decided to organise our schedule and open this office every day, but after 6pm: from 6 to 9pm. And look – we never stop working [pointing to householders in the community water office at the time]. Every day we receive people who come to pay, who come to complain, who need us to fix the infrastructure, debtors who we are good enough to call, or users who come to ask for an extension to pay” (Water committee president, Santiaguito, July 2010).

In the case of the *bomberos*, they are willing to serve their communities by taking on part of the responsibility for supplying drinking water. However, a main disadvantage of not being paid for this is that sometimes they neglect their responsibility, for example when there is a social event that they wish to attend, as occurs frequently at weekends. As a result some water users may not receive the DWSS for one or more days, while others in the same community receive it for

the entire day, such as a housewife domestic water user from San Mateo explained in an informal chat:

“This week we heard that the *bombero* had a party [in the community] and he came to open the valve around 6 pm and we had water all night long. I went to sleep at midnight and we still had water. I had to turn off the tap, because I did not have more containers to put [water] in. But I am sure that tomorrow we will not have any” (Housewife domestic water user, San Mateo, January 2009).

These kind of complain have been heard in the three case studies. The *bomberos*, like all community members, wish to attend social events. However, when they leave their post to go to these they neglect their responsibility as water committee members and may fail to open or close the water tap, interrupting DWSS distribution. The same can happen with other members of the water committee.

It is a challenge for water committees to pay the *bombero* for opening and closing the main pumping system tap and it is not possible in all communities. For example, Santiaguito pays the *bombero* \$1000 MXN (approximately £50 GBP). However, San Mateo and San Francisco pay neither the *bombero* nor any other member of the water committee for their activities in their communities.

Payment to the community members responsible for supplying drinking water is optional in every community and is a measure of compensation for the time spent in this activity rather than a compulsory payment. The water committee members agree the decision about whether or not the pump operator is paid. Sometimes a water committee decides not to pay any committee member but rather to give another kind of incentive. Hodge (1991) mentions there are incentives such as tax exemptions, tax reductions, subsidies, permits, quotas, contracts and the collective interest. In a focus group with water committee members from Santiaguito community, the treasurer gave his opinion:

“Economic incentives help the water committee to ensure that the *bombero* assumes full responsibility and willingness to make the water service available to households in different areas and at different times of the day” (Water committee treasurer, Santiaguito, July 2010).

The type of incentive offered depends on each specific context. Of the case study communities, Santiaguito is the only one that pays its *bombero* monthly as well as

giving him incentives. However, there is no payment for any other water committee member. In San Francisco and San Mateo none of the water committee is paid for their committee work, although in all three communities they sometimes receive a reduction on their monthly payment for the DWSS as compensation. The following table summarises the types of compensation that water committee members receive:

Table 7.1 Payment and incentives to water committee members for operation of the DWSS

Community Water supply service	San Mateo	Santiaguito	San Francisco
Payment to water committee members	None	None (engineers or technicians that eventually repair the water infrastructure are paid)	None
Payment to the <i>bombero</i>	None	\$1000 MXN (£50 GBP) per week	None, though, sometimes domestic water users give him a symbolic contribution
Incentive for <i>bombero</i>	None	Monthly fee for water is reduced	Monthly fee for water is reduced
Incentive to other water committee members	None	None	None However, domestic water users sometimes give to the man who mends the water infrastructure a tip as a contribution
No. of days water service is provided per week, per household	7 and 3 in some areas	3	1

Source: Author, from 2010 interview data

In San Mateo and San Francisco, the person responsible for the water pumping system – the *bombero* – does not receive a fixed payment. This work is considered a free community service. However, in San Francisco and Santiaguito, their payment for the DWSS they receive is sometimes reduced as a compensation measure; and sometimes *bomberos* receive a voluntary economic contribution from domestic water users, especially when they fix or repair the water infrastructure. Currently, domestic water users in San Francisco do not think they should give extra compensation to any other water committee member because of the argument that they are doing a community service. San Francisco community

members also think that, to some extent, water committee members get unauthorised payments from the money collected from householders' payments. Payments are unauthorised because it does not take into consideration community members' approval to pay or compensate water committee members because of their community services. Community members argue that some water committee members, such as the *bombero* or the person that fixes the infrastructure, sometimes take himself money without the consent of the community but with the consent of the water committee. Other domestic water users, in Santiaguito, think that the compensation provided to specific members of the water committee such as the *bombero* or the men who repair the water infrastructure should receive a small payment as an incentive to continue providing good-quality services. In San Mateo, payments to water committee members are not a problem because AyST manages money and water committee members have clear that they are providing a community service. However, when a householder decides to give them a tip, they are allowed to receive it.

These cases, in which supplying water is seen as a community service, show how the drinking water system is vulnerable to chaos in its distribution schedule. Over time, any water committee member might become less committed to continuing this activity and fail to fulfil the DWSS provision requirements, especially when there is no fixed payment, as in San Francisco. As a consequence members of the water committee might end their service when the community decides to remove them from this responsibility, or when they quit this responsibility. If member of the water committee do not end up their service before, the water committee finishes when the current period ends.

Providing the DWSS requires the coordination and management of natural and economic resources and the activity and time of water committee members, and this requires a budget and community cooperation to make the DWSS infrastructure work. The members of the three communities studied are aware of this, and householders are aware that it is necessary to pay for the DWSS in order that it can be organised, efforts can be coordinated and the service can be

managed. The following section analyses the main managerial problems faced by the water committees in the three case study communities.

7.2.2 Managerial problems recovering operation and maintenance costs

Recovering operation and maintenance costs for the provision of the DWSS has been a challenge for the water committees studied. Their members think that giving water a monetary value may help to provide and maintain the DWSS. They need to recover their operation and maintenance costs in order to continue to provide and improve the service. However, recovery of these costs has been difficult for the water committees, firstly because the committee members need to organise themselves to collect householder payments, and second, because water committees require appropriate financial administration to manage the DWSS.

There is still a long way to go to achieve the managerial challenges in the case study communities, which aim to continue governing by custom the DWSS. Not only the community members but also the water committee members prefer to learn and make decisions on their own, according to common consensus, rather than lose their rights to control and use their groundwater resources.

7.2.2.1 Difficulties in drinking water infrastructure maintenance

Maintenance of the drinking water infrastructure is absolutely necessary in order to provide a safe and good quality DWSS. It requires economic resources, which water committees should recover from householder payments. Without recovering these costs to pay for maintenance and repairs, the water infrastructure would become non-functional. However, cost recovery in small and medium sized communities, especially those customary-organised communities tends to be poor, and what is collected is mainly used to cover operations and basic maintenance.

In the Santiaguito, San Mateo and San Francisco communities, after paying for the continuous maintenance of wells, pumps, pipes and water reservoirs there is usually no budget for investment, network expansion and large repairs. For example, in San Mateo, maintenance of the well and the piped system is the responsibility of the community and the water committee. The water committee is

responsible for maintaining the pump house, the well, the pipelines and the water reservoirs, and the community is responsible for the maintenance of their own household pipes and reservoirs and fixing small street leakages. Householders also need to make sure their water infrastructure is functioning. The community is not totally responsible for large-scale maintenance and repairs. By maintenance it is understood the cleaning and basic infrastructure maintenance to make sure it works. By repairs mean to fix the infrastructure once it stops working. There are small and large repairs.

San Mateo's householders pay from their own economic resources to maintain the DWSS infrastructure. However, the municipality through AyST charges for the DWSS, which has specific responsibilities in the financial administration of two wells in the community. San Mateo water committee asks Toluca municipality for economic support for the maintenance and repairs of specific parts of the drinking water supply system when necessary. However, when the community asks Toluca's municipal government for financial support to fix larger problems, such as replacing the pump or the old water network, for or a pipeline extension, it is put on a waiting list with other communities with similar problems.

Toluca municipality tries to resolve the larger issues at the municipal level rather than at community level whenever possible and the financial department approves a payment for drinking water system maintenance. However, San Mateo community may have to wait a long time for municipal help to solve water infrastructure problems. In an interview, according to a representative of AyST, expert in water finance, public policies, and rights, the large projects that require municipal attention include:

“updating the list of domestic water users, general and in depth maintenance, installation of a potable water plant, installation of a water treatment plant and making sure it can be operated, unification of pipes of the water infrastructure, etcetera” (Municipal public administrator, Toluca, June 2009).

The water committee and community members of the three case studies perceive that economic support for the DWSS is not always provided. Water committee members think that municipal attention to community demands is provided only

during elections, when government institutions are looking for votes. In electoral periods the DWSS and water-related issues such as demand of drinking water become political rather than a service delivery covering basic needs (Loaeza 2009). I repeatedly heard in the three communities that the municipalities do not invest in water infrastructure because they are saving money for electoral campaigns. In a focus group, the secretary of the water committee from San Francisco thought that government institutions:

“...Want to save money for political campaigns or operating the water service in urban areas managed by the municipality, but they are not going to invest money in our community because they know we manage the water service” (Water committee secretary, San Francisco, July 2010).

In group discussions, focus groups, interviews, and informal conversations carried out during my fieldwork it was repeatedly heard that municipalities do not invest in water infrastructure maintenance and services because they do need to save some money for electoral campaigns. This is because politicians might prefer influencing people votes by promising solution to a never end unsolved drinking water problem. Frequently, local politicians prefer investing money in visually appreciated water infrastructure works. Thus, more population are able to see the works and probably a candidate and their political party might win more votes. After elections, water supply promises are left aside, coming back in the following electoral period. I think power is a key element influencing decision making and its operation to improve piped water networks and the DWSS; politics regularly influence government position and implement measures in order to win popularity and positive population opinions. This behaviour usually takes place at municipal and community level rather than at state or national one.

By contrast, in an interview, a representative of AyST expert in water finance and public policies at municipal level explained how the budget is used in formally organised water institutions:

“There is no money for investing in water infrastructure or works from municipal or [decentralised] water organisations' budgets, which [make up] approximately 80 percent [of the decentralised water organisations in the state of Mexico] ... the money comes from user payments [rather than from a federal, state, or municipal budget]” (AyST representative, Toluca, June 2009).

Toluca municipality attends to community demands related to DWSS infrastructure requirements. However, according to data provided in interviews by CONAGUA, CAEM and AyST representatives in October-November 2008 there is not a specific budget allocated to invest in either maintenance of or improvements to the drinking water infrastructure. This is because this responsibility is usually entrusted to communities and money collected is invested in minor repairs, water organisation members' salary, to pay debts, payments to Electricity Company and CONAGUA to legitimise water rights when necessary. This situation has been observed in San Mateo where water committee assumes responsibility for providing the DWSS, maintenance and repairs. Though, the main control of water finances is AyST responsibility.

In the state of Mexico it is also frequent finding that municipalities delegate not only the DWSS but also financial responsibility to communities aiming to govern and manage it. For example, Santiaguito and San Francisco, on the other hand, have full responsibility for maintenance of their water systems. They have to maintain and clean the well and reservoir and maintain the source of power to pump the drinking water. They also maintain the pump, pipes and water-related infrastructure. Water committees' expenses in maintenance are variable. Actually, they do not separate a specific amount per month for maintenance or repairs. They spend on this when necessary and if the infrastructure is totally damaged. If possible, they ask whether a community member has the skills to do it in order to save some money. It was not possible obtaining this quantitative information from fieldwork because water committees do not keep these records. The water committee and the person responsible for the pumping system are directly responsible for small repairs including fixing the pipelines and leaks, seeking ways to increase the available budget and basic maintenance of wells and water reservoirs. When larger repairs and maintenance procedures are required the water committee immediately notify the water users to keep the community informed and ask for their financial support if necessary.

If maintenance of the pipe system is necessary, the water committee asks the community to provide labour. Men usually play an important role in this activity.

When the maintenance is related to power sources or infrastructure repairs, the water authority asks for water users' financial support. They cost the work, divide the total amount among the householders registered on their list and ask for their cooperation. They plan to collect the extra money within a specific period of time; usually more than a month, because not all householders are willing or able to pay in a single payment. Once the money is collected they start the repairs.

Once the water system infrastructure in a self-managed community has been installed it must be sustainable. However, when a customary self-managed community faces large maintenance problems and cannot afford to pay for large repairs, the water committee has the option of asking the municipal water representative for financial support. Only under these conditions does the water committee have the option to apply for a specific federal budget. This budget to pay for priority issues is provided by the federal government to states and municipalities through the *Ramo 33* norm.

Ramo 33 gives all municipalities the right to an annual budget to improve, extend or resolve a specific social demand. Once states and municipalities receive this budget they must divide the total amount among number of communities they have and invest the money in resolving community problems. It should be used for priority demands in the municipal territory (Centro de Estudios de las Finanzas Públicas 2006; LVII Legislatura del Estado de México 2010). For example, the money provided is sometimes used for education, to build schools, pave roads, open health centres, install or extend DWSS network, for sanitation infrastructure, etcetera (Centro de Estudios de las Finanzas Públicas 2006). It is difficult to get access to this budget; however, especially for large maintenance and repair projects, because it is not easily granted. In terms of the money invested for the DWSS an AyST representative, public administrator expert in water finances and public policies at municipal level, declared in an interview:

“Governments do not like to invest huge quantities. Thus, invested money is used to mend leaks or to change just a piece of the system, but they do not invest more money to improve the entire system. Every government period is the same; obviously we all know the reason. We know the problems faced by municipalities because of governmental transitions” (AyST representative, Toluca, June 2009).

Assigning a budget requires official approval and can take years, depending on whether the municipal government considers the requirement a priority. As municipal authorities only have a three-year governance period and representatives are frequently removed from their jobs at the end of this period, it is common for drinking water-related issues at municipal level to be allocated very low priority. For municipal governments the DWSS needs are not always seen as urgent. Therefore, DWSS issues become political and are raised at almost every election.

The DWSS continues to function in the three communities studied because they have taken on the challenge and responsibility for providing it. Both municipalities – Toluca and Almoloya de Juárez – accept customary governance and management through community water committees besides their total responsibility for providing the DWSS to domestic users of their own communities. In parallel, every community is responsible for maintaining control over its water resources and infrastructure, charging for the DWSS and collecting user payments. However, even with the commitment and effort of customary water institutions, (Nyarko *et al.* 2007) suggest, customary authorities should strengthen their organisational skills and administrative systems to become self-sustainable so they can better govern the DWSS at the community level.

Strengthening the sense of community ownership through participation may have positively enhance community governance and management of the DWSS (Doe and Khan 2004; Nyarko *et al.* 2007). The relationship between community and drinking water authority requires cyclical feedback. It is important to constantly feed the community governance system with fresh ideas in order to improve decision making and management of the DWSS. Additionally, if the authorities gain the trust of the population it is easier to improve community participation and payment for the service.

Self-governing and managing the DWSS with appropriate community participation and water committee commitment may enhance water infrastructure maintenance. Maintenance of the DWSS infrastructure by customarily-organised

communities requires investment and labour. Acquiring the finances necessary for maintaining the infrastructure depends on water committees' successful recovery of the cost of operating the DWSS from domestic water users. I analyse water committees' difficulties in recovering payment for the DWSS in the following section.

7.2.3 Difficulties in collecting payments for the DWSS

Supplying the DWSS generates expenses that must be recovered by the water institution in order to continue with its provision. Operation and maintenance include the cost of staff and administration, electricity, routine maintenance, small repairs and water quality maintenance and monitoring, for example chlorinating the water. Nyarko *et al.* (2007) and Whittington *et al.* (2009) also find this to be true. However, neither the water committees nor AyST totally recover payment from the community. Households in each of the case study communities are charged a specific amount for operation and maintenance of the DWSS (see Table 7.2).

Table 7.2 Tariff for the drinking water supply service

Community	San Mateo	Santiaguito	San Francisco
Water supply service			
Monthly water tariff	\$70 MXN (£3.50GBP)*	\$50 MXN (£2.50GBP)	\$50 MXN (£2.50GBP)
Days of water service provision per week, per household	7; and 3 in some areas	3	1

Universal Currency Converter, Available on line: [27 December 2010] <http://www.xe.com/ucc/es/>.
Source: Author, from data obtained in interviews, 2010

The water institutions do not always manage to achieve full collection of payment for water used and for operation and maintenance expenses. Whittington *et al.* (2009) affirm that some communities in Bolivia, Peru and Ghana are not even able to collect their operational costs. According to my fieldwork it is found that there are communities in Mexico central highlands that are not able to always collect operational costs per month. The money collected from each householder is not equivalent to the water institution's expenditure. According to the analysis of information collected during my fieldwork, the amount of money collected

from community householders in Santiaguito and San Francisco only covered operational expenses, as reflected in a statement by the water committee president of Santiaguito in a focus group on July 2010:

“The money we collect only helps to continue providing the service. With this money we have to pay for electricity and the *bombero*. We have to pay electricity bills each month: on average, a bill of ... \$57,000 MXN [£2,850]. So, with the money we collect we can only guarantee the service but nothing else. Every house has to fix small leaks in their pipes. The committee cleans the well and reservoir, we also fix small failures in the infrastructure; we also ask if someone in the community knows how to do this to save some money. But if we need to pay additional costs we ask community members to cooperate with that” (Water committee president, Santiaguito, July 2010).

Not only customary but also official water institutions have difficulty recovering costs and collecting payments for the DWSS. Customary water committees have this problem from San Francisco and Santiaguito communities whereas AyST from San Mateo householders. AyST's difficulties are for two main reasons. Firstly, because even when community members receive the DWSS and it is mandatory to pay for this service, there is no payment enforcement mechanism in San Mateo because AyST only collects user payments and does not manage the operation and delivery of the DWSS. AyST might claim to limit the DWSS or the number of hours in which the DWSS is delivered to householders that do not pay for the service they receive, but the water committee cannot always limit or cut the DWSS. In an interview, an AyST representative expert in water finances and water rights at local level mentioned:

“When we [the official water institution] face a problem of non-payment we notify the householder. If the householder avoids the notification, we limit the service [DWSS] providing little amounts of water. We cannot stop providing the service because is not allowed. We could limit the DWSS per house without affecting the neighbours, but we have to go directly to the house. We do not necessarily have to do it in the whole neighbour” (AyST public administrator, Toluca, June 2009).

AyST can take drastic measures in urban areas or communities where it wholly manages the DWSS, but in San Mateo both a customary and official government manages the DWSS and both must agree decisions. In an in depth interview, a public administrator from AyST, expert in water finances and public policies, stated:

“The problem [for the official water institution] is its inability to collect user payments. The municipality could supply drinking water to 10,000 individuals, but if it only charges 100 [there is a problem] ... there is a methodological manual of tariffs, but there is no way to enforce it. Therefore, there is no compliance ... and people avoid paying for the DWSS. Everything costs money: water, electricity ...” (AyST representative, Toluca, June 2009).

Householders' failure to pay for the DWSS and the low level of cost recovery by official water institutions affects re-investment in drinking water supply infrastructure, maintenance and repairs.

The second main reason about the difficulty in recovering user payments is the non-payment water culture, as discussed by Goldblatt (1999). Referring to this topic, in an interview carried out in June 2009 a water finance expert, representative from AyST, wondered:

“But why do people not want to pay [for the DWSS] not only in Mexico but also in other countries, and why do people pay for other services such as electricity? I think this has a psychological aspect. (AyST representative, Toluca, June 2009)

Perceptions about the importance of paying, or not paying, for the DWSS are personal and based on users' experience of the DWSS they receive. Every householder has their own opinion and makes their own decision about paying, even in San Mateo, where payment is mandatory. In San Francisco and Santiaguito the payment is compulsory because of the agreement between the water committee and community members. However, there is no legislative norm that sanctions it but customary rules, approved by the water committee and householders, which ask for the payment.

The official water institution in San Mateo have difficulties recovering payment for the DWSS, even though there are incentives for householders to pay; such as a reduction in the water bill when householders pay in a single payment the annual bill. However, not all householders are able to afford paying the annual water bill in a single payment; thus they have the option to pay in a monthly or two-months basis without the possibility of applying any incentive. The majority of users would be encouraged to pay every month or two-month period, for the DWSS if they could see constant improvement in its quality and clearly understood how the official institutions use the money they collect. Householders see the failures in

the management of the DWSS and the service delivered as reasons for not paying. These failures affect the recovery of water user payments not only at the community but also at the municipal level. In an interview, a public administrator of Toluca municipality, expressed his concern about the deficit in DWSS payments collection at the municipal level:

“In the majority of cases municipalities are in deficit in terms of financial recovery of the water supply service... In the 125 municipalities in the state of Mexico, there is a 60 percent financial shortfall: 60 percent of the economically active population does not pay its water bills. However, this 60 percent is an encouraging number, as there are municipalities that currently receive payment from only 5 percent of their population. These are really alarming numbers” (Municipal public administrator, Toluca, June 2009).

In San Francisco and Santiaguito's self-organised communities the water committees also have problems recovering their DWSS operation and maintenance costs. There are six main reasons behind this. The first is that these communities' householder lists, water user databases and water payment records are not kept updated. Santiaguito and San Francisco water committees do not have up-to-date records of the total number of households receiving the DWSS. However, especially in Santiaguito, the water committees propose to carry out a new household census and then maintain it updated to make sure most households pay for the DWSS.

Secondly, water committees do not have control over the total amount of water extracted, delivered and consumed and therefore cannot charge accordingly. Instead they charge a standard water tariff for every household registered. According to information provided by water committee members it is extracted and provided drinking water the water committee is not charging for, which represent an extra difficulty to collect more money to cover operational and maintenance expenses.

Thirdly, there are no specific training, rules or incentives for customary committees to motivate them to provide high quality standards in the DWSS. Nor are there incentives for water committee members to provide reliable information, which affects community trust in the water committee that affect householders' willingness to pay for the DWSS. Currently, though, there is consensus between

community members and the three water committees studied that information about payment collection, expenses and debts will be produced and made public.

The fourth reason for the limited collection of payments is the relative lack of experience of members of every water committee for governing and managing the DWSS. This seems to be a key element in water committees' failure to collect payments. The provision of the DWSS was transferred from federal to state, municipal and community levels in 1992, and DWSS financial self-sustainability at community level has not yet been reached (Molano Ruiz 2007). In some areas of central Mexico federal subsidies have been given for infrastructure. Domestic water users in the centre and south of Mexico pay a small amount for the DWSS they receive because central and southern states are more likely to receive subsidies. In northern states, domestic users pay the total cost of the DWSS (Bourguett Ortíz *et al.* 2007). Santiaguito and San Francisco received a federal budget only to install the infrastructure and not to maintain it. See Bourguett Ortíz *et al.* (2007) and Sandoval Minero (2007) for research on self-sufficiency at municipal and community level in Mexico.

Householders in the three communities are charged according to how many days per week they receive the DWSS and a monthly tariff, as shown in Table 7.2. The low cost of the DWSS, inconsistent user payments and even householders' refusal to pay for the service are understandable. The lack of willingness to pay due to the unpredictable periods without receiving the DWSS, as analysed by Anthony (2007), are also understandable. Most payment and non-payment decisions are based on the financial situation of both actors. However, part of the lack of payment problem still depends on the trust that community members have in the water committee. Their trust in the water committee influence householders willingness to pay for the DWSS they receive.

Fifth, the water committees in Santiaguito and San Francisco would like to maintain their water tariffs at a reasonable and affordable level because then more people would pay for the service without overstressing their living expenses. Even when householders are charged a modest fixed amount for the DWSS, as detailed in Table 7.2, not all are able to pay.

Finally, the sixth difficulty involved in recovering operation and maintenance costs for the DWSS is the operation of local private water markets and water vendors. These markets are part of a cycle in which they sell drinking water to domestic users lacking enough water to cover their basic needs. As a consequence, some domestic users do not pay or do not promptly pay the water committee for the DWSS because the service is not always guaranteed even after it is paid for. On the one hand, buying from the water market generates extra expense for householders, affecting their ability to pay for the DWSS to the water committee. As Molano Ruiz (2007) and Herrera-Toledo *et al.* (2009) discuss, this cycle is a trigger that limits the ability of the water committee to be self-sustainable. On the other hand, there is a tacit consensus that water markets provide drinking water to users who do not have enough drinking water to cover their basic needs. According to Palmer-Jones (2001), water markets are crucial in alleviating drinking water deficiencies in rural environments and peri-urban areas.

7.2.4 Failures of water institutions to collect payment from domestic water users

In addition to the low level of payment collection, I found that in rural and peri-urban communities there are three frequent administrative failures of water institutions, such as AyST and the water committees in the case studies, to collect sufficient payment for the DWSS. In an in depth interview, a municipal authority AyST representative and expert in water finances affirmed:

“It is difficult to collect money because if nobody asks for or insists on that payment, people do not pay. Users in rural or peri-urban areas are not always willing to pay for services if there is no one asking for that payment. The payment has been politicised ... we have a culture of non-payment for water services as well as a culture of ‘I do not collect your payment’. The problem is not just the tariff system, but also the inability to collect payments” (AyST authority in water finances, Toluca, June 2009).

First, the official and customary water authorities' inability to collect payments is a key failure because it means there is neither capacity to encourage householders to pay nor rules to make them pay. Community members have learnt ways to skip, avoid or delay payment. Sometimes water committees argue that it is not a matter of inability but fear of collecting money from relatives or even friends of a

politician. Water committee members think that some water users make use of power relations to react with violence and loud comments against the water committee to avoid being charged. A few violent situations were identified in Santiaguito and San Francisco communities. For example, according to a narrative carried out in August 2009 from the president of Santiaguito water committee, a debtor community member once got angry because the treasurer explain to him about his responsibility to collect householders payments and insisted to him to update his payments. This person become angry and threatened the treasurer to leave him alone or he might react physically fighting against him or any other water committee member.

In San Francisco, the situation was extreme because a specific community group recently inhabiting this community killed a water administrator of a well. A housewife domestic water user from San Francisco explained in an interview:

“In a new housing development in this community some people killed the well administrator. He had a lot on money because he was always collecting people payments. He used to charge \$100 MXN [£5 BP] per month and people from this place used to have water everyday. However, people did not precisely know what he was doing with the money, and he used to insist in charging and collecting payments... One night, he was killed” (Housewife water user, San Francisco, April 2009).

The second problem is linked to treasurers who frequently and unpredictably overlook the total payment from some users completely. Sometimes the water authorities in Santiaguito and San Francisco charge the same household consumption price to householders with a small business on their property that requires more than the average amount of water. In Santiaguito water committee members sometimes prefer not to collect payment for the DWSS when their safety is involved in order to avoid problems with community members. All the outstanding payments represent a high loss that could be spent on Electricity Company payments or infrastructure maintenance. If the water committees were to collect the total payment owing from all householders they could obtain long-term advantages for the DWSS.

The third failure of the water committees, and especially of the treasurer, is the mismanagement of householders' payments for the provision of the DWSS. This

also occurs in official water institutions. Money collected from householders in the communities studied is not always properly used. Some water authorities keep the money for personal purposes rather than using it to maintain or reinvest in water-related issues. The total amount collected is not always registered or re-invested, and this affects community members' willingness to pay.

The communities studied hold meetings at which the water committee informs the community members about the financial status of the DWSS. However, apart from this the committees do not have to provide any more information unless community members ask for it. This facilitates community treasurers' recurrent mismanagement of water users' payments. San Francisco was the only community in which community members expressed awareness of this, and they did not know what to do about treasurers suddenly leaving town with their money. In an interview, sub-manager of water management from CONAGUA at regional level, wondered:

“Where is this money collected by the independent water committees? Just in a few hands” (CONAGUA sub-manager of water management, Toluca, November 2008).

The above is also the thought of formal local water institutions representatives as AyST. Paying for the DWSS means that money collected can be reinvested in planned aims. However, when money, at least for the operation and maintenance of the DWSS is not recovered, the water committee cannot reinvest. If money is not reinvested or used to meet other DWSS purposes, social distrust generates a cycle of non-payment, non-reinvestment, water shortages, lack of service, lack of infrastructure maintenance and mismanagement of collected financial resources (Usobiaga Suinaga 2007). Non-payment also generates problems in the management of the DWSS, because customary water committees do not have money to implement decisions. Customary governance of the DWSS is also affected, due to community members' lack of trust in the water authorities.

In Santiaguito and San Francisco, the treasurer of the water committee's has repeatedly used householders' payments inappropriately to his own personal advantage. As a consequence, users stop paying the water committee their monthly quota for the DWSS. Non-payment prevents the resolution of DWSS

problems such as the need for infrastructure repairs, water shortages, non-provision of the DWSS and outstanding bills for electricity to power the pump. Such problems require rapid attention to improve not only the operation and delivery but also the quality of the DWSS. When water committees cannot pay for electricity to pump the drinking water, delivery to community households is affected (for more information on the delivery of water services see Nyarko *et al.*, 2007 and Biswas and Tortajada, 2010b).

Payment for the DWSS depends on users' willingness and ability to pay and their trust in the water committee to administer the payments correctly and supply drinking water. Paying for water is not easy, because besides the fact that not all users are willing to pay for it, many cannot pay. Willingness and ability to pay for the DWSS are analysed in the following sections.

7.3 Willingness and ability to pay for the DWSS

Householders' willingness and ability to pay their water bills affects improvement of the DWSS. Not all householders in the communities studied are always willing to pay for water. Some pay only to avoid water shortcuts or stop receiving the DWSS. However, in some communities, such as San Mateo, while people may not always be willing they have to pay for water on time, otherwise they are fined and the water committee temporarily suspends the DWSS to their property. The service is reinstated when the user pays the bill and a fine. See Babel *et al.* (2010) for more on willingness to pay. Another finding in the communities studied was that while some householders are willing to pay for the DWSS, they are unable to do so. This section analyses both willingness and ability to pay for the DWSS in the communities studied.

This analysis supports the argument that householders are willing to pay for a DWSS that is delivered when they need it. Householders do not like paying for the DWSS and not receiving it; therefore if it is delivered with sufficient quantity and pressure to cover domestic needs, domestic water users are willing to pay for the service on time.

7.3.1 Willingness to pay for the DWSS

'Willingness to pay' refers to the maximum amount that individuals are willing to pay for a good service (Nyarko *et al.* 2007; Biswas and Tortajada 2010b). In this thesis a *good service* refers to a supply of drinking water suitable to cover domestic users' biological, personal and domestic needs. Water has a financial value (Savenije 2002) which makes it tradable at the point of providing a service. If a domestic water user regularly receives the DWSS at home, this service should be priced and paid for because the DWSS is a commodity. Nyarko *et al.* (2007) divide domestic water users into four main categories: those willing to pay the full supply cost of the DWSS; those willing to pay more than the existing tariff but not the full supply cost, which in the three communities studied is not precisely known because it includes labour; those who want to maintain the existing tariff; and those who wish for a reduction in the existing tariff. In the case study communities it was also found that some householders are willing but unable to pay in cash; however, they are willing to contribute with their labour (*faenas*²¹) if necessary (see Kyessi (2005) for more about ability to pay).

In San Mateo, where AyST collects domestic user payments, the municipal council approves a fixed quota for the provision of the DWSS. At community level, the DWSS is priced according to operational and managerial expenses. The water committee agrees the price with the community. The charge usually depends on the number of days and hours on which the service is provided to individual households, the total number of households in the community and the monthly expenditure of the water committee on operations and maintenance. I found that the price of the DWSS varies across communities.

Even though water is priced, there is no a guarantee that all households will pay for the service they receive. In my fieldwork I found water users who pay more than others, even when the monthly charge is the same for all domestic water users. Yuling and Lein (2010) report that some communities are not charged for

²¹ *Faenas* are contributions of physical labour from some community members (Kyessi, 2005) It is a community practice to carry out group works. For example, through a *faena* community members fix pipes, clean the well and the streets, etcetera.

their DWSS. The reason each householder has to pay or not depends on willingness and ability to pay for the DWSS received.

Taken into account total inhabitants data for 2005 census for the communities studied (INEGI 2011a) times the current price charged for the DWSS show that San Mateo should have collected \$270,760 MXN pesos, equivalent to £13,538 GBP, from all community households; Santiaguito should have collected \$61,450 MXN (£3,072 GBP) and San Francisco, \$151,750 MXN (£7,587 GBP); but according to the water committees, the amount collected is frequently less than the total owed. According to the experience shared by Santiaguito water committee president in a focus group by July 2010:

“We [water committee members] are currently collecting only the amount required to pay monthly operational expenses, which reach, on average, \$55,000–\$60,000 MXN pesos [£2,750–£3,000] per month. The problem is that the water committee has not been able to collect payment from everybody” (Water committee president, Santiaguito, July 2010).

In San Francisco people are not always willing to pay for the DWSS and it is difficult to find out the monthly average collected or spent by the water committee. Community members argued that there are inconsistencies in the DWSS and that paying is no guarantee of receiving the service. By April 2009 in a semi-structured interview carried out in San Francisco, in the words of one householder:

“There is a committee to which we have to pay \$50 [MXN pesos] monthly. This is a small quota, but not everyone pays. Not everyone is conscious of the need. For example, we didn't pay because at least three times a year we didn't have water. I don't know what problem the committee has with the Electricity Company because they say the bills are very high. So they pay, but the next month they don't have money to complete the payment and then soon they stop the drinking water [supply] service. For example, I particularly have been a debtor. Before, an old man came to collect the water payment. I used to pay on time because he came every month. But once he told me that there were people owing five [years-worth of bills] and the [water] committee was condoning two or three years [payment] if people would be willing to pay two years in a single payment. So I told him I didn't want to pay and he got angry. I thought, that is so funny; it will be better not paying for the water for years and after that I only have to pay for water for two years. But this was just my whim. Anyway, apart from this payment we have to buy a water tanker-full ... and even if people pay on time they might not get the water service [DWSS] for three or four months. Older people are more conscientious. They pay early in the year. All payments are promptly made, even though they don't have a discount. This isn't fair [that debtors get discounts as incentive to pay while people promptly paying do not

have discounts in their water bill], because they have already paid for the entire year..." (Female water user, San Francisco, April 2009).

Willingness to pay varies according to domestic users' perception of the quality of the DWSS they received each month. It also depends on the number of days and hours they have received water, and their trust in the water authority. Three female domestic water users commented on their willingness to pay for the DWSS. The first is a user from San Francisco. The second and the third are from Santiaguito:

"I am willing to pay \$50 pesos [£2.50]. I think paying \$50 MXN pesos is fair because there are enough people in this town to pay. Maybe, this price is even a bit expensive. I say, it is only \$50 pesos, but it would be ok if the service [DWSS] is a good one. What also happens is that we don't see all the expenses the committee has because we are outside the committee. So we don't understand how it works" (Female water user, in depth interview, San Francisco, April 2009).

"We pay \$720 MXN pesos [£360] for the entire year; this is \$60 MXN pesos per month [£3]. I would be willing to pay for a better service. Currently, I am fine paying for the service because even when it is limited I somehow ensure that I get it. I know if I pay I will look to receive the service [DWSS]. I am willing to pay for water. I think the current price is adequate. In Toluca, people pay thousands. As a user, I would be willing to pay individually for a good service ... I think each family should pay for water. Each house should pay. But I would not be happy paying extra money for the infrastructure. However, Only a few people pay, and this always happen, So, this [extra] payment would not be useful to pay for infrastructure, but because not everybody pays, I am not willing to pay more" (Female water user, focus group, Santiaguito, June 2010).

"I pay for the service [DWSS] because I know it requires maintenance. I believe the amount I pay is appropriate. But it is well known that there are very negligent people who should pay for the service [DWSS] and they refuse to pay ... there are many who have not been willing to pay for years. I would only be willing to pay a bit more if I knew I would always get a good service" (Female water user, focus group, Santiaguito, June 2010).

In the first quote, the domestic water user is willing to pay the tariff agreed between community members and the water committee because she thinks the amount is fair. The second case shows how water users might be willing to pay more if the DWSS were to improve and provide sufficient water to cover their needs. However, this user realised that her payment for the DWSS she receives can only guarantee that drinking water is delivered to her house. Once she realised

that not all householders pay even for the DWSS they receive, without including a payment for infrastructure repairs, she considered not making any extra payments.

Finally, the third case also considers that paying the current amount charged per household is fair. However, she would only be willing to pay more than she does now – around \$20 MXN [£1 BP] – if the water committee committed to improving the DWSS. According to San Francisco and Santiaguito householders' opinion, community members would be willing to pay a small amount extra once they see improvements in the DWSS; otherwise they would not pay in advance. This statement, and the accuracy to represent the population of these communities, is delimited within the limits of error of the methodology and the boundaries to obtain quantitative information in this research. In interviews in the field I found that no one is willing to pay their share of the full cost of the DWSS, which includes infrastructure installation, maintenance and small and large repairs.

The 35 domestic water users interviewed in San Francisco and Santiaguito were willing to pay to receive the DWSS but mentioned that they would like to receive a good service, which they saw as people receiving enough drinking water to cover their needs. Interviewees mentioned they think other community members would do the same if the community would receive a good DWSS because it would mean not generate extra expenses such as buying water from tankers or bottled water (see Bourguett Ortiz *et al.* (2007); Usobiaga Suinaga (2007); Babel *et al.* (2010); Nayar and James (2010) for more about payments for the DWSS). The accuracy to represent the entire population of these communities is also bounded within the limits of error of the methodology. San Mateo inhabitants are willing to pay because they currently have to pay; there is no chance they do not do it because it would mean a 90% reduction of the amount of water supplied.

Kyessi (2005) affirms that in Tanzania about 90 percent of community households are willing to contribute to the operation and maintenance costs of water supplies. Kyessi's research was done in community managed water supply projects. Therefore, this outcome might be relevant to understand that community members from community managed DWSS in the Mexican case studies, are also willing to contribute to the operation and maintenance costs under condition of receiving the

service. The 90% outcome in the case study communities is circumscribed to apply quantitative techniques in further researches. In the case study communities, most of the domestic water users interviewed were willing to pay for the operation of the DWSS. They also agreed to maintain the existing tariff, whether or not they receive the DWSS on the number of days agreed with the authority. A few are willing to pay a little more, though not the full supply cost, and only if they know and experience that the DWSS is guaranteed.

In San Francisco and Santiaguito, reduction of the amount that some householders owe for the DWSS has been offered as an incentive to pay. For example, they can pay only two or three rather than five years' outstanding bills. Debtors and users that do not receive the DWSS on the agreed days are willing to pay if their water committee offers reductions. The few householders receiving the DWSS, those who do not recurrently have problems with the DWSS they receive, feel comfortable paying the amount suggested. This is the case of a domestic water user from the San Francisco neighbourhood who talked about this in an informal chat:

“I am willing to pay for the service because it is so cheap. We pay \$60 MXN pesos per month, \$720 MXN pesos per year. If we buy a water tank of 10,000 litres we pay \$480 MXN pesos. Those who don't have a cistern, where can they store it? I think what we pay for water is moderate, and also the increase [in the water bill], when has been necessary, is moderate. It has always been moderate” (Female domestic user, San Francisco, April 2009).

However, some householders are not willing to pay at all, and these are generally domestic water users from the community who do not receive the expected water at all – because of water committee lack of skills to distribute the DWSS to all community directions – or receive it on only a few days per month. This situation has been frequently heard in San Francisco. Under these circumstances they refuse to pay and become debtors. According to Usobiaga Suinaga (2007) most domestic water users are not willing to pay for a low-quality service, even when they have covered their basic needs expenses and have the money to pay for the monthly DWSS bill.

Analysis of the total amount of fees that water committees expect to collect, and of the fees actually collected from nearly 50 percent of householders' receiving the DWSS, reveals that the water committees are unable to meet their operation costs. This problem affects the delivery of drinking water to the community. The water committee is frequently in debt to the Electricity Company, which constrains provision of the DWSS and its improvement. If every householder were to pay for the DWSS, water committees could recover their operation and maintenance costs. However, more than 50 percent of water users are not willing to pay for the DWSS, or their payments are incomplete. Some householders who would be willing to pay are not able to do so. I discuss ability to pay in the following section.

7.3.2 Householders' ability to pay for the DWSS

Inability to pay for water is another reason constraining householders' payment for the DWSS. Their ability to pay is defined by comparing household water consumption expenditure with monthly household income (Nyarko *et al.* 2007). This should be related to total household expenditure per month. At the community level, where a large proportion of inhabitants are in low-paid employment, people are subject to variable incomes. This can be reflected in poor ability to pay for the DWSS. Households might concentrate their financial resources on basic needs such as food, education, payment of other metered services and cultural events such as community celebrations, after which there is not always enough remaining to pay the monthly DWSS bill. In an interview, a housewife domestic water user explained her inability to pay for the drinking water service to the water committee:

“I don't know how to do it because I don't have a job. My husband gives me money, but sometimes it is not enough because I also have to cook for my family, and there isn't enough money [to pay the DWSS bill]. If I pay, I can't eat. Sometimes my husband is not paid on time, and sometimes we have other expenses ... you can cut the service if you want, but I can't always pay. I'll make an effort to save some money to pay something when possible” (Female domestic water user, Santiaguito, April 2009).

According to householders domestic water users from Santiaguito and San Francisco communities with a variable income, the monthly water tariff of \$50

MXN [£2.50BP] in their community is not excessive; however, some housewives from these communities cannot pay their DWSS bill because they spend their family monthly income on food, electricity service, transportation and contributions to community celebrations and then might not complete to pay for the insufficient DWSS. Householders and domestic water users with a low and variable income have to decide where their payment is best invested. If they consider the cost of a good or a service reasonable, they save some money to pay for it. However, payment for the DWSS is not always a priority, because users are aware that the service is unreliable and some prefer to save money to buy bottled water and sometimes water from tankers. Bottle water is used for drinking and cooking whereas water from tankers is also used for domestic activities and hygiene. Willingness and ability to pay are often closely related. Some users are not willing to pay for an uncertain and unreliable service and prefer to limit their expenses in order to be able to pay for alternative sources of drinking water.

Most householders in the case study communities are able to pay, although there are cases where they have to decide which service to pay for first. However, in Santiaguito and San Francisco a small percentage of householders are unable to pay for the DWSS. When the water committee identifies these individual householders they try to negotiate the amount of money they can manage to pay. The water committee suggests paying whatever the householder can afford each month, which can be as low as 20 pesos (£1). In a focus group, a female domestic water user from Santiaguito stated:

“I do not always have money. Sometimes my husband gives me [money] but other times he prefers drinking and I do not have enough even to eat. So how can I pay? I do not have the chance to pay. But I went to see the [water] committee and I told them that if I manage to save \$20 pesos I will bring them this money. If I have more I will bring more...they agreed” (Female domestic water user, Santiaguito, June 2010).

Domestic users' uncertainty about whether the DWSS will be provided on the allotted days and the mismanagement of payments collected by some water committee members has generated caution in some water users about paying and entrusting their money to the water committee. The following section discusses communities' trust in their water committees.

7.4 Community trust in the water committee: a main difficulty

As part of the difficulties faced by domestic water users and water institutions regarding the provision of the DWSS this section discusses about community trust in the water committee members and the resulting outcome to avoid paying or having overdue in the payments for this service. This section helps to answer the fourth research question. Trust in the water authority is important not only for domestic water users but also for the water committees governing the DWSS themselves. If water committees have community members' trust they have also their support in making decisions about improving provision of the DWSS, without which they would not be able to make and implement decisions, and a vicious cycle of difficulties in the operation, distribution, maintenance and payment collection could affect the DWSS.

Domestic water users' trust in their water committees in the communities studied depends on water committee management of the DWSS and the ability of committee members for collecting payment for the DWSS which helps to pay for the operation and householders can receive the drinking water service. However, not every domestic water user trusts the members of their water committee, for two reasons, which became clear during my fieldwork. The first is that the water committee does not always comply with agreements made with the community, resulting in its not always providing sufficient drinking water as agreed; the second reason is that water committee treasurers, especially from San Francisco community, consistently steal community members' DWSS payments with the result that users no longer want to pay.

In terms of the fulfilment of agreements between water committees and community members, interviews with members of the populations of San Mateo and Santiaguito revealed that they receive the DWSS three days a week on average. This is because even when the DWSS is operated every day, the water is delivered to one area of the community for three days and to another for three days a week per five hours in average. The hours of service provided per day varies in the three communities. San Francisco should receive the DWSS five hours but householders do not always receive it. Santiaguito water committee

tried to provide the DWSS the agreed number of hours. And San Mateo householders receive the DWSS almost 12 hours per day. Only a few households receive the DWSS every day, or all day long on a limited number of days. The problem with receiving water all day long is that not all domestic water users have storage facilities in which to store the surplus of water received over a whole day, and thus it is frequently wasted because householders do not always know they will receive it a whole day and they might not be at home to turn off their taps. However, even the provision of water for three days a week is not always kept up because water committees make decisions to change the pattern without notifying domestic water users, or because financial constraints limiting provision of the DWSS. In an informal chat, a female domestic water user from San Mateo that was complaining because she did not received the DWSS in her property argued:

“In this community we are supposed to receive water three days a week. But this week I just had water for two days ... Usually I don't have water problems, but this week we heard the *bombero* had a party and he came to open the valve at around 6 pm and we had water all night long ... But I'm sure that tomorrow we won't have any. They think that because they open the tap for an entire day we are not going to need more water later on in the week, but this is not true” (Female domestic water user, San Mateo, January 2009).

Some community members receive water on variable schedules and store as much as possible in small containers or tanks in case of unexpected changes in the supply. Variable and unreliable schedules also generate lack of trust in the water committee. Of the three case study communities, San Francisco is the most worrying case. There, provision of the DWSS by the water committee varies from that in the other communities in terms of trust in the water authority. Community members have lost trust in the water committee due to lack of commitment to comply with their obligations on the part of members such as the *bombero* and the treasurer. The domestic water users think that their DWSS is not going to improve in the short term if water management procedures are not renewed when a new committee first takes over the water administration.

In San Francisco, householders receive water on average once a week. This is not the only problem: there is also uncertainty about whether water will be delivered at all. A female domestic water user in San Francisco commented in a focus group:

“We should be receiving water every day, because it comes from a common well. But the [water] committee distributes it [to different areas of the community] a different day. I receive it once a week. For example, today water is sent to the hill, tomorrow it goes towards the other road, on Thursday it is for the other street or neighbourhood, and so on. But the service is badly administrated by the committee. For example, here we have 12 hours of [non-stop] [drinking] water [supply] when we have the service, which is regularly during the night. We [family household] have cisterns, but people that have not built a large cistern (to hold 10,000 litres or more) suffer because they do not have anywhere to store it. Now we haven't received water for over a month since. There is no water coming from the network. Last week we bought a water tank [and] with a full cistern we have water for only 15 days. Water is not arriving when we need it. We never know. I would be happy if water was [delivered] regularly one day a week but with a good service” (Female water user, San Francisco, June 2010).

San Francisco's drinking water supply problems are closely related to the water committee's managerial skills and honesty. In particular, householders believe that the lack of honesty erodes water users trust in the committee. Community members demand transparency from their water authority. They want to know not only general but also budgetary information – incomes, expenses, any leftover money, etcetera. They also wish to be informed about water committee decisions. Additionally, they request appropriate use of their payments for water, which are frequently not administered honestly. A female key informant who has lived in San Francisco since childhood spoke in an in depth interview about how trust in the water committee has been lost since the community received a piped DWSS:

“There are two or more meetings per month on average because the drinking water problem is severe. We have been almost a month without water. But it is always the same. When the community [elects] the new committee, it already has debts brought forward from the previous committee's administration. Then people get desperate because they see that the new [water committee] members do the same as the old ones. And the previous committee takes the money and does not come back. People do not see them again. So one who was part of the committee, the old man that used to repair the pipes, disappeared: he has run away with the money, he did not come back. Nobody knows how much he took; people just know there is no money again ... so how are people going to pay for water yet again? ... For example, yesterday there was a meeting. The community chose some people to be representatives of the committee and the community started to say: the previous committee did x, y, z and now we have this debt. The community brought everything to the board and called [for the election] of another [water] committee. Only the president of the previous water committee was present. But the person who collected the money did not appear. This senior [member] has not yet given information about the finances ... nothing” (Female key informant, domestic water user, San Francisco, April 2009).

One reason that community members do not trust the water committee is that many treasurers have quit the community without notice, stealing users' DWSS payments. This happens over and over again. The lack of trust also relates to lack of transparency in the information provided to domestic water users. Sometimes the water authority does not tell domestic how their payments have been used, who they have to pay or how much they have collected or spent on providing the DWSS. This lack of transparency leads domestic water users to suspect that the water committee may be concealing information biases or hidden business.

Dishonest practices out not only by water committee members and formal water institutions and the householders not willing to pay for it, have a negative effect on community trust. Trust is reflected not only in community participation in common activities but also in water users' confidence in continuing to pay for the DWSS. Low community participation affects the management and governance of the DWSS. Community members react to the water governance system's actions and try to adapt to the challenges of an inadequate DWSS

Money and power are the causes of most dishonest practices. At the community level, water committee members' dishonesty is regularly associated with the administration of payments for the DWSS. San Francisco treasurers often take this money for their own personal use. In San Mateo, householders mentioned that AyST does not necessarily report how much money it has collected to the population of San Mateo or to the official water institutions with transparency. Neither is money reinvested in infrastructure improvements. Yuling and Lein (2010) also report such behaviour. Some representatives of the water authorities commit fraud and take users' payments without community permission or other water authorities permission. In depth interview, a key informant community member from San Francisco raised a frequent problem with water committees:

“The problem we [community members] have had with the majority of water committees is that they spend our money for personal purposes. The worst thing is that many people from the community would like to become part of the water committee because they know where the money is. People know that water [the DWSS] generates a lot of profit, because a lot of money can be collected. However, we have never had improvements because every water committee period is the same. Community members want to be part of the committee because is a way for them to improve their house or buy things they need” (Female water user, key informant, San Francisco, April 2009).

Despite the concerns, and identification of the problem by not only community members but also water committee members, dishonest practices such as stealing money from users' payments are somehow socially and politically forgiven. Currently there is no way to prevent this practice. In the communities studied there is no legal or social punishment for dishonest water authorities, even when the community does not agree with their behaviour and does not condone it.

I have identified that a community trust in its water committee is necessary to facilitate the water authority's collection of household payments for the DWSS. In San Francisco, for example, where there is no trust in the water committee, which directly affects householders' willingness to pay for the DWSS, the community still aims to maintain its customary water governance system because the community owns the well and the drinking water. Community members do not want to lose their right to control underground water. This community is afraid to share its drinking water with other communities because they are aware that their water rights property rights over water will be either shared or given to other water authority. Community members have the worry that by sharing their drinking water with other neighbour communities consequently might suffer from more frequent water insufficiency than currently occurs.

Governing the DWSS is a complicated activity in customarily organised communities. Water committees, official institutions and community members need to be coordinated if the DWSS is wished to succeed. However, coordination between authorities and domestic water users may be difficult, especially where issues of water rights, pricing and payment collection are involved because of the diverse interest of the actors and institutions legitimated either by an official or

customary institution. Actors would like maintaining their property rights to control management of the DWSS.

At community level, community members and the water committees both believe that charging for the DWSS is necessary to improve the service. However, according to domestic water users' perspective water is not necessarily an economic resource *per se*, but the DWSS needs to be priced to ensure the functioning of the infrastructure for providing, maintaining and repairing the drinking water supply infrastructure. However, while they may understand this perspective, not all domestic water users pay for it. The two main reasons behind non-payment are that householders are not willing to pay for a poorly-delivered DWSS and that not all domestic customers are able to pay for the service, due to financial constraints.

The rationale behind analysing water institutions and domestic water users' difficulties with collecting user payments or paying for the DWSS has been to reveal the differences between the official and customary governance systems and explain the failures in provision of the DWSS to domestic users in the three communities studied. The following chapter concludes this thesis by summarising the main issues of community governance and management of the DWSS.

CHAPTER 8

Conclusions

CHAPTER 8. Conclusions

8.1 Introduction

The research process that this thesis illustrates implied a comprehensive and extensive review of theoretical issues of governance and community management to understand the drinking water supply service (DWSS) at community level. Given the need to illustrate empirically the analytical framework designed, the research is based on the analysis of empirical information provided by the case studies selected. It is notable to remark that these case studies demonstrated to be illustrative of the theoretical implications imbrocated in the analytical framework designed. Hence, this research has two main contributions. The first contribution is theoretical, following the design and implementation of an analytical framework that illustrates the process of water governance and community management in Mexico and its closer relationship with legal pluralism, rules and property rights over water resources. The second contribution is empirical, since the case studies selected contribute to a better understanding of the involvement of customary water institutions in the governance and management of the DWSS at community level.

This research investigates the governance and management of the DWSS in three customarily organised communities in central Mexico: San Francisco, Santiaguito and San Mateo. The DWSS investigated is provided through a piped water network and is governed and managed by water committees which represents the water authority within each community. Water committees are customary community-managed institutions, legitimised by community members and social groups, organised to control the management, operation and maintenance of the DWSS. Therefore, this thesis approaches to the DWSS through the lens of governance, legal pluralism and community management.

This research situates my work on commnity-managed drinking water systems in Mexico. My research acquires relevance due to the integration of water committees as community management compensation for decisions carried by government institutions about the provision of a networked DWSS. This thesis

contributes to better understanding of governance of the DWSS at community level as the rules, decision making and plurality of actors and institutions – *i.e.* public sector, civil society, private institutions, customary authorities, and individuals – involved in the development and management of the DWSS, recognition of water institutions and its authority, and their decisions about the management, operation and maintenance of drinking water and its infrastructure to provide a public service, specifically the DWSS. It highlights the importance of the legal pluralism involved in the governance of water. The thesis is rich in substantial empirical information collected through semi-structured interviews, deep interviews, focus groups, groups discussions, observation and informal talks with domestic water users and vendors, and water institutions representatives. It is especially abundant in qualitative data collected during my period of fieldwork.

The thesis develops analytical and empirical conclusions within the nine main sections of this chapter. These conclusions respond to the research questions elaborated to answer how do customarily-organised institutions address water governance to manage the DWSS at community level? and will be explained in each section accordingly. The next section addresses the analytical findings; the third deals with methodological conclusions; the fourth section develops the empirical findings; the fifth sets out this thesis' contribution to development studies; the sixth section explains about further research; the seventh section offers difficulties found in this research; the eight section offers some concluding remarks and the final section offers policy recommendations.

8.2 Analytical conclusions

One of the main concerns of the thesis was to illustrate that the research design responded to the analytical framework. In other words, the management of empirical information responded to the theoretical requirements of the thesis. In this sense, the first analytical conclusion this thesis finds is that the analytical framework was properly illustrated empirically by the selected case studies. Therefore, the research questions were also answered in a separated chapter; each theoretical concept used in the analytical framework responds to one research question. Below are included the main conclusions responding to these questions.

To answer the main research question about how do customarily-organised institutions address water governance and management of the DWSS at community level, it was essential to engage with issues of legal pluralism, community management, and governance. Legal pluralism was useful to comprehend there are formal and informal legitimate institutions and rules that might interact within the same governance and community management system.

This study extended the discussion about the importance of recognising customary institutions in the governance of water resources at community level where there were insights from Von Benda-Beckmann (1995); Helmke and Levitsky (2004); Matsinhe, Juárez *et al.* (2008). In this research customary institutions were studied to explore the responsibilities they assume at the moment of governing and managing the DWSS from the extraction source (water well) to the final user. This study took into account both, Chhotray and Stoker's (2009) governance concept and the Global Water Partnership (GWP) (2003: 2) water governance concept to understand the governance of the DWSS at community level as stated in section 2.4. and 8.1. Community management concept was also important to situate my work on community-managed drinking water systems in Mexico. It was also analysed society's participation, customary and official actors, and local water markets involved in the water provision.

There are multiple and different legitimate institutions and actors interacting and influencing a drinking water governance system, especially at community level. Thus, the second analytical contribution arrived at in this study is the utility of informal/customary institutions at community level to legitimate legal plural ways of governance and management of drinking water, and to legitimate property rights of actors over water resources. This thesis acknowledge the participation of legitimate informal water insitutions and individual actors at community level with authority to make and implement common decisions.

In the case study communities I have investigated, water committees represent the customary water institutions recognised by community members as legitimate authority responsible for the DWSS, as I discussed in Chapter 5. They are responsible for governing and managing activities such as the operation,

distribution and maintenance of the DWSS. In customarily organised communities, both formal and informal actors might be involved in the management of water; for example, in the communities studied there is a close and frequent relationship between water committees and community members to make decisions related to the DWSS, and between official water institutions and community members to collect users payments.²² There are also direct managerial relationships between official water institutions and customary water committees. My analysis also finds that besides formal and informal institutions, other actors such as local private well proprietors and informal water vendors should also be taken into account when it comes to the provision of drinking water. As discussed in chapter 5, in postcolonial countries, such as Mexico, the wide array of actors influence the decision making and the implementation of such decisions with legitimacy.

Through a literature review about governance, water governance, legal pluralism, community management, water rights, property rights, and willingness and ability to pay; and the empirical analysis of the performance of formal and informal water institutions governance and management of the DWSS, this thesis finds that the recognition and legitimacy of community managed water committees help to theoretically strength legal pluralism and customary water governance systems at community level. Additionally, it helps to reduce the potentially negative effects of formal institutions' unilateral decision making.

Governing water resources by plural legal institutions at different administrative levels generate disjunctures in the rules governing and the responsibilities allocated to each water institution and its representatives, such as analysed in chapter four. When it comes to the management of the DWSS the main difficulties are related to decisions about who has to invest in infrastructure maintenance.

The plurality of actors involved in the governance and community DWSS in Mexico, the adaptive capacity of community members and common decision

²² The literature also refers to official and customary authorities as formal and informal or as state and non-state institutions (Meinzen-Dick and Pradhan 2005).

making bring advantages to domestic water users in issues related to the access to drinking water. In general terms, this study highlights the importance of the participation of legal plural institutions and actors in the governance and management of the DWSS at community level. For example, it is relevant the involvement of community members, water committees, and local private markets in the control of specific groundwater sources. This study analysed the involvement of legal plural water institutions at community level; it concludes that even though the participation of legal plural legitimate water institutions and actors, a reduction of central government involvement is necessary for successful management of the DWSS when community members agree to assume the corresponding governance and the managerial responsibilities.

By contrast, in terms of community members' involvement in the governance and management of the DWSS it is found that community management plays an important managerial role. Community management is a customary governance system that allows a community to manage its resources, according to a common set of rules, to provide this service to its households.

Following discussions in the literature of property and water rights, as developed in chapter six, this research agrees that every actor has the right to access and use specific water resources. These water rights are recognised by the legitimate water authority or society and let actors make decisions about the provision or use of groundwater. Every water user holds specific property rights according to their position an owner, proprietor, authorised entrant, authorised claimant, authorised or unauthorised user in the water governance system, see Table 2.1 in section 2.4.3.1, and the way they have used to legitimate their right, such as defined in Chapter 6. This means that every position of every actor affords them specific property rights to access and use groundwater resources for specific purposes such as access, withdrawal, management, or the exclusion or alienation of water rights to others.

This thesis agrees with the general classification of water rights as collective and individual rights recognised by Von Benda-Beckmann *et al.* (1998); Meinzen-Dick and Pradhan (2005); Roth *et al.* (2005); Boelens (2008). Collective rights are

the group of rights held by users of a water system: in the study area, communities and water committees hold them. Single water users such as water vendors, well proprietor, or a single household hold individual rights. Based on information obtained from interviews, this research finds that the recognition of collective and individual rights of community members by those actors involved in the governance of water strengthens the letters' participation in water governance, community management, and decision making about the DWSS.

Additionally, the institutions involved in the governance of the DWSS have to define which actors have property rights to manage and maintain control over water resources. Every actor has specific property rights. The extent of the rights held depends on their position in the water governance and management system. Each actor has access to a specific amount of groundwater for specific purposes.

Based on the literature, it is necessary to promote the recognition of authority to the lowest governance level for governing and managing water resources (Gregersen *et al.* 2007). Recognising the authority of customary institutions integrated and legitimated at community level is important, because community members are the ones who know their community's water needs. Customary community institutions can understand their communities' needs and take them into account when finding solutions without having to follow complicated bureaucratic procedures.

This study shows that local formal governments such as the municipality are not the bottom-most authorities at the local level. There are also customary authorities responsible for governing the DWSS at the community level, managing the water resources and assuming full responsibility for DWSS management, even when they are not part of a formal governance system.

The rationale behind calling for the recognition of authority at the community level is that community actors have a greater understanding of the physical and social community context and its particularities, which means that they can allocate, use and operate drinking water resources appropriately, such as suggested by Gregersen *et al.* (2007). Customary water authorities play an active

role in decisions about and operation of the DWSS and actively face and resolve its challenges.

One of the main difficulties of domestic water users and water institutions encounter regarding provision of the DWSS relates to the quality and quantity of water. To be able to provide quality and quantity in the DWSS, water committees need to cost the service appropriately, as explained by Kumar and Managi (2010). Based on this argument, this study supports water committees pricing their DWSS according to their community's operational, managerial and maintenance costs. It is important that the community water institution – whether official, customary, or private – considers the population's social needs and socio-economic situation when deciding the price to be paid for the DWSS. Pricing water does not immediately guarantee its successful distribution and delivery. It is also important that the water institution collects householders' payments for the DWSS.

Scholars who recognise water as an economic good suggest that it is necessary to price it because the costs of the DWSS include its management, transport and delivery (Goldblatt 1999; Nayar and James 2010; Tian 2010). This study agrees that the operation, management and maintenance of the DWSS generate costs must be recovered in order to be able to continue providing this service. Pricing water contributes to improving the DWSS and water use. However, it does not totally guarantee improvements for two main reasons; first, water is not always priced according to the population's socio-economic status, generating difficulties in paying for the DWSS, and second, water committees have difficulties in collecting householders' payments.

As argued in section 4.4 about water tariffs for the DWSS, specifically in section 4.4.1, this thesis agrees with the contributions of Tortajada (2010) and Biswas and Tortajada (2010b) that the price of water should be sensitive to the social, political, economic and environmental requirements of the geographical space in question and to every relevant context. Water pricing must be decided on a case-by-case basis, rather than accepting one general tariff for communities, cities or regions. In this sense, this thesis agrees with the thought that community members and community water institutions better know community needs and therefore,

they make decisions according to population needs. When water pricing does not take socioeconomic context into account, domestic users' willingness to pay may be affected (see Kaliba (2003); Nyarko *et al.* 2007; Snowball *et al.* (2008); Echenique (2009); Nallathiga (2009).

In the water governance system, official and customary institutions are organised differently to manage the DWSS. Both need to be strengthened to improve the way they collect payment from water users in order that they can become economically self-sufficient; and both systems need to manage the distribution and quantity of drinking water better to provide community households with a good-quality DWSS with enough pressure, quantity and timeliness. The first challenge is recognising the failures of each legal water institution, working with their differences, and agreeing a minimum basic requirement for the provision of the DWSS. Both official and customary systems require reliable information, training and/or guidance on issues related to water resources, water management and the service provision, and the freedom of water institutions to make decisions. The recovered running costs of the service can be reinvested in infrastructure, operational costs, maintenance and minor and major repairs. This section has addressed the main analytical conclusions. The following section presents the main methodological conclusions.

8.3 Methodological conclusions

The rich methodology used for this research included a variety of different techniques for collecting information and obtaining evidence from a wide array of sources. The use of multiple research techniques allowed me to contrasting information to better understand the DWSS distribution process in a customary governed and managed water regime.

The multiple techniques used for collecting data – semi structured interviews, focus groups, deep interviews, groups discussion, and documental sources – allowed exploration of not only primary but also secondary sources of information. Use of the snowball technique helped in identifying key informants who could provide key empirical data. The advantage of using qualitative

methodology is reflected in the amount of detailed information about customary practices for providing and obtaining drinking water from groundwater sources. I was able to obtain this information from the key informants interviewed and from focus groups. Using of qualitative methods allowed me to collect reliable, deep and detailed information.

Qualitative methods are essential in water governance research in order to understand the information gathered; for example, government representatives' opinions and domestic water users' perceptions, and to obtain oral evidence from water committee representatives, well proprietors and water vendors. Information about the quality of the infrastructure used to provide the DWSS was gathered through direct observation in the communities studied. Focus groups provided deep information from small groups of four or five people who shared similar characteristics such as gender, occupation, age and so on. Finally, deep interviewing yielded detailed oral evidence from key informants who are well-informed on the evolution of the DWSS. The qualitative information obtained was analysed through the lens of water governance, community management and legal pluralism. The following section presents the empirical findings and main conclusions of this research.

8.4 Empirical findings

This section addresses the main empirical findings and conclusions that empirically answer the research questions that guide this study. These conclusions regard the management, operation and maintenance of the DWSS in Santiaguito, San Mateo and San Francisco communities, where community members, through their water committee, assume total or partial responsibility for providing households with drinking water. When the water committee, assumes total responsibility, as in Santiaguito and San Francisco, it organises, operates, distributes and charges for the DWSS to householders of the community. However, when the water committee assumes only partial responsibility, as in San Mateo, it operates and provides the DWSS. However, AyST as the official decentralised institution collects water user payments.

Provision of the DWSS in the communities selected is governed and managed by a customary system that works for small and medium-sized communities. As water committees are also community members they are familiar with domestic water users' needs and concerns. Despite this, however, certain aspects of the DWSS need to be improved in order to provide a better service.

According to empirical analysis of the data collected, as described in Chapter 4 about legal pluralism, there are disjunctures in the current relationship between official and customary institutions providing the DWSS in the case study communities. These are mainly about two issues. The first concerns official and customary actors' property rights to obtain and use drinking water. Legal plural institutions legitimised by either custom or State law have specific property rights according to their position in the property rights system. Therefore, differences in decision-making implementation by official and customary institutions are also differently recognised; the second disjuncture occurs in the success of payments collection from the water institution responsible for manage them. These disjunctures between official and customary water institutions reflect a weak relationship between the LAN and water committees' actual customary practices in the organisation, operation and distribution of drinking water to the community.

8.4.1 Property rights recognised in the case study communities

Empirical analysis of the three case studies has shown that in customary water governance systems, actors legitimate their claims to property rights by custom or convention or through formal law. Customary and official water institutions also recognise the water rights of domestic water users, water vendors and well proprietors; municipal water institutions also recognise some customary property rights. Property rights in the communities studied are mainly recognised by custom, convention or statutory law, as discussed in Chapter 4. Recognition of actors' property rights enables them to access and use drinking water.

The recognition of water rights and property rights by non-state institutions has been proved to be valid, such is the case of community members recognising their water committee's rights and *vice versa*. Community members' right to access

drinking water is legitimised by customary water committees, usually through the payment for the DWSS to the water institution. The distribution of drinking water by local private vendors is legitimised by informal institutions and actors, such as community members and water committees, because they recognise water vendors as an alternative water source in which water users find options to solve insufficiency of drinking water problems in a water rich area. These problems are mainly caused due to managerial practices and limited economic resources of water committees to pay for the operation costs of providing drinking water. Buying drinking water from informal water tanker vendors is recognised as a valid and legitimate common practice in customarily organised communities that often lack the DWSS. Nevertheless, formal institutions do not legitimate water vendors' performance because they do not hold an official permit.

Official water institutions only recognise as valid water rights granted by CONAGUA, the main official water institution. However, a water committee recognises as valid not only property rights gained through State law but also historical rights acquired by community members through labour, custom, use and convention.

My fieldwork in the three case study communities identified that the water committees and most community members have specific property rights over the drinking water they use. The property rights that every actor holds depends on other actors' recognition of the legitimacy of their rights, gained either through their historical use of water or their payment for it. In the communities, actors legitimate property rights in different ways. Households receive a monthly, two-monthly or annual bill, payment of which legitimates their consumption of groundwater and allows them to receive the DWSS. Water committees make formal payments to CONAGUA, which validate their access to groundwater, its withdrawal, and provision of the DWSS to community households. Private well proprietors payments to CONAGUA legitimate their property rights to access groundwater and profit from it. However, they sell water to local private water vendors' who legitimate their access to water through the payment they do to water well proprietors. Community members also recognise water vendors'

property rights by custom because when necessary they require their service. Additionally, the property rights of specific community members to extract water from their water wheels, access water from other sources such as neighbours' facilities, or buy water from local markets can be recognised by others community members.

8.4.2 Rules and decision making about the management of drinking water

The governance and management of the DWSS by official and customary water institutions produces different rules and decision making and therefore different outcomes. The rules and decision making cannot be the same in both systems, as each has different origins, rules and actions, and decision making is carried out according to its own particularities. State institutions are frequently responsible for enforcing norms and rules; for instance under the national water law, CONAGUA expects the DWSS to be provided, charged for, maintained, repaired and improved by official institutions at the local level. However, community institutions expect the water committee to be self-sufficient in organising and providing the DWSS to the householders of the community, despite knowing that this is not an easy task. Community members see the main cause of DWSS problems as the result of mismanagement of financial resources.

Indeed, water committee members' mismanagement of financial resources is the main cause of drinking water supply problems at any administrative level, especially on the ground in the community. Difficulties in recovering consumers payment for the DWSS and the on-going mismanagement of payments collected also result in unsuccessful delivery of the DWSS in the communities studied. These failures have generated community members' distrust in the water institution, and many domestic water users withhold payment as a result. When domestic user payments do not even cover operation and maintenance costs the water committee finances to pay for operation expenses, such as electricity, is affected and the water pumps cannot be operated; therefore, there is consequently a lack of drinking water.

An additional issue concerning community trust in the water authority relates to public information generated and provided by the water institutions. The amount of oral communication between water institutions and householders at community meetings is an important factor in gaining or losing community members' confidence and trust in the water institution. Community members expressed a desire for receiving detailed information about the money collected, spent and reinvested in the DWSS by the water committee.

In terms of communication between administrative levels of both official and customary institutions, direct communication occurs between the national and municipal water institutions. Customary institutions communicate directly with national and sometimes municipal official institutions, especially about issues that legitimate community water institutions formal water rights to access and withdraw groundwater. By contrast, customary water committees maintain direct communication with their community members, and *vice versa*. Community members, when necessary, take their DWSS problems directly to their water committee rather than with upper governmental water institutions.

Disjunctures regarding decision making among administrative levels and between the official and customary institutions governing the DWSS have been also identified. Decisions made by the federal government in terms of the DWSS management has no always direct relation with decisions made at state level, and the state of Mexico government has little to do with its municipalities' decisions about the distribution and management of the DWSS. However, there is more communication between the federal and municipal levels than federal and state or municipal levels in relation to groundwater use.

8.4.3 Pricing and collecting payment for the DWSS

Answering the fourth research question, the provision of drinking water involves difficulties between water users and institutions or between official and customary water institutions' decisions about pricing the DWSS at community level. These difficulties might consequently affect collecting payments from water users, as discussed in chapter 7. In Mexico, formal and informal institutions at national,

municipal and community level set the prices for the use of groundwater resources. The rights to legitimate access to water are paid either through concessions of *agua en bloque* or through the DWSS (CONAGUA 2008c); prices vary according to region or customary agreements. In some parts of the country, particularly in the north, the user pays the real cost of the DWSS, while in some states, particularly in central and southern Mexico, users pay just a small amount for their drinking water because it is subsidised as scholars have also identified (Bourguett Ortiz *et al.*, 2007; Sandoval Minero, 2007; Biswas and Tortajada, 2010; Wilder, 2010). In the communities studied, householders pay for the operation and maintenance of the DWSS. The total amount to be paid is mainly agreed between customary water institutions and community members or formal water institution through the city council; this depends on who is responsible of collecting users payments.

The main coincidence identified in the case study communities is that both official and customary systems charge all water users for the provision of drinking water. The differences between these systems are based on how they perceive the challenge of setting a price for the DWSS and then collecting water user payments.

The customarily-organised case study communities agreed that the price for drinking water should be decided according to the expenses generated by provision of the DWSS and householders' financial status. In the official system, the price of the DWSS depends on the regional socio-economic characteristics of the population and the tariffs approval by the municipal council's financial department. There are also differences in the extent of community members' involvement in water-related activities. In customarily-organised communities community members involvement in decision making, operation and maintenance of the DWSS and infrastructure is more frequent and they engage more than in an official water governance system.

Community members whose DWSS is financially managed through an official system are not usually consulted about the cost of water or payment collection methods. They are only informed of decisions taken by the municipal authority

and how these decisions are to be implemented. This practice was observed in San Mateo community, where AyST notifies the community of pricing agreements made by the *cabildo* (local county council decision makers). Householders have to obey and comply with their obligations to pay for the water services, including sewage, DWSS and treatment, in order to have the right to access. They monthly pay AyST for the drinking water, even though the community owns the wells from which the water is withdrawn, and the customary water committee organises and distributes the DWSS, from the pump house to the households.

Water cost in urban, peri-urban, and rural settlements is an indicator of the quality of the DWSS provided. Usually, in urban areas the DWSS is reliable in terms of being delivered everyday/24hours/sufficient pressure. However, in peri-urban and rural areas the DWSS tend to be intermitent and the quality of the DWSS and water quantity also varies. At community level, social and power relations and community decisions legitimate property rights over water while in urban areas formal water institutions and decisions are legitimised through formal law. In peri-urban communities, at community level, social networks help community members to find diverse ways to access drinking water when the DWSS is insufficient. Nevertheless, this might also generate more expenses to water users. Though, in urban areas, with a formally governed DWSS, domestic water users tend to access drinking water every days. The price they pay cover all possible expenses and population right to access. According to the findings, this thesis concludes that peri-urban communities organised by custom pay more money for accessing drinking water receiving less, and to face these contingencies they adapt and find more options to obtain water. In urban areas, people might pay less money and have continuous access to the DWSS.

Interaction between the two legal systems about water governance can strengthen and improve the quality of the DWSS if the tasks for each institution and actor are well defined. However, financial resources are required in order to implement decisions, which should be collected from water users. Investment in maintenance and repairs of the water infrastructure is required as well as successful collection of householders' payment to cover operational, maintenance and repairs costs.

In a customarily managed DWSS community members are more involved in decision making on pricing and participation in aid of the service. Also, community actors participate in the DWSS more than in officially managed communities at municipal level. In general, in self-managed communities, householders agree to pay for the DWSS because they trust that paying for it will ensure that water is delivered to their property; it allows their DWSS to be financially self-sustainable and keep working. If people do not pay, the water committee is not able to absorb the operational or maintenance costs necessary to continue providing the DWSS. Paying for their DWSS makes householders feel included in the community, since their payment enables them to participate in community meetings and put forward proposals to improve the service.

Community members consider it is good practice to keep their DWSS payments up to date. Otherwise, the DWSS might be interrupted. When a member of the community requires any other community service, such as a burial ceremony and funeral service in the community cemetery, the response of other community institutions such as social groups or members of the church might depend on their previous payment not only for the DWSS but also for religious festivities and services. This was identified in Santiaguito and San Francisco communities but not in San Mateo.

Differences among legal water institutions regarding methods of communication and making decisions also create difficulties in collecting payment for the DWSS. Water committees' struggles to collect householders' payments and householders' struggles to pay for the service. According to empirical information presented in this research, two main issues frequently affect payment collection: willingness to pay and ability to pay. These difficulties are addressed in the following section.

8.4.4 Difficulties in collecting payments for the DWSS: willingness and ability to pay

According to empirical findings, householders' willingness to pay is frequently affected by their ability to do so. According to the findings of this research, householders receiving an insufficient and intermittent DWSS are not willing to pay for it, or at least not promptly, and therefore some become debtors. On the

other hand, the ability to pay of some householders, especially from rural areas and medium sized communities is constrained by their income. Their salary is frequently insufficient to maintain their payments for the DWSS they receive. Therefore, less economically favoured householders are not always able to pay for the DWSS. These householders with a variable income are consequently less willing to pay for the DWSS.

Formal water institutions are usually interested in achieving economic sustainability through cost recovery, while informal water institutions are mainly interested in recovering their operational and maintenance costs. From the water committee members' perspective, major repairs may be carried out with the community cooperation that might vary from *faenas* (contribution of physical labour), to an extra payment for specific repairs, which require to using money from the monthly payments received to make minor repairs.

8.4.4.1 Willingness to pay

Analysis of the communities selected made it possible to identify three of the four main categories of householders' willingness to pay that Nyarko *et al.* (2007) propose, and which I detail in order of importance below.

First, those who wanted to keep the existing tariff. 45 householders domestic water users were interviewed in Santiaguito, San Francisco, and San Mateo communities. From the total, 35 domestic water users, from Santiaguito and San Francisco, were willing to pay only if the current tariff for the DWSS is retained. Based on municipal statistics for Toluca and Almoloya de Juárez, approximately 60 percent of householders pay for the DWSS. San Mateo community members submitted the most payments (to AyST), followed by Santiaguito and finally San Francisco, paying to their customary water committees.

This first category of 'those who want to keep the existing DWSS tariff' in the communities studied includes domestic self-employed water users or those who earn a variable monthly income. They want to maintain and pay the current DWSS tariff because they calculate that the payments likely to be collected from

all householders water users cover all the expenses generated in pumping water from its source to the community houses.

In San Mateo, paying the fixed DWSS tariff is compulsory. The service can be temporary stopped for defaulters, who are also fined by AyST who is responsible of payments collection. In San Francisco and Santiaguito communities, householders who pay for the DWSS do so because they hope that paying will ensure the timely delivery of the DWSS to their homes and because it supports the community-managed DWSS in becoming financially self-sufficient, allowing the water committee to continue providing drinking water to community members.

The second category consists of users who are willing to pay more than the existing tariff, but not to the extent of covering the total supply cost, which includes operation and maintenance expenses, infrastructure installation and large repairs. Santiaguito was the only community in which (approximately 10 percent of) householders were willing to pay more for the DWSS. However, these financially stable households mentioned they would only pay an extra \$20 MXNpesos [£1] a month if they first saw improvements in the DWSS. This was also on condition that they would receive the DWSS according to the agreed schedule.

Third, 5 percent of householders, approximately, in San Francisco and San Mateo were willing to pay if the existing tariff was reduced. These householders are usually debtors who would be willing to pay if the DWSS improves but not the current tariff but a reduced one, or if they have a reduction in the overdue amount. San Francisco householders' argument was that it is not fair to pay for water that does not come when it should because they also necessitate buying bottled drinking water or water from tankers. In San Mateo, those asking for a reduction were not householders but proprietors of family businesses or small shops who receive big bills due to their high consumption of water.

In the three communities studied, the most frequent expenditure is on drinking water because householders monthly pay for the DWSS, bottled water, and 10,000 litre tankers of water from water vendors. Some domestic water users have also

invested in constructing cisterns in which to store drinking water when water is being supplied and thus avoid extra expense when they do not receive it. In water-stressed periods some domestic users ask neighbours or relatives for water, which they usually transport in 20-litre containers. Nevertheless, even if the water committee does not supply drinking water on schedule, householders do not receive a reduction of their bill.

Users from San Francisco who are behind in paying for the DWSS would like a discount in order to be able pay their debts to the water committee. Domestic water users from San Francisco who are up-to-date with their DWSS payments also consider themselves eligible for a reduction in their monthly or annual payment, arguing that if debtors get a discount as an incentive to pay, they too should be entitled to an incentive since they pay regularly. Some domestic water users mentioned that the fact that there are no reductions for users who promptly pay only encourages them not to pay for a year or more in order to become eligible for a discount.

The only category not found in the three communities studied was users willing to pay for the full supply cost of the DWSS. Domestic water users are not willing to pay this because they assume that the infrastructure is already in place so they do not have to pay for it. However, they may be willing to cooperate in paying for large repairs if necessary such as analysed in Chapter 7.

There are householders that receive the DWSS and are not registered in the community user book. In the three case studies, according to water committee representatives, approximately 20 percent of the inhabitants of Santiaguito and San Francisco are unauthorised users; while they do not pay for the DWSS they manage to access it.

In general, community members agree to pay for the DWSS. However, it is important to keep the water tariff affordable according to the population's socio-economic status to support people in managing their living expenses. 'Affordable' means that community members can pay without compromising their living needs. To keep the water tariff affordable, users must pay their water bills.

Frequent maintenance of the water infrastructure is also important to prevent the need for expensive, long-term and large repairs.

This study has found that domestic water users, especially those in rural and peri-urban areas, spend more money on obtaining drinking water than urban inhabitants because when they do not receive the DWSS as expected they buy bottled water or water from tankers from private local sellers, and are not willing to pay extra money if the service does not improve first.

According to information collected during my fieldwork, willingness to pay involves the desire to cooperate only if customary water institutions improve the current DWSS or can guarantee that householders' payments will be used to improve the service. However, willingness is no guarantee that users will pay, as not all householders are able to pay. Willingness was identified as a conditioned wish to pay only if community members identify improvements in the DWSS first. The following section addresses the main conclusions about ability to pay for the DWSS in Santiaguito, San Mateo and San Francisco.

8.4.4.2 Ability to pay

This research highlights the importance of payment for the operation and maintenance of the DWSS. Receiving the DWSS is a commodity that generates expenses when provided, thus it is associated with the payment of water users for this service. However, sometimes householders cannot afford to pay; in San Francisco and Santiaguito, payment for the DWSS is frequently constrained by householders' ability to pay. After paying for their basic needs and, often, for a DWSS not provided by the water committee, they cannot afford to pay their DWSS bill. Ability to pay was discussed in Chapter 7.

Community members' education plays an important part in their ability to pay for services. According to the findings of this research, a low educative level often corresponds to an intermittent or low salary, which is reflected in payment or non-payment for public services such as the DWSS. This pattern was identified in San Francisco, San Mateo and Santiaguito.

Registered householders users who are unable to pay for the DWSS are usually registered with the water institution to receive it. They become debtors and may also be classified as unauthorised users because they cannot pay for the property right to access drinking water unless they directly contact the water institution to explain their main reasons for not paying.

There are some users that are not able to pay for the DWSS to the water committee because they previously bought water through water tankers. The more water householders buy from water tankers, the less they are able to pay for the DWSS; and the fewer payments the water committees collect, the more intermittent is the DWSS. Even though the DWSS costs less than water purchased from water vendors, the water committees cannot always collect enough to pay the operational costs.

Additional findings from empirical analysis conclude that incentives to pay for the DWSS are important, making it financially viable and affordable for domestic users with financial constraints. Water committee members also thought that offering incentives to householders who are unable to pay is important because they encourage householders to make the effort to pay part of their debt to their community's water committee.

Householders with a higher income and able to pay build cisterns to collect and store drinking water on the days they receive the DWSS. Storing water ensures access to drinking water at home when not receiving the DWSS. Fieldwork observation found that most of the houses in the three communities studied have a water tank on the roof for storing drinking and making it available with enough water pressure to use it when needed for showers, toilet facilities, kitchen use.

Having a cistern or rooftop tank helps householders to solve their basic needs without worrying about regular delivery of the DWSS. However, Bourguett Ortíz *et al.* (2007) mention that the presence of cisterns and rooftop tanks is a reflection of the low quality of the DWSS received. Findings during my fieldwork suggest that storing drinking water not only helps domestic water users to save money but

also means they have water when they need it. However, not all households in the three communities studied could afford tanks or cisterns.

According to analysis of the data collected for this research, the presence of water tanks or other storage facilities are not necessarily evidence of a low-quality DWSS. However, they do reflect differences in households' financial situations that sometimes constrain their ability and willingness to pay for the DWSS. In the case studies, the presence of cisterns, rooftop tanks, and ground water containers is as a collective action of householders implemented to deal with the changing and insufficient DWSS they receive daily, on three days a week, weekly or monthly. This is a collective action and adaptive capacity because even when householders did not organise to build all cisterns together, is a way to face the difficulties caused by the variable provision of the DWSS.

Water committees' management and governance of the DWSS are affected when householders are unwilling or unable to pay for a DWSS that is not delivered. By contrast, householders have the expense of constructing water reservoirs in their household, paying for the DWSS monthly, and purchasing water from water vendors. In addition, if provision of the DWSS is inconsistent and householders do not know how the water committee spends their payments, their trust in the water institution's rules and decision making is affected too and a cycle of non-payment-no-service-no-trust causes problems for DWSS governance and management.

In the water governance process it is important that water committees understand the needs of domestic water users and domestic water users understand the effort and requirements of the water committee governing and managing the DWSS. Both institutions, community and water committees, need continuous communication and trust to maintain an active customary water governance system.

8.5 Contribution to development studies

The comprehensive and extensive review of theoretical issues of governance, legal pluralism, and community management and the empirical analysis of data about the DWSS at community level responded to the theoretical requirements of the thesis. The management of empirical evidence was useful to respond to the analytical framework requirements and its findings contributes to development studies.

Drinking water is required to cover basic human needs as well as social, cultural and economic activities. The importance of water resources to the survival and development of societies makes water-related research an important element in development studies. Therefore, the provision of safe, clean drinking water has become a core international development topic discussed in international conferences; such as the 1992 Conference on Environment and Development in Dublin, the 2000 Second World Water Forum in The Hague, the 2001 International Conference on Fresh Water in Bonn, the 2006 Fifth World Water Forum in Mexico, the 2009 Sixth World Water Forum in Turkey, etc., where debates about drinking water provision and sanitation have been at the international forefront.

Water governance and community management concepts are approached from the field of development studies and legal pluralism. This research has explored how customary communities are organised to govern and manage the DWSS at community level. In order to make a community water system work it is important to know the cultural context and socioeconomic characteristics of the population. Being sensible to communities context and commit with the community according to their needs might enable successful administration of a customary DWSS and achieve positive outcomes.

In development studies, sensitivity to context is important to approach communities, especially regarding the governance and management of water resources and the DWSS. The study of water governance and community management in development studies contributes to understanding common

decision making in the interface between official and customary institutions. Community management of groundwater is an example of a legitimate customary water governance where multiple actors are organised to manage their water resources and provide a service. For better management of the DWSS this study finds that community members should control the DWSS in small and medium-sized communities.

This research aimed to understand water governance and management of the DWSS through water committees in three Mexican communities. Therefore, community management, legal plural institutions, and water governance studies related to the DWSS, are important for literature in development studies by the understanding of different legal rules, decision making, and actors interacting within the water system.

In a legal plural water regime both official and customary actors let actors decide how water resources are to be managed, and by whom, according to their own rules. In a customary system, recognition of actors' rights to access and manage specific water resources is legitimated by its members through consensus or through payment for property rights over water, and customary water institutions' management of the DWSS is recognised and validated by its members. Understanding and acknowledge the existence of these practices are a relevant contribution in development studies.

8.6 Further research

In future research, statistics involving a) groundwater extracted not only at regional but at community level; b) the number of litres of water delivered at household level and c) an updated list of the total householders of the communities, would help to bring quantitative evidence per community to the research. Further research is also suggested to obtain up-to-date information about the total amount collected by water committees in payments for the DWSS per month and year, and a record of the expenses generated monthly and yearly in providing the DWSS. The use of diverse qualitative and quantitative techniques is recommended, including focus groups and in-depth interviews. Questionnaires are

recommended, to allow contrasting qualitative and quantitative evidence and findings.

Based on scientific information about community management, further research about community management is suggested to understand how communities organise themselves and make decisions, specifically regarding issues related to DWSS provision. Further consideration of community management of the DWSS in relation to water governance studies is required to learn more about customary rules, with particular focus on the structure and internal organisation of the community, the responsibilities allocated to each social actor and interactions among them, such as internal (community) and external (government institutions, well proprietors and water vendors) actors and other, non-state institutions.

Understanding water institutions' financial resources and water infrastructure for providing the DWSS to community households might be approached through the lenses of community management. It is important to seek community actors' recommendations on how provision of the DWSS may be improved and what do an improvement represents for them.

The academic literature suggested for further research includes explorations of user satisfaction issues in officially governed communities with all the facilities to distribute the DWSS from source to end user; however, more input about domestic water user satisfaction at the community level is required. Moreover, the quality of provision of the DWSS has not been deeply explored in the literature about water governance and water supply, and it offers enormous potential for further research.

Further effort to understand the governance of drinking water could be enhanced through the use of quantitative data about user satisfaction with the DWSS, the authorities' performance, and the price of water and water committees' provision of the DWSS. The literature about governance and community management offers no significant outcomes of water committee performance or how community members perceive such performance. This is relevant for development studies

because it is another way of understanding community participation in issues related to the DWSS within their community.

Further research about the sale of drinking water by local private water vendors and the purchase of drinking water from domestic water users at community level is also required to understand private local water markets and the contribution they make to community development by providing an alternative option for accessing drinking water. It could be helpful to know the extent to which local water vendors and well proprietors can join in partnership with water committees to provide drinking water when the water infrastructure requires medium and major repairs and it cannot be operated to provide this service. Water vendors have a network of contact-relationships with other water vendors that help them to maintain communication about the communities that require water through water tankers as well to offer a faster and efficient service for water users in terms of timing to deliver the service and distance. This network of relationships help water vendors to sell and distribute drinking water when official or customary water institutions are unable to provide enough through the DWSS and community members cannot obtain the drinking water they need. Local water market actors have created private local dynamics in the distribution of water, not only at community but also at municipal level, which are worth investigating in depth. Furthermore, research into the property rights held by informal water vendors would help to fill the gaps in the literature and research about water governance, the DWSS and sales of drinking water.

Finally, domestic water users' adaptive capacity for dealing with water insufficiencies caused by customary or official water institutions' DWSS at community level requires further investigation.

8.7 Difficulties for this research

I experienced difficulties with the use of semi-structured interviews to collect specific data. Using semi-structured interviews generate difficulties to carry out enough interviews for the data gathered to be representative of the large number of water users across the three communities studied. The hardest part of the data collection was obtaining interviews with government representatives, due to their last-minute cancellations.

It was also difficult to obtain quantitative information about community finances. Obtaining access to records of the money collected by the water committees from the householders of the communities studied and to information about expenses generated in the provision of the DWSS was not easy. The difficulties were also caused firstly by the lack of updated records; secondly by the fact that newly-elected water committees do not always keep the records from previous administrations; and thirdly, customary water authorities do not always keep a record of the money they collect or of all their expenses.

8.8 Concluding remarks

Based on theoretical and empirical evidence I suggest that through their water committee, communities should hold ownership rights over the water extracted or stored within the community. This would allow the community to own the access, withdrawal, management, exclusion and alienation of drinking water involved in provision of the DWSS.

It is necessary for the customary water committee to interact with official water institutions to some extent in order to generate continuous mutual feedback. Training for water committee members about the physical characteristics of the water cycle and financial management of payments for the provision of the DWSS collected would help members to understand the aquifer recharge process, acquire managerial skills and so on. It is important that the water committee does not lose its autonomy.

Customarily organised communities face some limitations when managing drinking water and might require guidance from water experts to improve management skills not only on the technical aspects of DWSS distribution but also regarding the administration of payment collection. Such guidance can help water committees to maintain the DWSS as a self-governed and self-managed customary institution. It is important that the community does not have to adopt all mandatory requirements established by official institutions for receiving guidance. However, it is important they attend the guidance workshops to raise their main concerns, exchange ideas, and discuss or find solutions to the problems they face in the DWSS provision in their community. Sometimes when communities receive some guidance from formal institutions, especially from government institutions, they have the commit to exchange or give them back a payment, change its methods of charging and collecting user payments, or to report its income and outcome and administrative procedures to an official institution. These extra activities are a distraction from the main DWSS activity and might cause other administrative problems that consequently affect the delivery of the DWSS.

This thesis suggests as is necessary not asking water committees for a payment back. Neither, compulsory providing CONAGUA reports about their income, outcomes, expenses, water system requirements, etc. because it might implies attending administrative procedures rather than providing an appropriate DWSS. It is also important not to generate bureaucracy between official and customary institutions to make decisions related the financial management, operation, maintenance, and repairs of the DWSS.

Community members should continue to be responsible for the DWSS and decision making about it through a water committee. In order to succeed, communities organised by custom need the support of community members; and the water committee needs to be recognised and legitimised by both the community and municipal government in order to gain and maintain property rights to freely operate the DWSS in their communities. Water committees need to win the trust of the community regarding not only their provision of the DWSS

but also their collection and handling of payments, decision making and management of finance for improvements related to the DWSS.

The DWSS need not be provided on a daily basis in the three communities studied. According to data collected in San Francisco, San Mateo and Santiaguito, domestic water users mentioned as important that drinking water is not delivered daily and 24 hours service because not all households have the facilities to store the extra water provided. The problem is not receiving 24 hours DWSS. The problem is that currently, not all households have a well-installed tap system that allows them turning it off when they are not in the property. According to fieldwork data for domestic water users it is more important that the drinking water comes regularly and when expected than receiving 24 hours DWSS. Besides this, the water committees have neither the infrastructure to provide a 24-hour daily DWSS nor sufficient financial resources to pay for the electricity needed to pump and distribute a continuous service. In addition, if the DWSS in the three communities would be provided 24hours daily, the fee for the provision of the DWSS would have to increase, putting pressure on users' willingness and ability to pay for the DWSS.

It is strongly suggested that the DWSS should be provided on the days agreed between the water committee and householders. My fieldwork revealed that Santiaguito, San Mateo and San Francisco would benefit from provision of the DWSS to every household on three days a week. Delivery of the service in accordance with the timing agreed between the water committee and householders is also important.

Improvements to the DWSS, not only as a national priority strategy but also as a local reality, require constant effort from the water institutions, water authority, water users, legislators, local private actors, engineers and water technicians, academics and decision makers. It also requires the will of domestic users and water institutions to improve this service.

Currently there are no specific policies in Mexico with an emphasis on DWSS matters. It is important that legislators update and adapt national water law to the

current situation of the country in general, the particular social and economic issues in the different regions and the particularities of small and medium size communities.

Finally, it is also important that the national water law acknowledge the existence of customary regimes providing the DWSS at community level in order to legitimate community management and water committees autonomy to administer ground water for a social purpose. It is relevant mentioning that formal acknowledgement does not necessarily mean that customary water governance and management regimes have to be formalised. It is suggested CONAGUA provide formal and permanent, rather than temporary water title concessions to those customarily organised communities, through water committees, to manage the DWSS. Permanent formal water rights to communities might generate advantages to water committees to systematically provide the DWSS without stressing their economic possibilities to pay in a year or five-year basis formal water rights to CONAGUA. Therefore, water committees only would have to pay operational and maintenance costs. The recognition of customary management practices by a formal institution might bring advantages to communities in terms of receiving federal funds to maintain, repair and improve their water infrastructure. It could also be beneficial to withdraw communities' obligation to pay for the official water rights to manage community wells from which water to provide the DWSS is withdraw. If customarily organised communities are not obliged to pay CONAGUA annually for these water rights they might manage to provide a continuous DWSS according to population needs. Customary committees could also provide maintenance and improvements to already existing drinking water infrastructure when necessary.

Water governance and community management of the DWSS should be inclusive and supportive of community members' customary ways of organising their DWSS. Based on the idea that the state should give communities total responsibility to manage their water resources, it makes room for informal institutions to govern and manage the DWSS. The following section offers some policy recommendations.

8. 9 Policy recommendations

The recommendations offered here, based on the analysis presented throughout this thesis, are concerned with improving decision making in the governance and management of provision of the DWSS.

Self-organised communities governing water resources should be responsible for organising and managing their own groundwater or surface water for providing the DWSS; especially, when these communities aim to control operation, management and maintenance of water resources available in the community.

Frequent feedback between national and customary water institutions about provision of the DWSS is important in order to improve it. Where required by the customary water committees and official water institutions it is also important to provide with training or guidance from professionals about specific water-related topics that help them to improve the DWSS; for example, to improve managerial and financial skills of the members of the water institutions to recover operational costs that let them re-invest in the provision of this service.

Customary water institutions, such as the community water committees, should maintain communication with municipal and federal government about improvements required in the drinking water network and management of it to consequently improve the DWSS. Government should respect customary institutions' performance in terms of their organisation, distribution and control to provide drinking water. In addition, municipal and federal institutions, through CONAGUA, should maintain communication with water committees in order that they are aware of the communities' strengths and weaknesses in supplying the drinking water service.

Currently, water committee members provide their services voluntarily as social labour and in cooperation with their community. Some of them receive an economic incentive that encourages them to improve their participation in DWSS activities. It is recommended that community members and water committee members readdress the possibility of paying a fixed salary, agreed between water committee members and community members, to every member of the water

committee rather than only the *bombero*, with the aim of motivating them to provide a reliable DWSS. A salary might reduce mismanagement of householders' payments by some committee members.

If water committee members are paid for their service to the community, they might not be helping themselves from householders' payments for the DWSS. When a water committee, rather than the official institution, manages DWSS financial resources and the reinvestment in the operation and maintenance of this there are consequently improvements to the drinking water infrastructure and the quality of the DWSS provision might be made more rapidly.

Policy development is needed about allowing official and customary water institutions a federal budget for maintaining and repairing the water infrastructure, which would allow not only small but also medium size and large communities to keep their drinking water supply infrastructure in good order and able to provide the DWSS to every household, so that people do not lack drinking water.

It is suggested that communities be allowed to hold property rights as owners rather than as proprietors to manage groundwater for the provision of the DWSS. As owners, water committees would not have to pay a tax to any government formal water institution, such as CONAGUA, for a water concession title. This measure should guarantee the supply of drinking water to cover basic needs without facing constraints to pay the Electricity Company for the electricity used for pumping the drinking water infrastructure. However, it should only be applied to water institutions such as water committees or municipal and public water institutions that provide the DWSS to for domestic use at community level. Institutions that sell or resell drinking water for obtaining private revenue should not be included in this category. Recognition of community water committees as owners of the water resources found in their community should be legitimised by the LAN, public water policy at state and municipal level, as well as by customary water institutions.

This thesis encourages the payment for the DWSS. Taking into account domestic water users thoughts obtained from fieldwork I suggest that the DWSS in the

three communities studied should be priced. I recommend a fixed monthly tariff of \$70 MXN pesos for most of households receiving the DWSS. However, this amount should be modified and adapted to householders demonstrating to receive a lower and variable household income and/or the monthly household expenses. This tariff is suggested to provide a good DWSS in accordance to community needs and common water committee-community members agreements to avoid water insufficiency. If the DWSS is provided accordingly, domestic water users might be willing to pay the tariff. Payments collection would enable the water committee of the communities studied to pay the electricity bill and maintain regularly the drinking water infrastructure in good order. Maintenance of the drinking water supply infrastructure also includes cleaning of water reservoirs, water well, pipes, and chlorinate drinking water and to keep the infrastructure in appropriate functioning conditions.

I suggest that in customarily organised communities the price for the DWSS is agreed between community water institutions and community members considering the socio-economic conditions of the community. I suggest each community designs and use the tariff for the DWSS that better suits their needs. It is also recommended that the water committee charges and collects payments for the DWSS and decides how the income is best reinvested.

While both official and customary water institutions need to provide greater commitment and engagement to provision of the DWSS, domestic users also need to participate by paying promptly for the service.

This research encourages the provision of the DWSS with sufficient water pressure, quantity, quality and timeliness. Good-quality DWSS and water committee performance will also improve the governance and management of the DWSS. This high quality in the DWSS should be reflected in the provision and delivery processes. To achieve quality it is necessary that customary water institutions, through the water committee, are autonomous in their governance, management and operation of the DWSS. According to the empirical analysis, this should provide communities with the recognition what they are the authorities in decision making and managing of the DWSS. This can only happen if the

community decides to take on the governance and management of the DWSS. When communities do not decide to govern and manage this service it is necessary to respect their decision otherwise the water committee and community members would struggle to achieve successful DWSS outcomes.

Finally, transparency of the information provided to water users is crucial. Reliable and clear information available to everybody in the community and at any time will generate community trust. This should include an up-to-date list of householders receiving the DWSS, the amount of money owed and payments collected. Data about the total amount of payment collected and costs of the DWSS operation, maintenance and repairs, the service's main failures and water committees' difficulties in providing a good-quality service should also be made available. This information will be useful when seeking to improve the DWSS with community participation.

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Annex 1. Sample of semi structured interviews design

Fieldwork stage in peri-urban communities

Household information

Women/men

How many people live there?

How many babies

How many children?

How many teenagers?

How many adults?

How many elder people?

Personal hygiene

How many people live in this house?

How many members of the house do take a daily shower?

In average, how many days per week do you take a shower?

Socioeconomic situation:

Rich

Middleclass: high, medium, low

Poor

About the drinking water supply service

Do you have water supply service? (Yes) (No)

If yes, how many litres per hour/day?

- Number of hours of water service per day
- Number of hours of water service per week
- Number of days in a month they receive the drinking water supply service

If no, how do you solve water problems?

Borrow water from neighbours

1. If borrow from neighbours, how often?
2. How much water do you borrow?
3. How is this favour reciprocated?
4. In case you pay for it, how much do you pay?

Buy water tanker trucks

1. How often?
2. At what price?
3. Do you think is cheap of expensive?
4. Who provides the service?

owns a well

1. For how long have you had a well?
2. Does it have a legal concession?
3. How often do you withdraw water from it?
4. Is this well for a household consumption, do you share it with neighbours or it is used for a business purpose?
5. Do you know if there is a community well?
6. What are the rules governing access to ground water?

Store water

1. Where do you store it

- top reservoirs
- outside reservoirs
- cistern
- kegs

2. For how long have you stored drinking water?

What is the average of money you invest in buying water?

- bottles. How often?
- Water tank trucks. How often?
- others

Do you receive water when you need it? (Yes) (No)

If no, how often would you like to receive water?

Does your house have:

Cistern: (Yes) (No)

Top reservoir: (Yes) (No)

Please tick the appropriate

Do you drinking water from:

- Tap. Do you boil it before previous consumption? (Yes) (No)
- Bottle water
- Water tank trucks
- Own well

Do you think you receive the piped water service with enough quantity? (Yes) (No)

How often do you receive water?

- Daily
- Twice per week
- Tree times per week
- Four times per week
- Five days per week
- weekends
- monthly

For how long do you receive it each time?

- All day
- Intermittent
- Few hours but continuous
- how many hours?

Do you think is adequate the service provided?

When there is no sufficient water, how do you save water?

What of intra-household activities do you prefer to sacrifice when water is not sufficient water?

When you receive more water, do you use more water? Or do you maintain the level of consumption you have?

Quality of the service

How do you describe the quality of the drinking water supply service you receive?

Do you receive the drinking water service with enough pressure? (Yes) (No)

Is the flow of water continuous? (Yes) (No)

Is the water clean?

Can you and your family meet your basic needs with the water you receive? (Yes) (No)

Which of the next activities can you carry out with the water you receive?

- Cooking
- Cleaning clothes
- Cleaning house
- cleaning dishes/kitchen
- Water for drinking
- Water for showering/ bathing
- Water for sanitation/Discharge toilet
- Irrigation or homestead land
- Animals
- Irrigating trees
- Plants
- Others

Do you have any other water requirements? Water for industrial use, commercial use, growing crops, homestead land)

Do you think the drinking water service in your community is well managed? (Yes) (No) (Why?)

Do you agree with the way in which the drinking water service is distributed?

Do you recognise/agree with water authority? (Yes) (No), why?

Do you know if there are water lost between the source and the end user delivery due to infrastructure failures/leaks? (Yes) (No)

Do you waste water? (Yes) (No) Here I will compare with my own observations.

Are you satisfied with the drinking water supply service you receive? (Yes) (No)

Is there something that you might change from the service? (Yes) (No) (what?)

General

Do you save water in some activities to allow using it in others? (Yes) (No)

When you have water problems, who do you talk with?

- Municipal government
- Local authority
- Community organisation
- Nobody
- Write a claim for an official authority
 - If you write a document, what is the response elicited from complaints?
- Neighbours

Do you know who actually repairs water infrastructure when necessary?

Does the answer of water authorities to solve the client demand is fast? (Yes) (No)

Does repairing water pipes infrastructure, when necessary, are fast? (Yes) (No)

What do you do when you do not receive the drinking water supply service?
(adaptive capacity to access drinking water)

Do you think the drinking water supply service is efficient? (Yes) (No)

Which of the following characteristics apply to the DWSS you receive?

- Quantity
- Quality
- Timeliness
- Sufficiency
- Cost recovery through bills collection
- Governance compliance
- Pricing
- Frequency
- Access

Payments for the DWSS

Are you willing to pay for the DWSS? (yes) (no)

What are you willing to pay for?

- A) Water
- B) Infrastructure
- C) Service
- D) Electricity
- E) Quality of water
- F) Quantity of water
- G) Timeliness
- H) Others

How much are you willing to pay for these issues?

How are you willing to pay for the above issues? (individually) (collectively)

Do you pay for the drinking water service? (Yes) (No)

If yes, how often do you pay water?

In which range of payment are you in:

- Less \$50 pesos
- Between \$50 and \$100 pesos
- Between \$100 and \$200 pesos
- Between \$200 and \$300 pesos
- Between \$300 and \$500 pesos
- Between \$500 and \$1000 pesos
- between \$1000 and \$1500 pesos
- more than \$1500 pesos
- other

Do you have water meter? (Yes) (No) why?

Who take the measure?

Management of the drinking water supply service within the communities

Who is responsible of the DWSS?

Who operates water service?

Who claim water payment?

Is water priced?

Who is responsible of water bill collection?

Is money recovered re-invested?

Are there water markets?

How community adapts to solve water problems?

Are there social relations to solve water short-cuts?

Important

- What do water users are willing to pay for?
- What people do get for free?
- What the suppliers need to supply for free?
- Do water institutions consider water supply as an economic good?
- Does people see water or the water service as an economic good?

Extra information needed from interviewees

- The drinking water consumed comes from the tap, is it boiled, water bottles, tankers?
- Number of households that receive water through well installed taps?
- Are there householders that have to bring water from other sources?
- Do householders that receive water through well installed taps
- Money expended in drinking water supply?
- Average of money households invest in buying water (bottles, water tank trucks)?
- What water is used for in a house? drinking, bathing, cleaning clothes, cooking, washing dishes, cleaning house, irrigation, animals, growing vegetables, irrigating trees, plants?
- For cleaning the shower and toilet, how much water do you need to do it? How many kegs do you need?